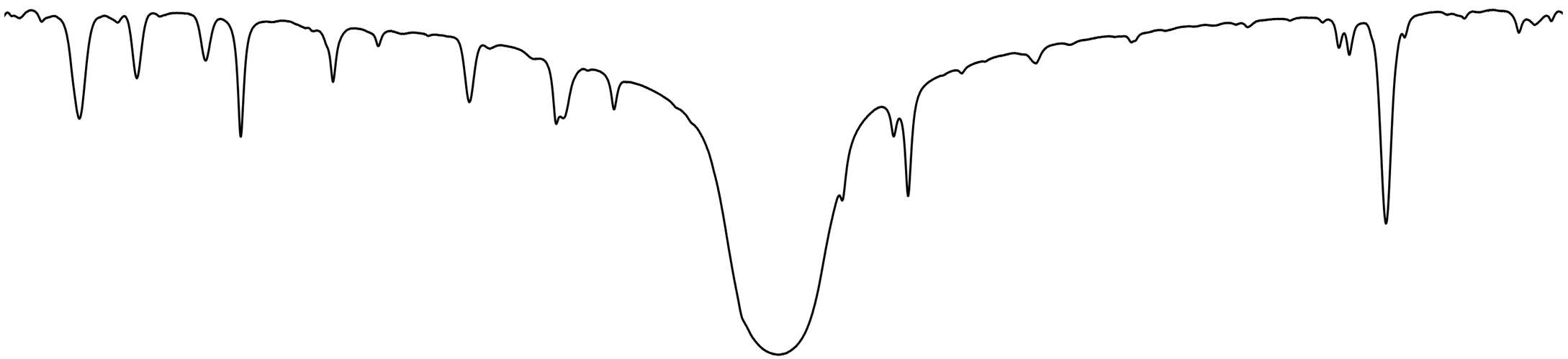
Spectral Atlas of the Sun from *405* to *2300* nm

Niclas Mrotzek, Ulrike Lemke, Johannes Hinrichs, Klaus Reinsch & Ansgar Reiners



Institut für Astrophysik Göttingen

Georg-August-Universität Göttingen

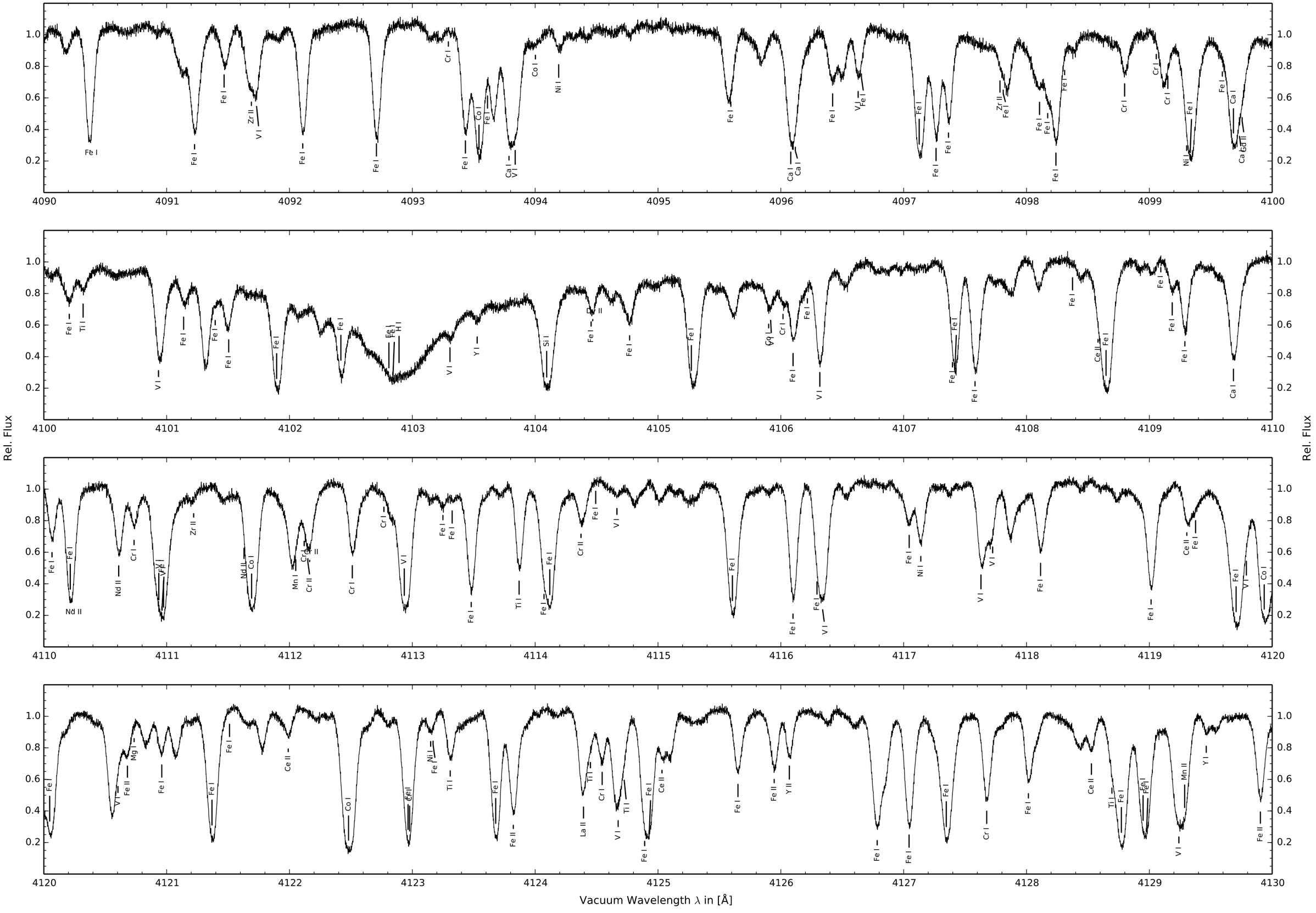
This spectral atlas of the sun was prepared in the context of a master thesis. In *A high resolution solar atlas observed with a Fourier-Transform-Spectrograph* by *Niclas Mrotzek*, the details of observation and instrumentation are given. The atlas covers a spectral range from 400 nm up to 2.3 μm with a spectral resolving power of $R = \lambda/\Delta\lambda = 1\,000\,000$ ($\Delta\tilde{\nu}$=0.01 cm^{-1} for the visible setup and $\Delta\tilde{\nu}$=0.0044 cm^{-1} for the near infrared setup). The data were recorded with a new setup for integrated solar measurements and an Fourier-Transform-Spectrograph at the Institut für Astrophysik in Göttingen. The spectra were all recorded between February and July 2014 after the maximum of the 24. solar cycle.

The atlas consists of an average of 1190 single scans (integration time: 32.7 h) for the visible spectral regime and 1130 single scans (integration time: 32 h) for the near infrared up to 2.3 μm. Line identifications are taken from different databases and are provided for solar as well as for telluric lines.

Special thanks to Ulrike Lemke and Johannes Hinrichs, whose help in recording and analysis was essential.

Rel. Flux

Vacuum Wavelength λ in [Å]

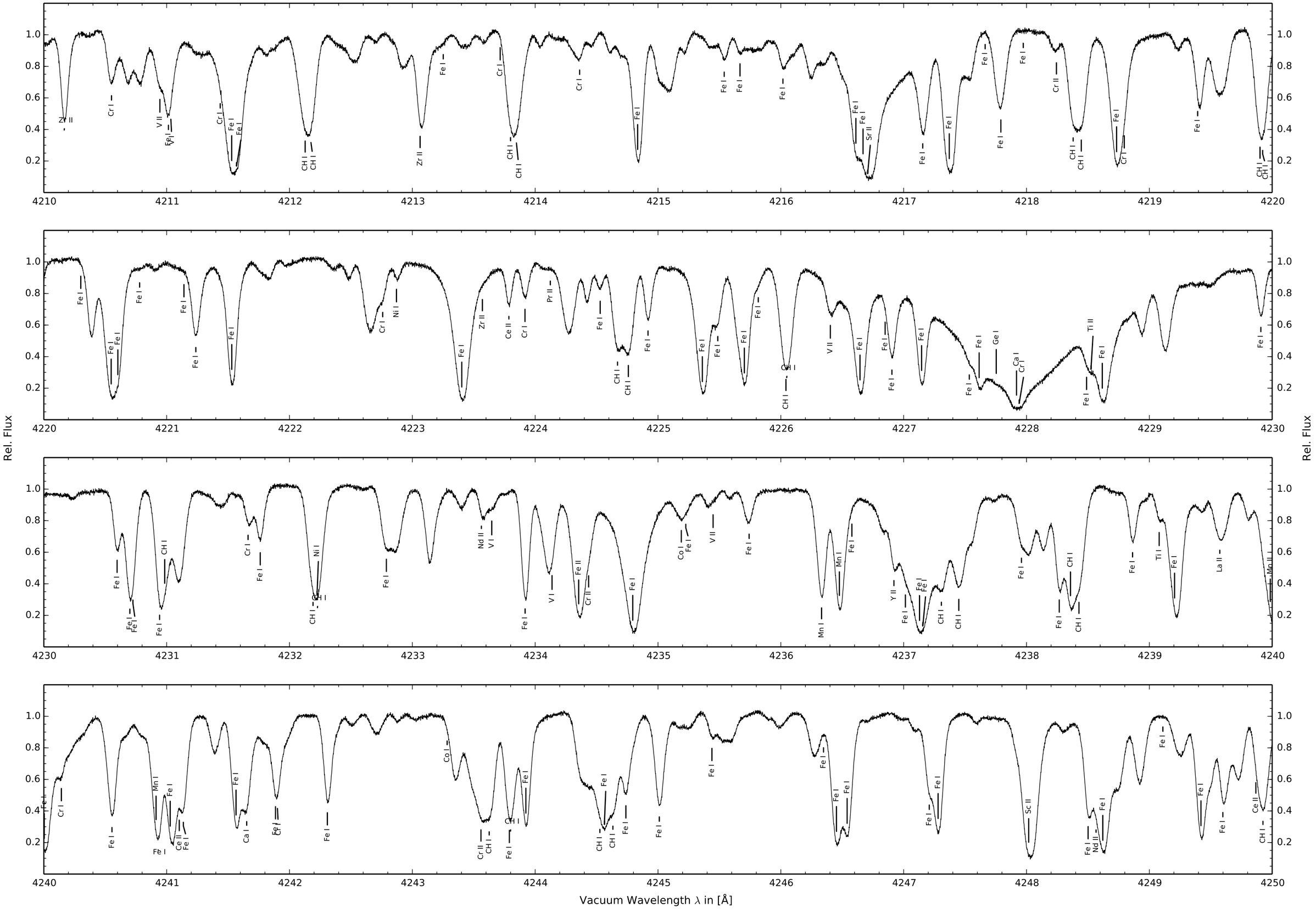

Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Zr II
Cr I
V II
Fe I
CH I
Cr II
Zr II
Fe I
Cr I
Fe I
Fe I
Fe

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

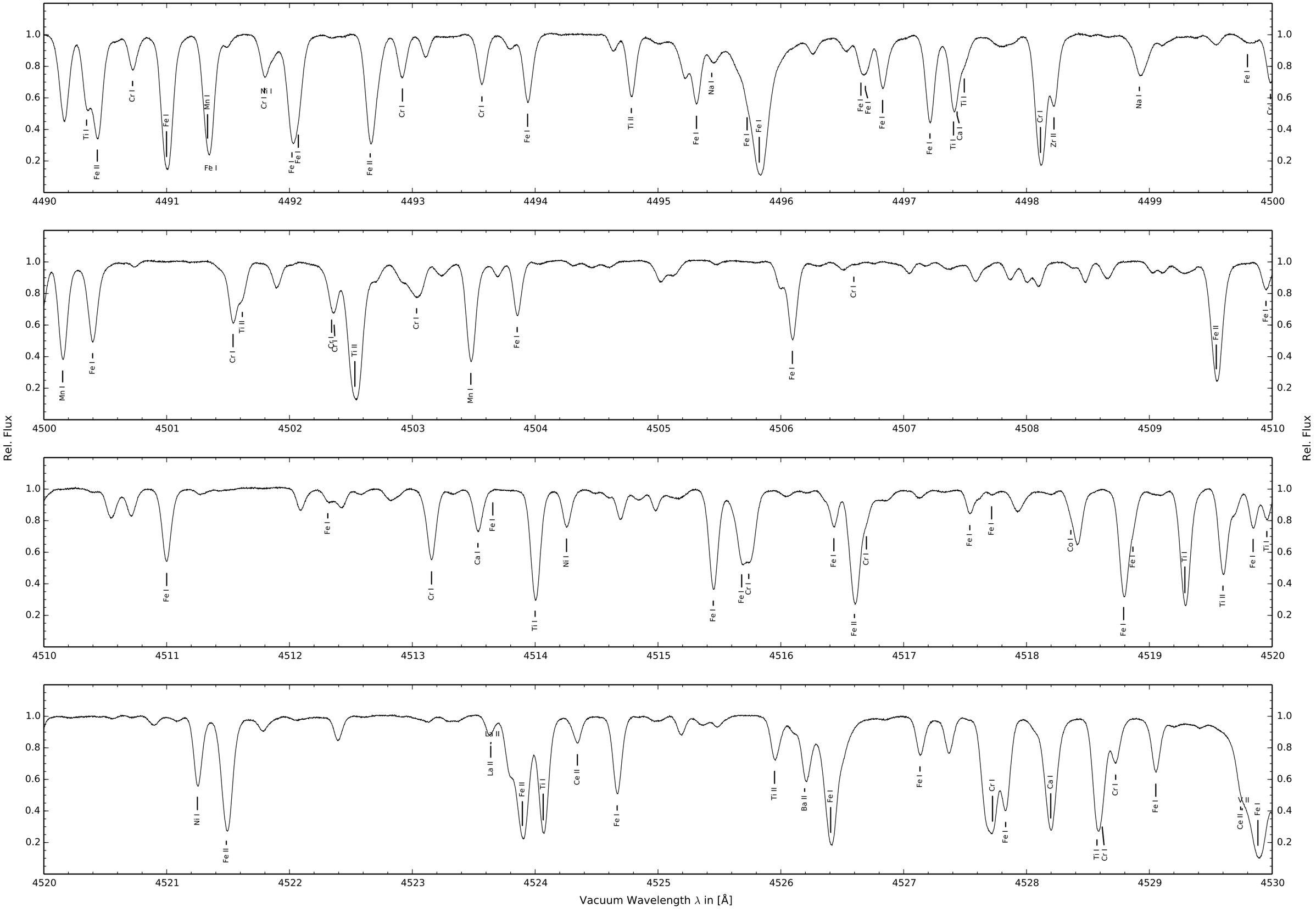
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

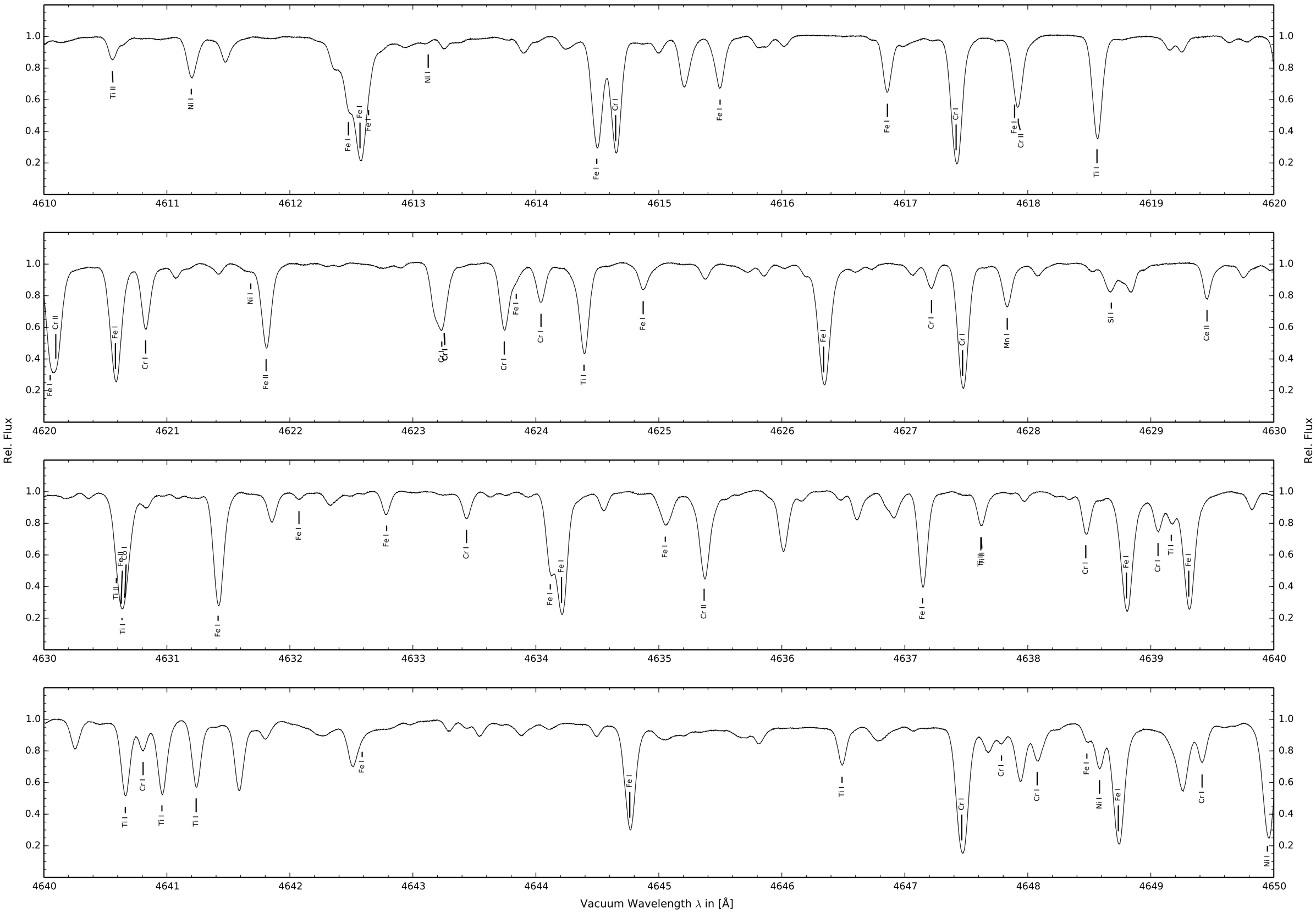

Rel. Flux
Vacuum Wavelength λ in [Å]
Ti I
Fe II
Cr I
Fe I
Mn I
Cr I
Fe I
Fe I
Fe II
Cr I
Cr I
Fe I
Ti II
Fe I
Na I
Fe I
Fe I
Fe I
Fe I
Ti I
Ca I
Cr I
Zr II
Na I
Fe I
Mn I
Fe I
Cr I
Ti II
Cr I
Cr I
Ti II
Cr I
Fe I
Mn I
Fe I
Fe I
Cr I
Fe II
Fe I
Ni I
Fe II
Fe I
Ca I
Fe I
Ti I
Ni I
Fe I
Fe I
Cr I
Fe II
Cr I
Fe I
Fe I
Fe I
Co I
Fe I
Ti I
Ti II
Fe I
Ti I
Cr I
Ni I
Fe II
La II
La II
Fe II
Ti I
Ce II
Fe I
Ti II
Ba II
Fe I
Fe I
Fe I
Cr I
Ca I
Ti I
Cr I
Cr I
Fe I
Ce II
Fe I

Rel. Flux

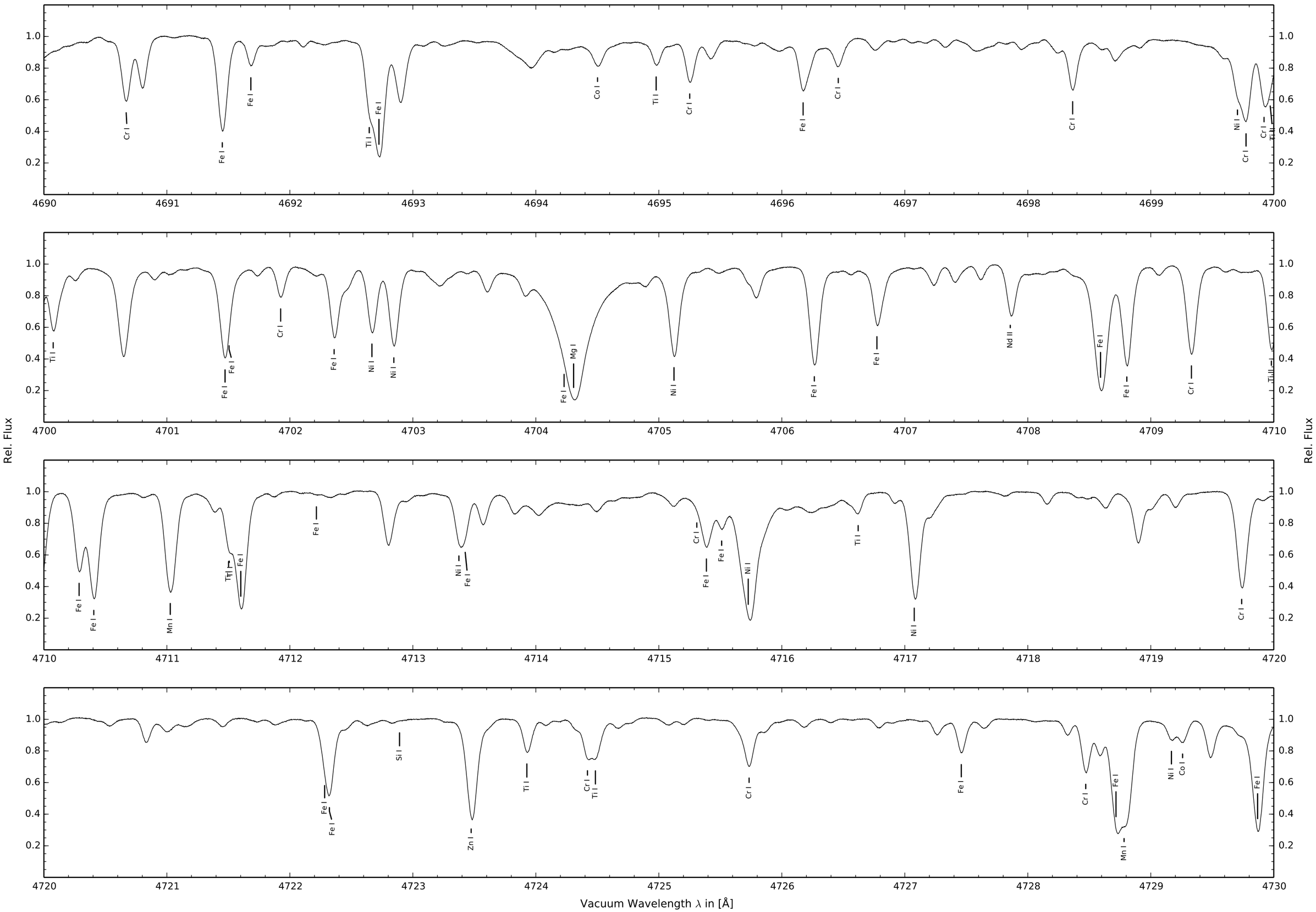
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Ti II
Ni I
Fe I
Cr I
Cr II
Fe II
Mn I
Si I
Ce II
Co I
Ti I

Rel. Flux
Cr I
Fe I
Cr I
Fe I
Ti I
Fe I
Cr I
Cr I
Fe I
Fe I
Fe I
Cr I
Ti II
Cr I
Fe I
Ti I
Fe II
Ti II
Fe I
Fe I
Fe I
Fe I
Cr I
Co I
Fe II
Cr I
Fe I
Cr I
Na I
Fe I
Fe I
Cr I
Fe I
Cr I
Fe II
Ni I
Fe I
Ti I
Ni I
Fe I
Fe I
Na I
Fe I
Fe I
Fe II
Sc II
V I
Fe I
Fe I
Fe I
Fe I
Ti I
Ni I
Fe I
Fe I
Zn I
Fe I
Cr I
Fe I
Cr I
Fe I
Ti I
Fe I
Y II
Co I
Fe I
Fe I
Fe I
Fe I
Ca I
Ni I
Fe I
Fe I
Zr I
Fe I
Vacuum Wavelength λ in [Å]



Rel. Flux
Vacuum Wavelength λ in [Å]
Cr I
Fe I
Ti I
Co I
Ni I
Mg I
Nd II
Mn I
Si I
Zn I

Rel. Flux

Ni I
Fe I
Mg I
Cr I
Ti I
Fe II
Fe I
Ni I
Ni I
Fe I
Fe I
Fe I
Fe I
Fe I
Cr I
Fe I

Mn I
Ni I
Fe I
Fe I
Fe I
Ti I
Fe I
Cr I
Fe I
Fe I
Si I

Co I
Fe I
Cr I
Ni I
Ni I
Mn I
Ni I
Cr I
Ni I
Fe I
Ti I

Ti I
Mn I
Mn I
Ni I
Ti II
Ti II
Ni I
Cr I
Ti II
Fe I
Fe I
Mn I
Fe I
Fe I
Fe I
Mn I
Cr I
Co I
Fe I
Fe I

Vacuum Wavelength λ in [Å]

Rel. Flux

Ce I
Fe I
Fe I
Ni I
Ni I
Ti II
Fe I
Co I
Fe I
Ti I

Fe I
Fe I
Fe I
Si I
Cr I
Mn I
Fe I
Ni I
Ni I
Y II
Fe I
Fe I

Fe I
Cr I
Fe I
Cr I
Ni I
Fe I
Si I
Si I
Ti I
Cr I
Co I
Fe I
Fe I
Ti II

Fe I
Fe I
Ni I
Fe I
Fe I
Fe I
Cr I
Fe I
Fe I
Fe I
Ti II
Ti I
Ti II
Ni I
Fe I
Fe I
Ni I

Vacuum Wavelength λ in [Å]

Rel. Flux

Fe I
Ni I
Fe I
Fe I
Zn I
Cr I
Ni I
Cr II
Fe I
Co I
Ni I
Fe I
Ni I
Fe I
Ni I

Ti I
Ni I
Fe I
Y II
Mn I
Cr II
Fe I
Nd II
V I

Ni I
Cr I
Cr I
Ni I
V I
V I
Ni I
Fe I
Fe I
Fe I
Fe I
Cr II
Cr I
Fe I
Ni I

Fe I
Fe I
Co I
Fe I
Ti I
Fe I
Fe I
Fe I
Ni I
Fe I
Fe I
Fe I
Ni I
Fe I
Fe I
Fe I
Cr I
Ca I
Fe I
Cr II

Vacuum Wavelength λ in [Å]

Rel. Flux

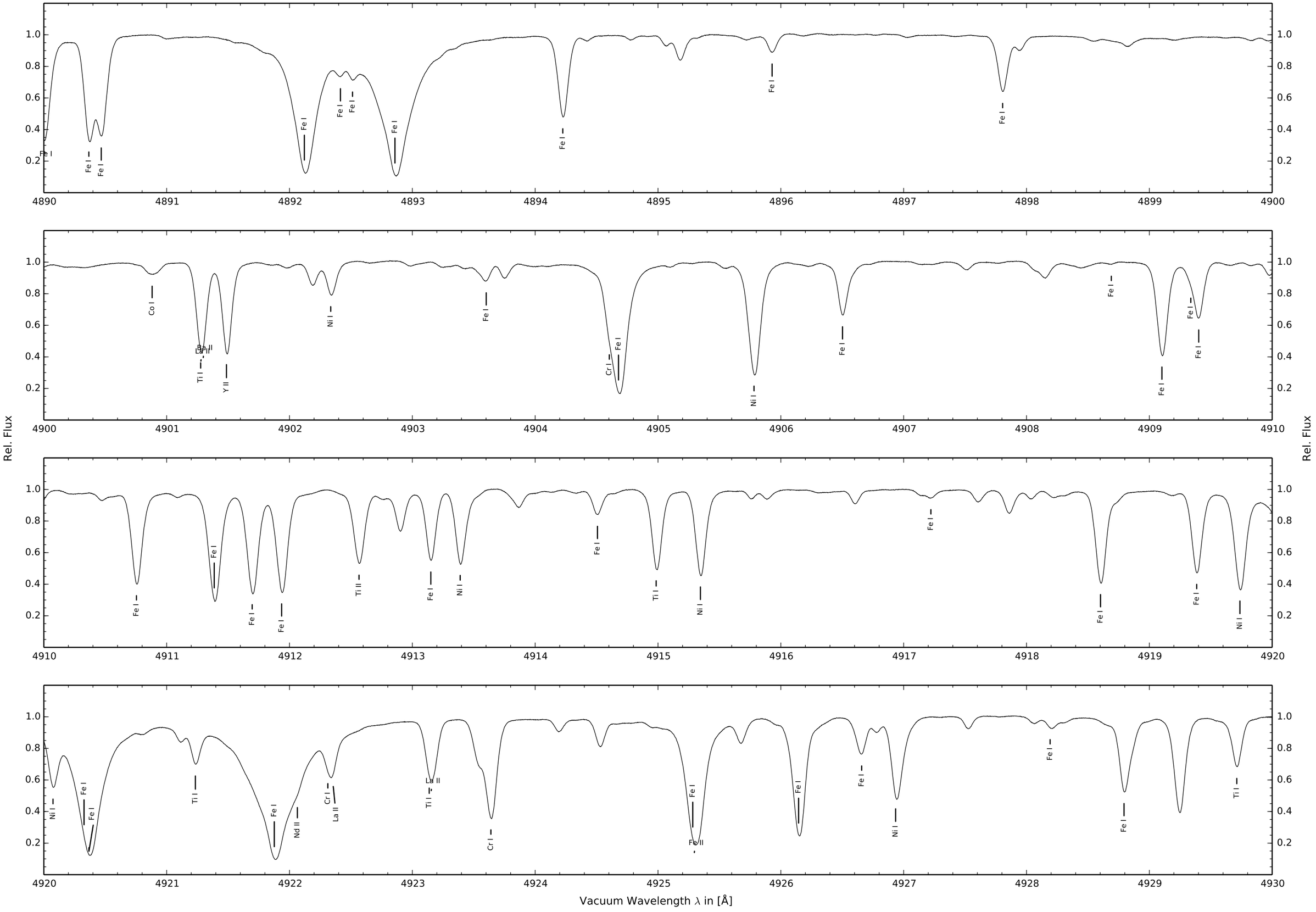
Fe I
Ti II
Fe I
V I
Fe I
Ni I
Ni I
Y II
Fe I
Ni I
Fe I
Ti II
Ti I
Cr II
Ni I
Fe I

Fe I
Fe I
Cr II
Cr I
H I
Fe I
Cr I
Fe I
Ni I
Fe I
Cr II
V I
Ti II
Ni I
Co I
Ti I
Fe I
Fe I

Fe I
Ti I
Cr I
Ni I
Fe II
Fe I
Fe I
Fe I
Fe I
Ni I
Ni I
Ti II
Fe I
Cr I
Ni I
V I
Fe I
Cr II
Cr II
Fe I
Ca I
Fe I

Fe I
V I
Fe I
Fe I
Y II
Cr II
Ti I
Fe I
Ni I
Cr I
Fe I
Fe I
Zr I
Fe I
Cr I

Vacuum Wavelength λ in [Å]



Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Co I
Ti I
Ba II
La II
Y II
Ni I
Cr I
Ti II
Nd II
Fe II

Rel. Flux

Fe I
Fe I
Fe I
Fe I
Fe I
Fe I
Fe I
Ni I
Cr I
Fe I
Ni I
Fe I
Ni I
Fe I
Ti I
Fe I
Fe I
Fe I
Fe I
Fe I
Cr I
Fe I
Ni I
Fe I
Ni I
Fe I
Si I
Ni I
Fe I
Fe I
Ni I
Cr I
Fe I
Fe I
Fe I
Mn I
Fe I
Fe I
Fe I
Ti I

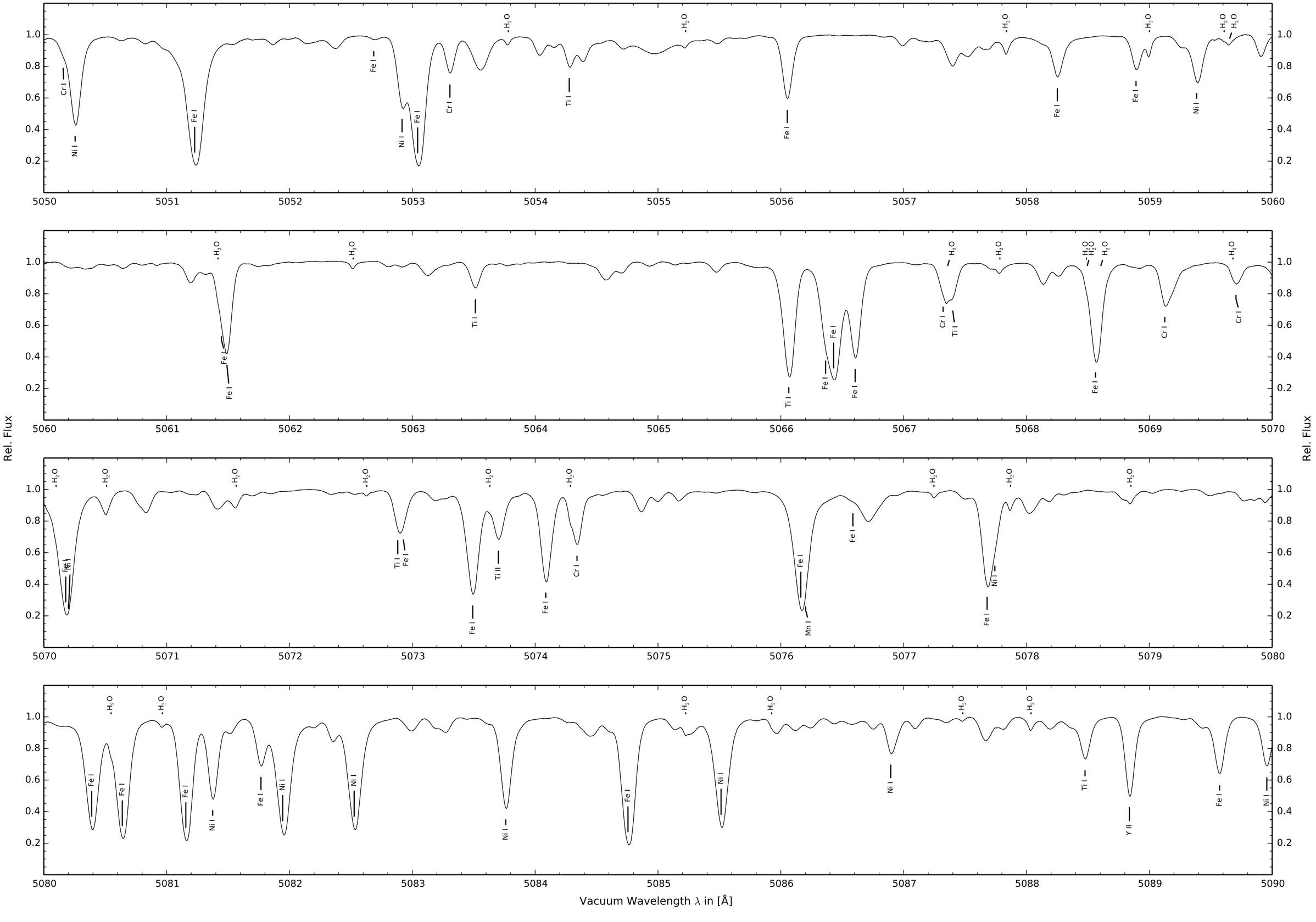
Vacuum Wavelength λ in [Å]

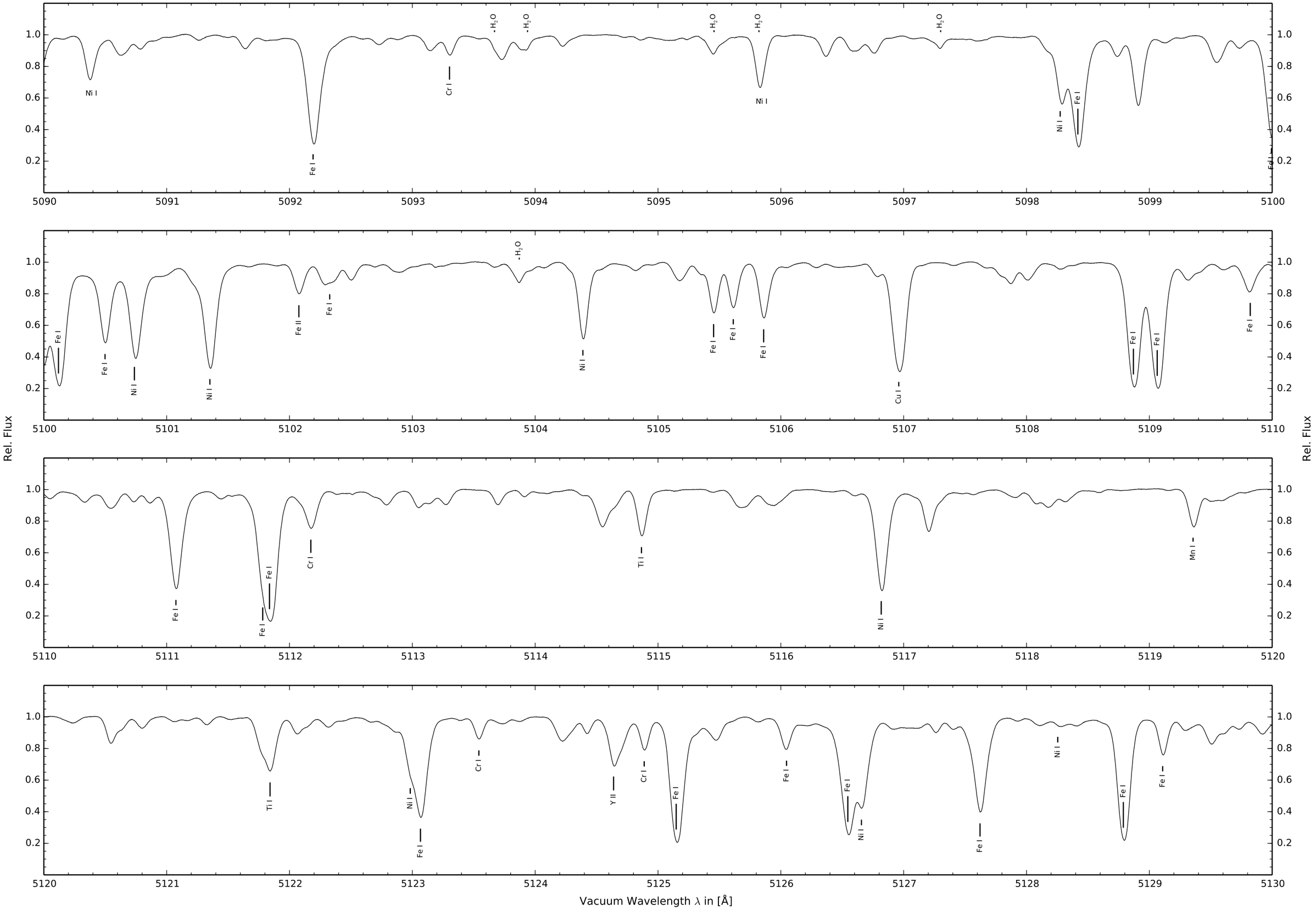
Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Cr I
Ni I
Fe I
Ti I
Ti II
Mn I
Y II
H2O



Rel. Flux
Vacuum Wavelength λ in [Å]
Ni I
Fe I
Cr I
H2O
Fe II
Cu I
Ti I
Mn I
Y II

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

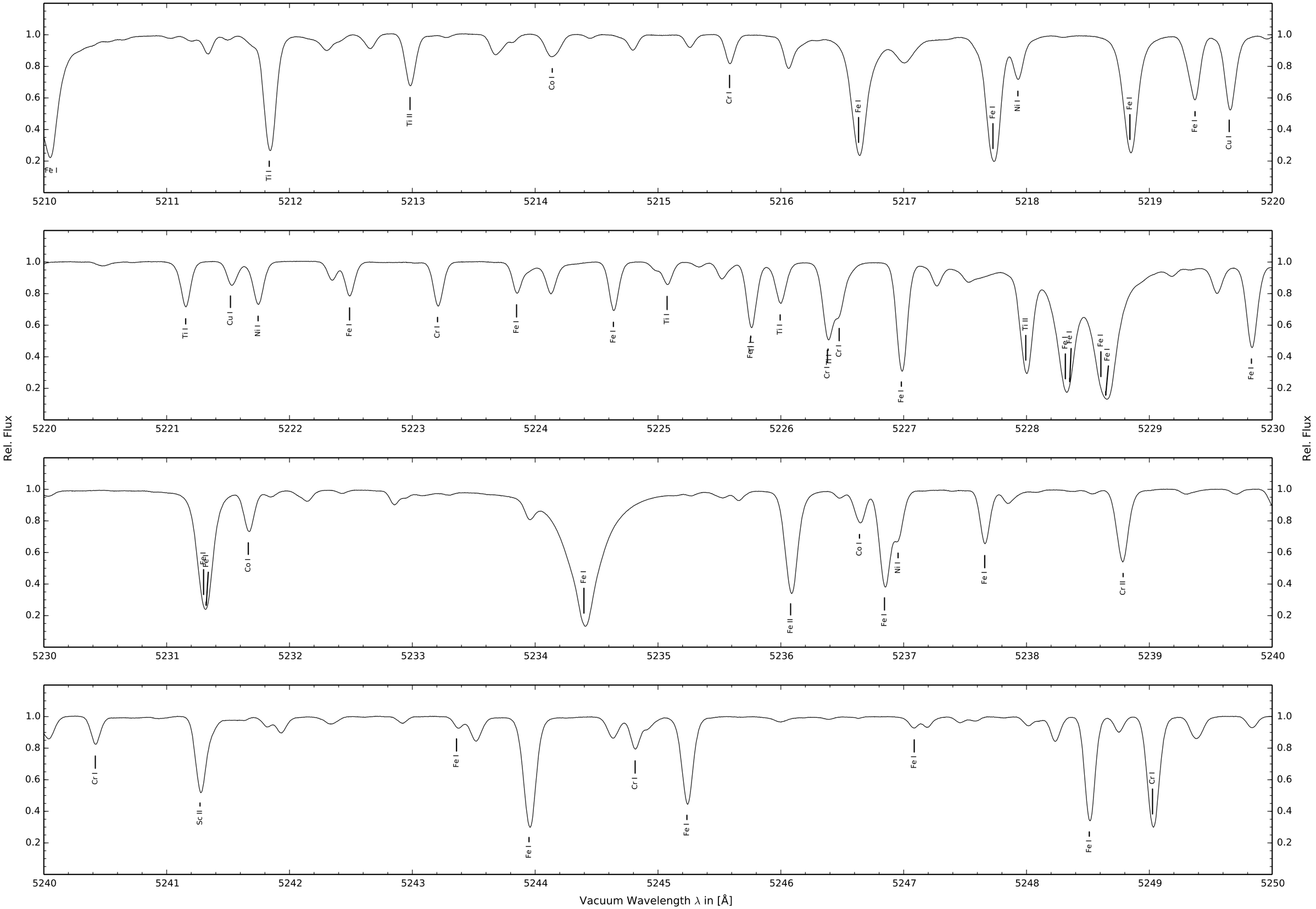
Ni I
Fe I
Fe II
Fe I
Fe I
Mg I
Ni I
Ti I
Co I
Ni I
Fe I
Cr I

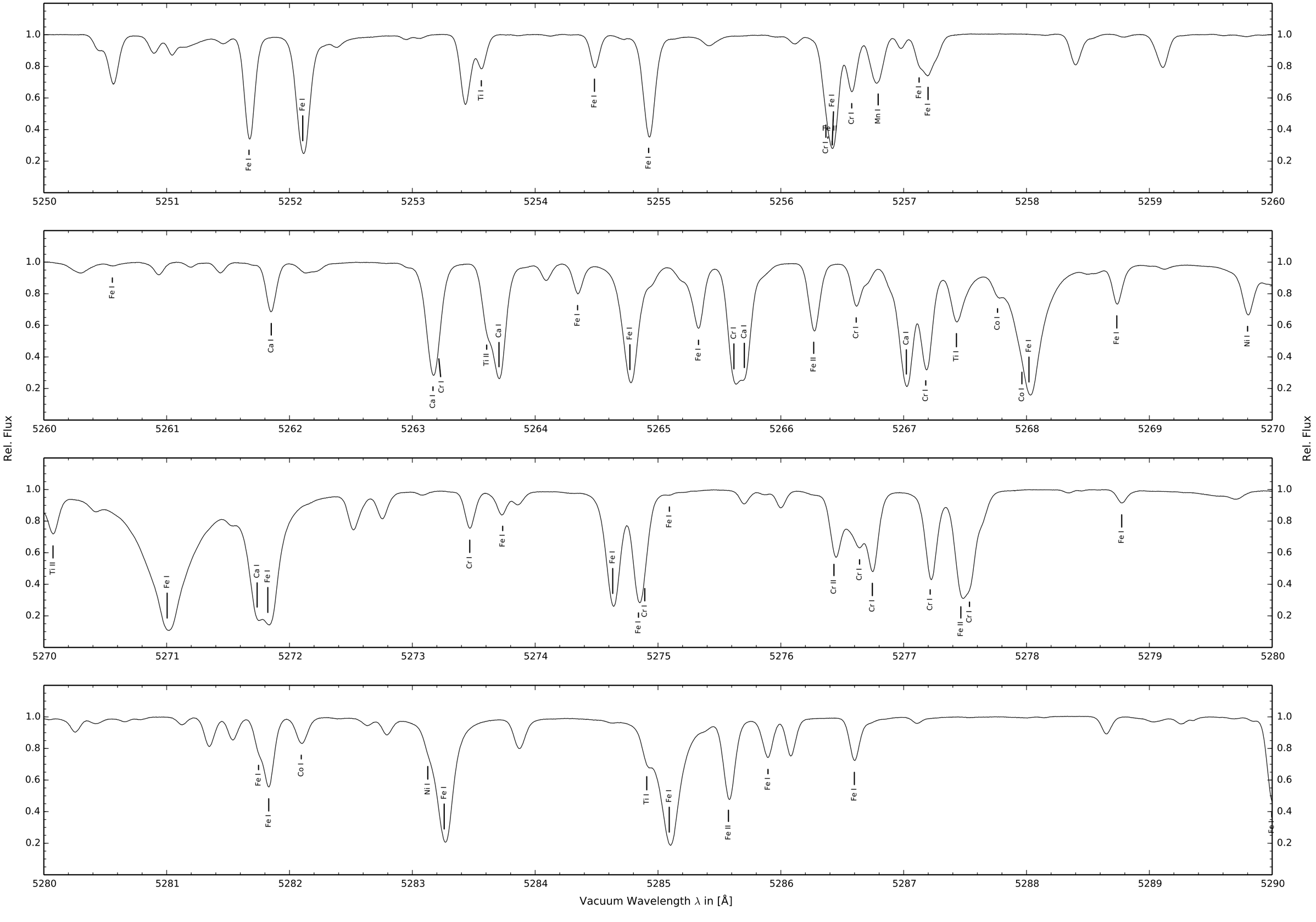
Fe I
Fe I
La II
Mg I
Fe I
Cr I
Ni I
Fe I
Ti II
Ni I
Fe I

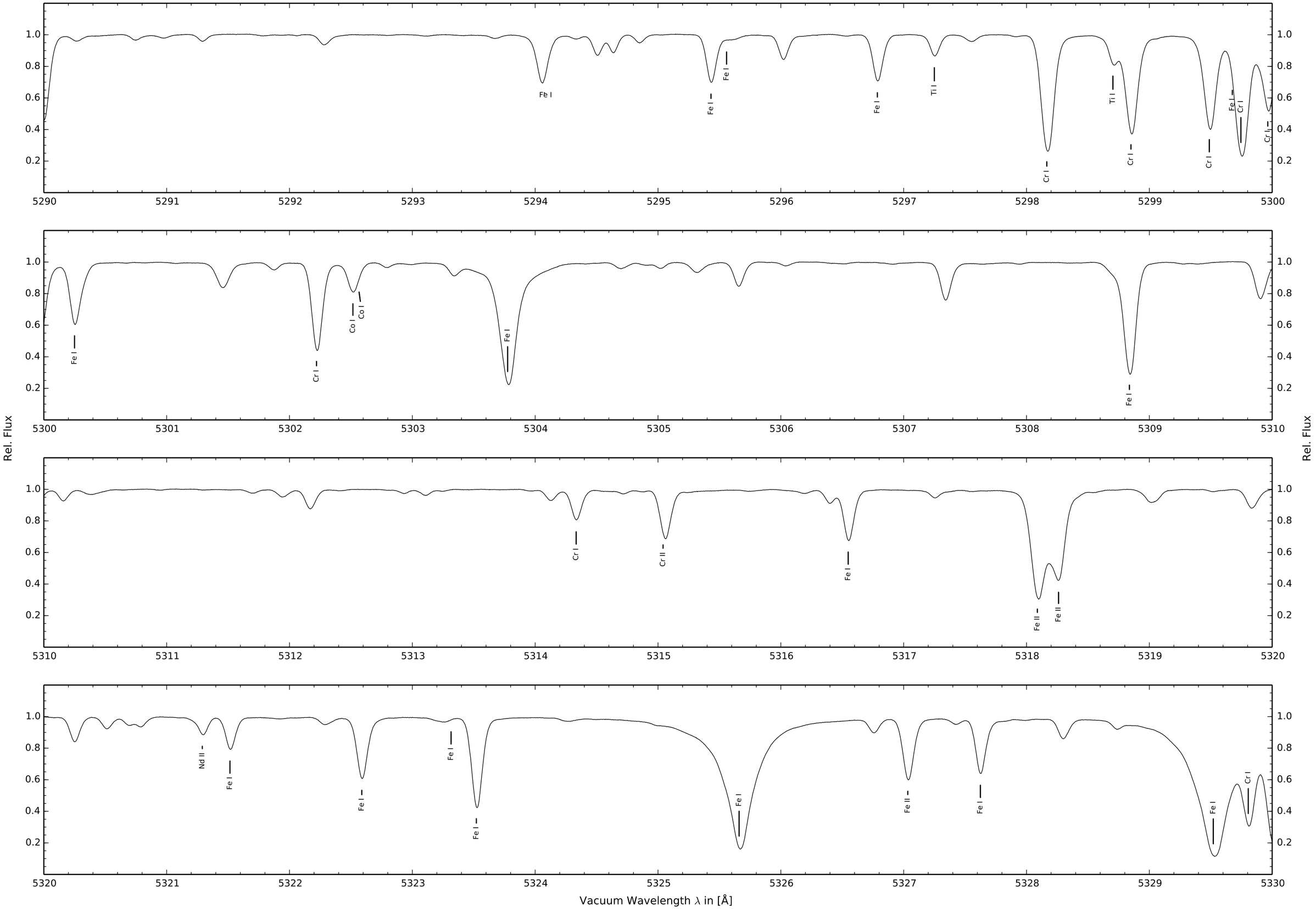
Ti II
Ca I
Fe I
Cr I
Fe I
Ni I
Ti I
Fe I
Fe I
Fe I
Cr I
Mn I
Ni I
Fe II
Fe I

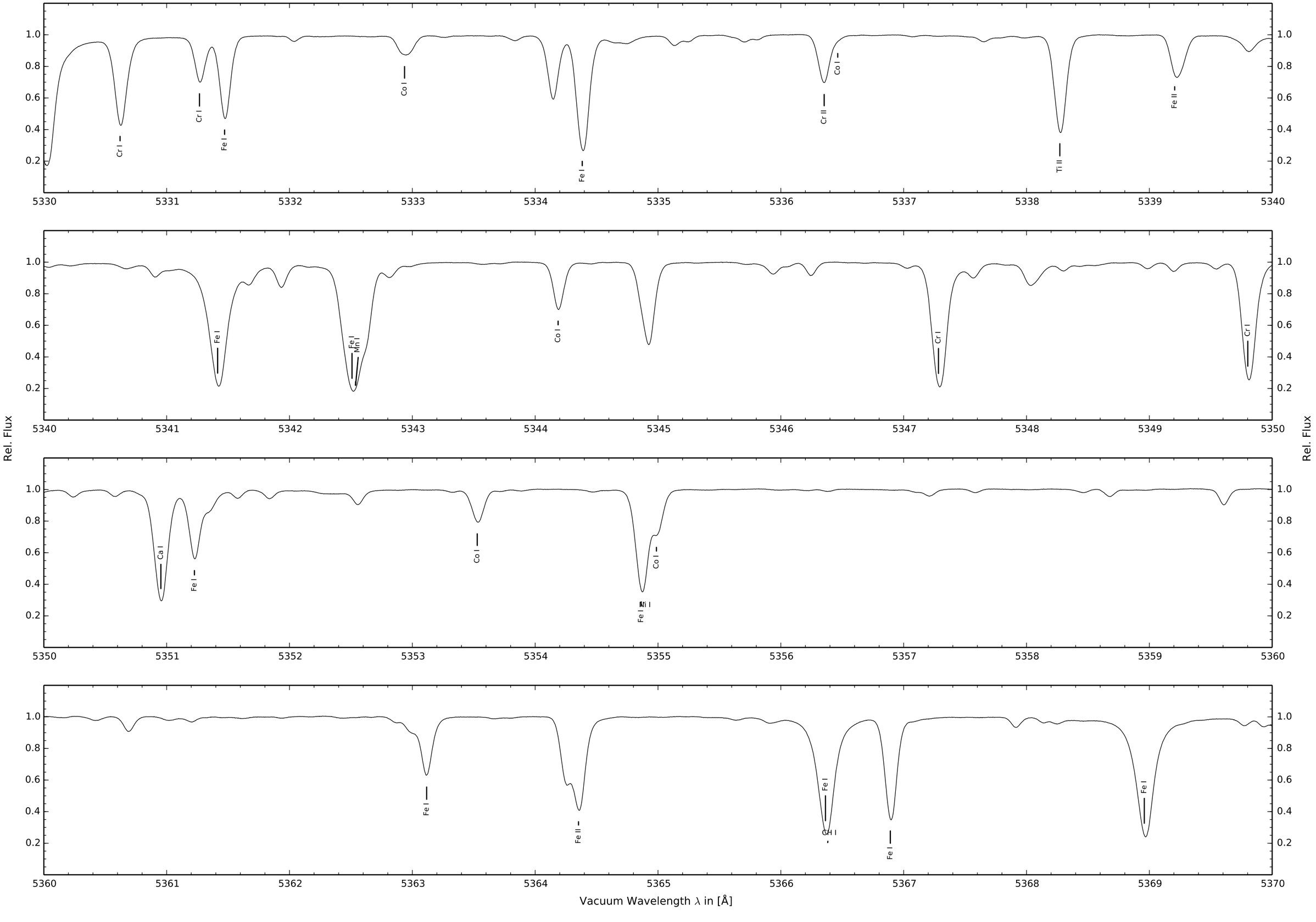
Fe I
Cr I
Y II
Fe I
Fe I
Cr I
Fe I
Y II
Cr I
Cr I
Fe I
Cr I

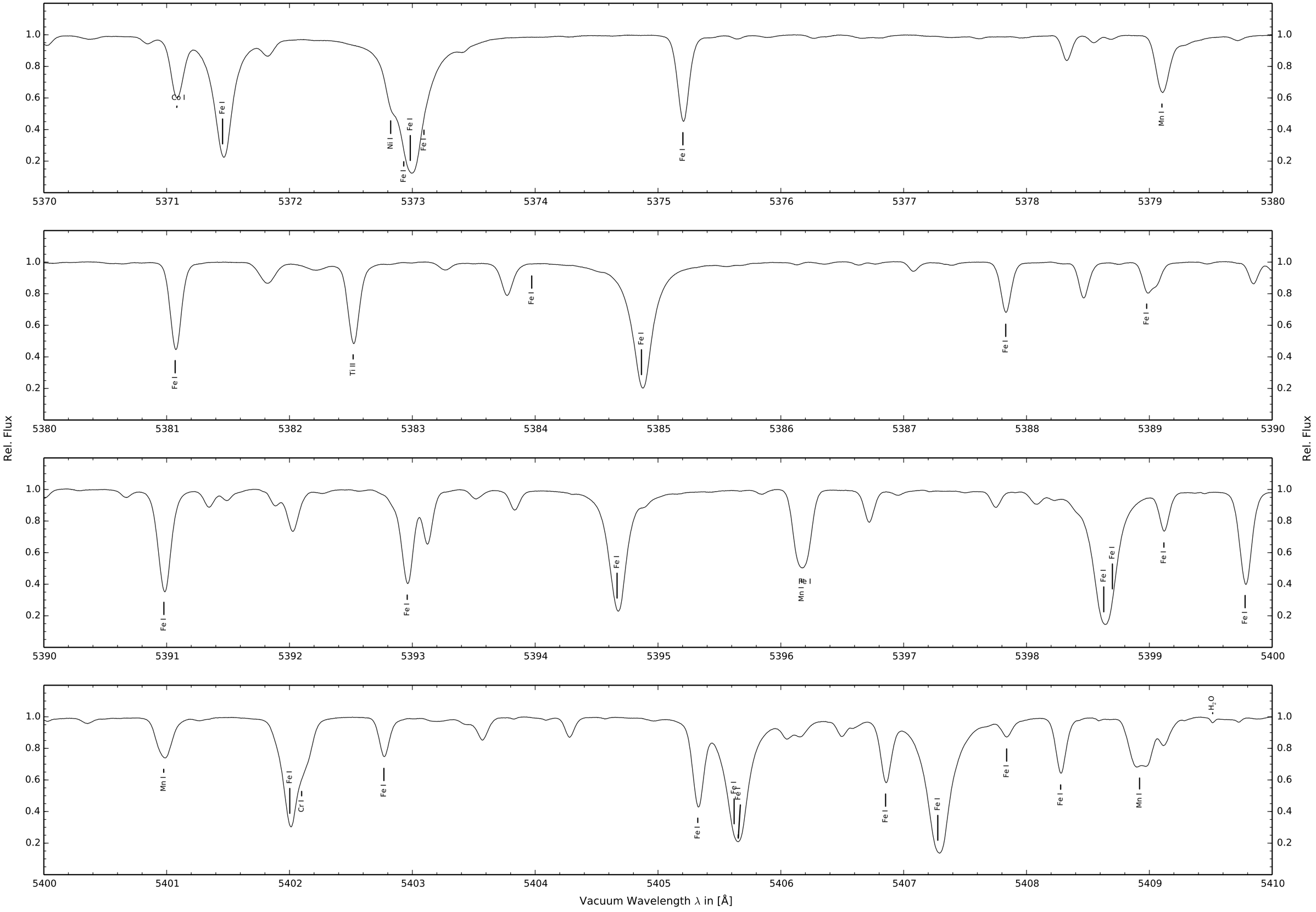
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Ti I
Ti II
Co I
Cr I
Fe I
Fe I
Ni I
Fe I
Fe I
Cu I
Ti I
Cu I
Ni I
Fe I
Cr I
Fe I
Fe I
Ti I
Fe I
Ti I
Cr I
Cr I
Fe I
Ti II
Fe I
Fe I
Fe I
Fe I
Fe I
Co I
Fe I
Fe II
Co I
Fe I
Ni I
Fe I
Cr II
Cr I
Sc II
Fe I
Fe I
Cr I
Fe I
Fe I
Cr I

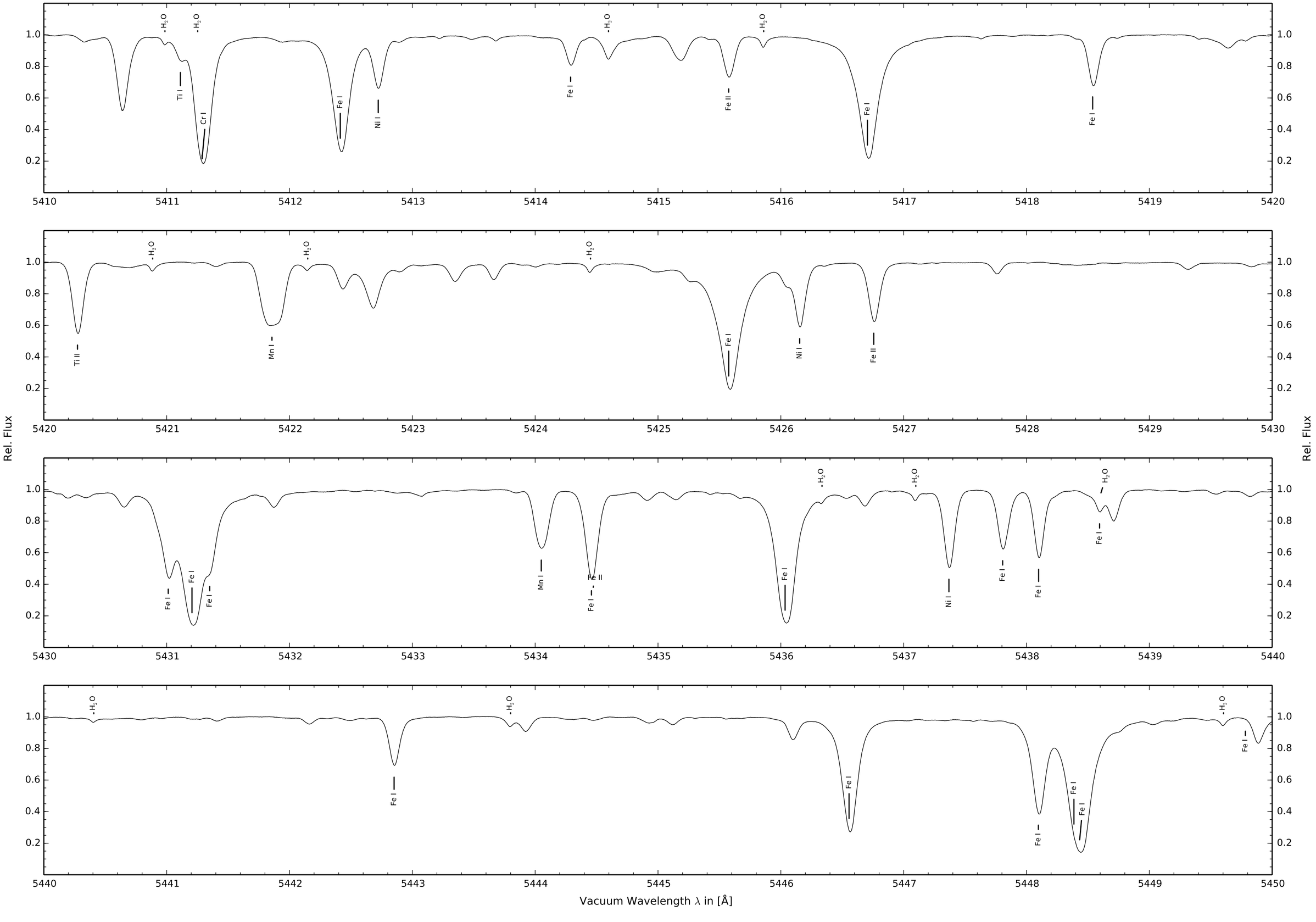

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Ca I
Ti II
Cr I
Fe II
Co I
Ni I
Ti I
Cr II
Mn I
5250
5251
5252
5253
5254
5255
5256
5257
5258
5259
5260
5261
5262
5263
5264
5265
5266
5267
5268
5269
5270
5271
5272
5273
5274
5275
5276
5277
5278
5279
5280
5281
5282
5283
5284
5285
5286
5287
5288
5289
5290
0.2
0.4
0.6
0.8
1.0

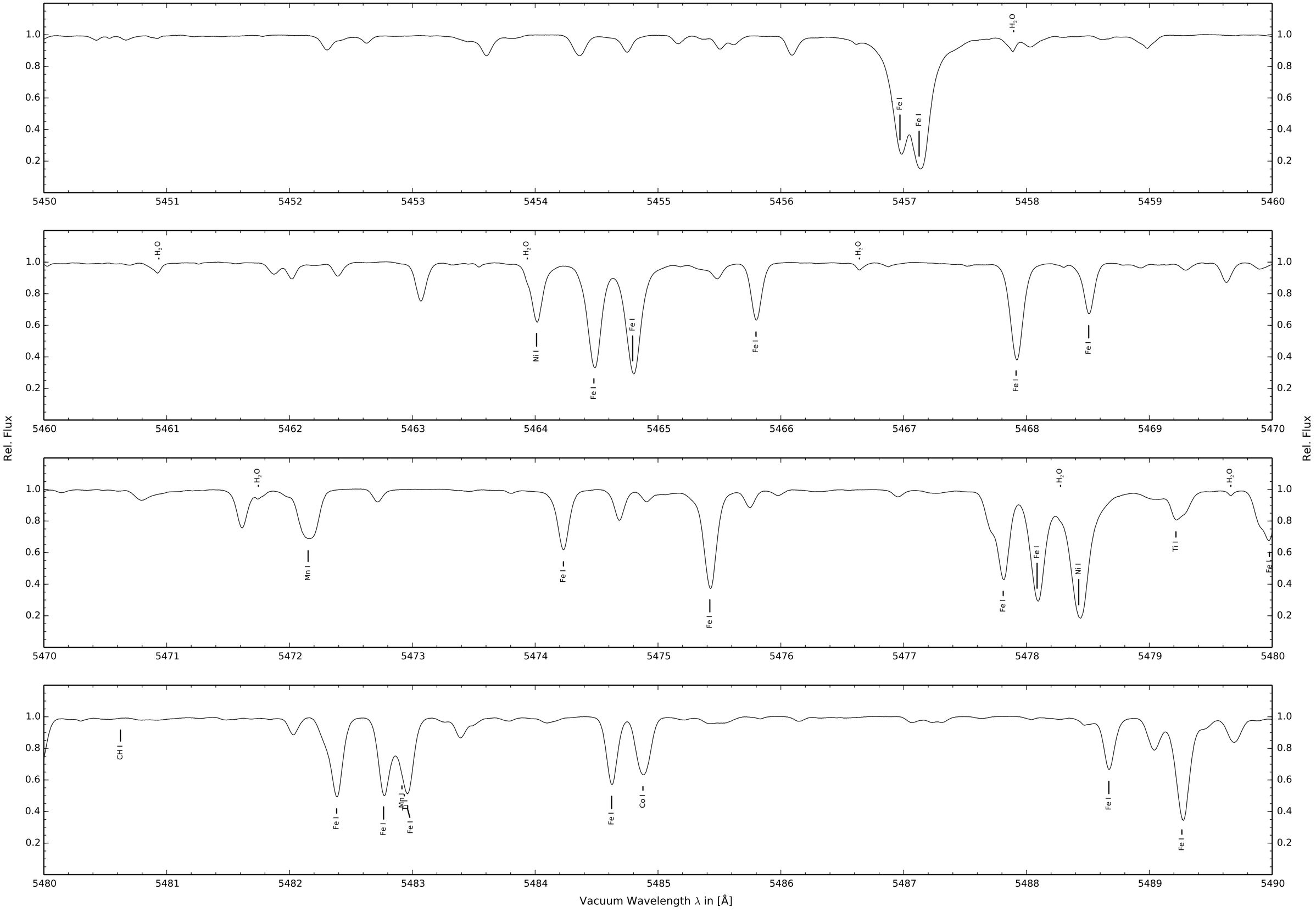

Rel. Flux
1.0
0.8
0.6
0.4
0.2
5290
5291
5292
5293
5294
5295
5296
5297
5298
5299
5300
Fe I
Fe I
Fe I
Ti I
Cr I
Ti I
Cr I
Cr I
Fe I
Cr I
Cr I
5300
5301
5302
5303
5304
5305
5306
5307
5308
5309
5310
Fe I
Cr I
Co I
Co I
Fe I
Fe I
5310
5311
5312
5313
5314
5315
5316
5317
5318
5319
5320
Cr I
Cr II
Fe I
Fe II
Fe II
5320
5321
5322
5323
5324
5325
5326
5327
5328
5329
5330
Nd II
Fe I
Fe I
Fe I
Fe I
Fe II
Fe I
Fe I
Cr I
Vacuum Wavelength λ in [Å]


Rel. Flux
Cr I
Cr I
Fe I
Co I
Fe I
Cr II
Co I
Ti II
Fe II
Fe I
Fe I
Mn I
Co I
Cr I
Cr I
Ca I
Fe I
Co I
Fe I
Co I
Fe I
Fe I
Fe I
Fe I
Vacuum Wavelength λ in [Å]

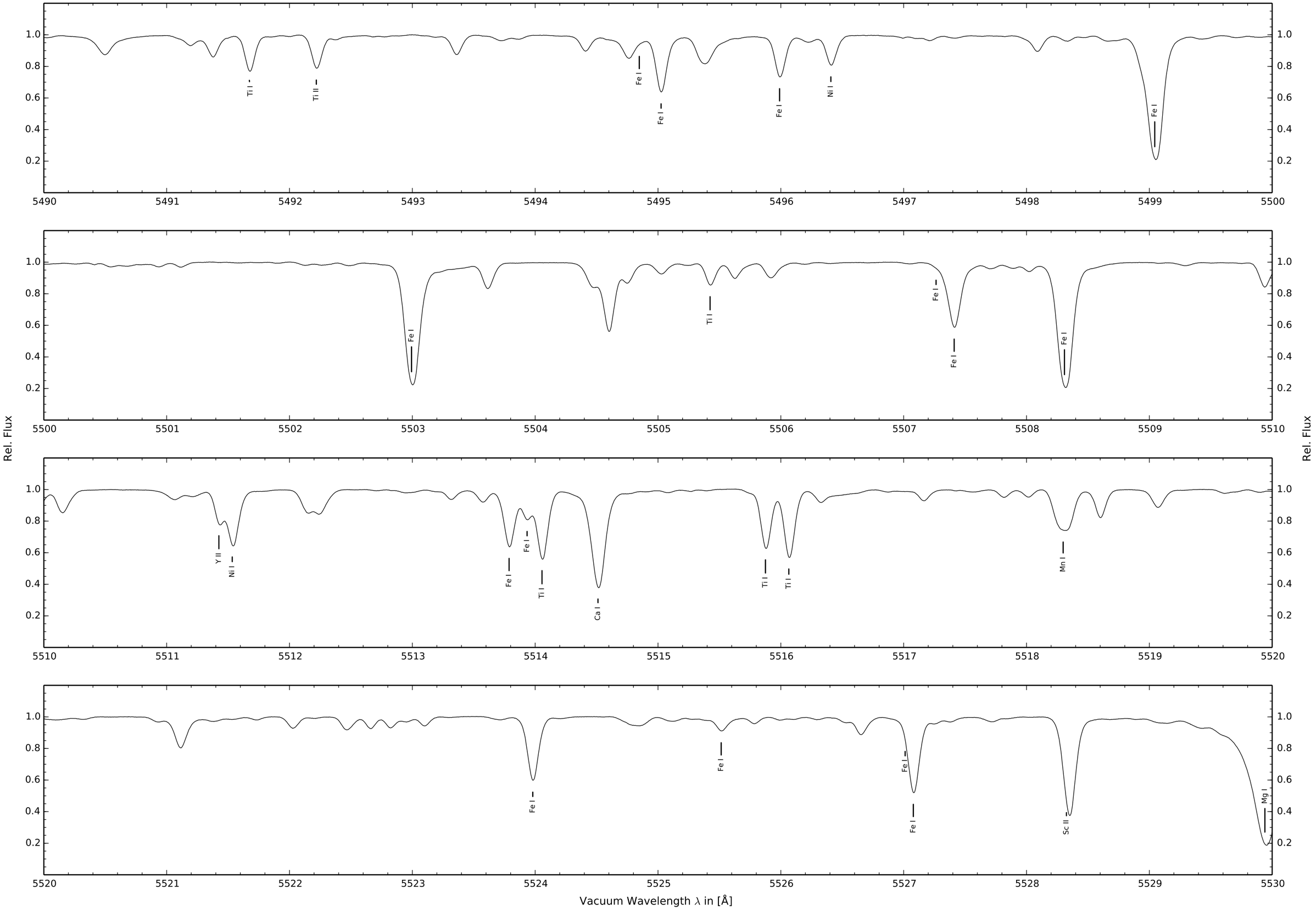


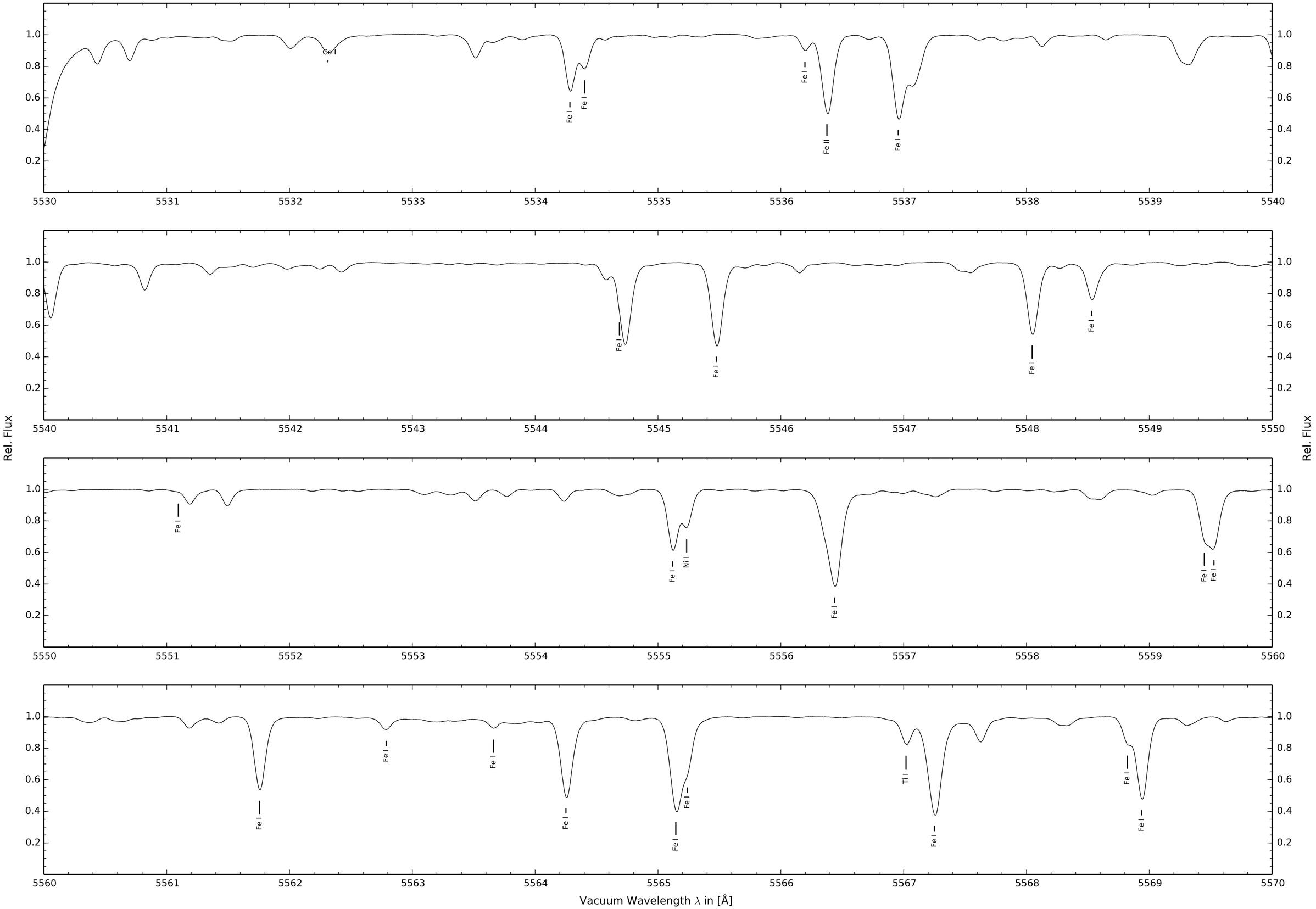
Rel. Flux
Vacuum Wavelength λ in [Å]
Co I
Fe I
Ni I
Mn I
Ti II
Cr I
H2O


Rel. Flux
1.0
0.8
0.6
0.4
0.2
5410
5411
5412
5413
5414
5415
5416
5417
5418
5419
5420
H_2O
Ti I
Cr I
Fe I
Ni I
Fe II
5420
5421
5422
5423
5424
5425
5426
5427
5428
5429
5430
Ti II
Mn I
5430
5431
5432
5433
5434
5435
5436
5437
5438
5439
5440
5440
5441
5442
5443
5444
5445
5446
5447
5448
5449
5450
Vacuum Wavelength λ in [Å]



Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ni I
Mn I
Ti I
CH I
Co I

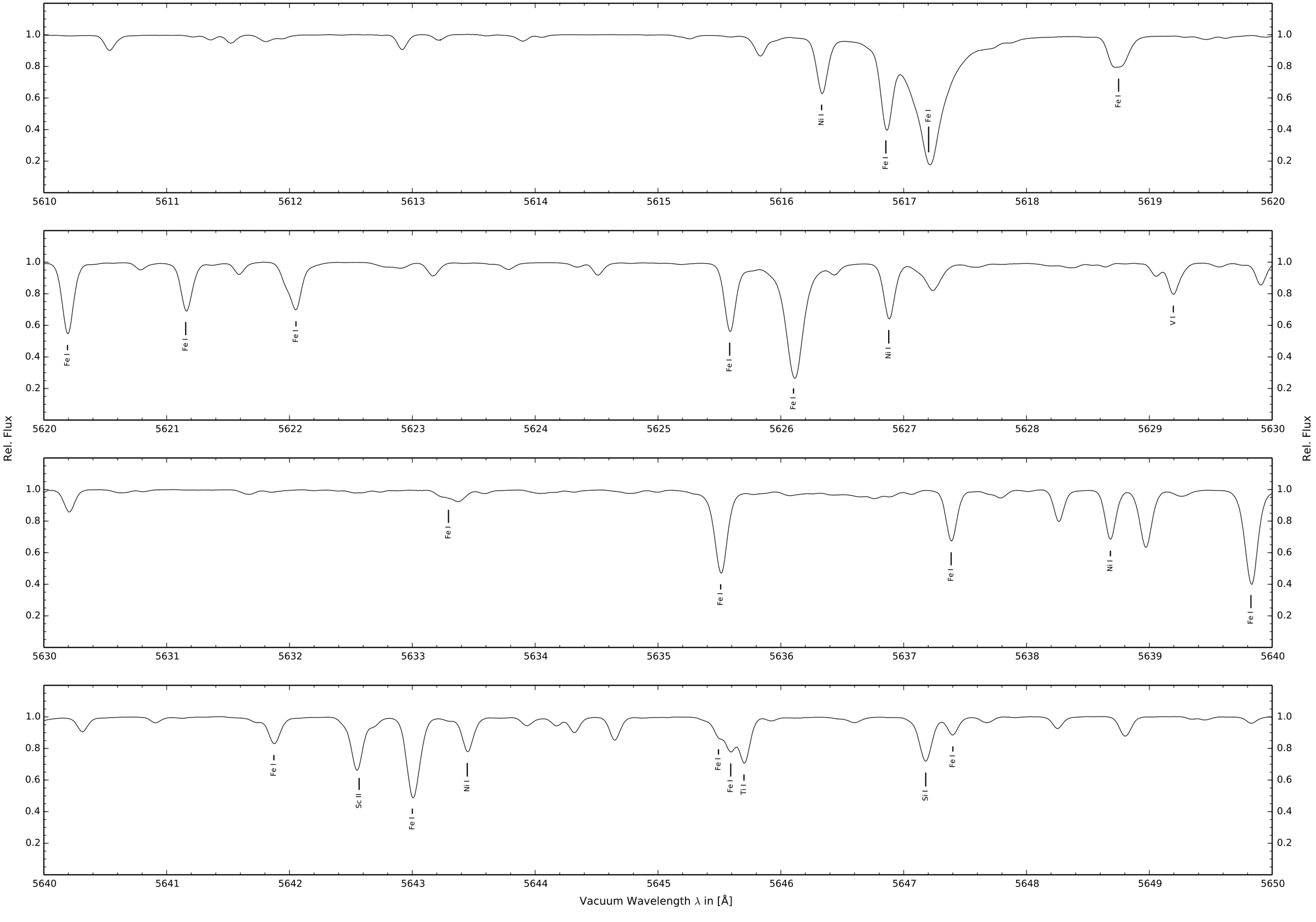

Rel. Flux
Ti I
Ti II
Fe I
Fe I
Fe I
Ni I
Fe I
Fe I
Ti I
Fe I
Fe I
Fe I
Y II
Ni I
Fe I
Fe I
Ti I
Ca I
Ti I
Ti I
Mn I
Fe I
Fe I
Sc II
Fe I
Mg I
Vacuum Wavelength λ in [Å]

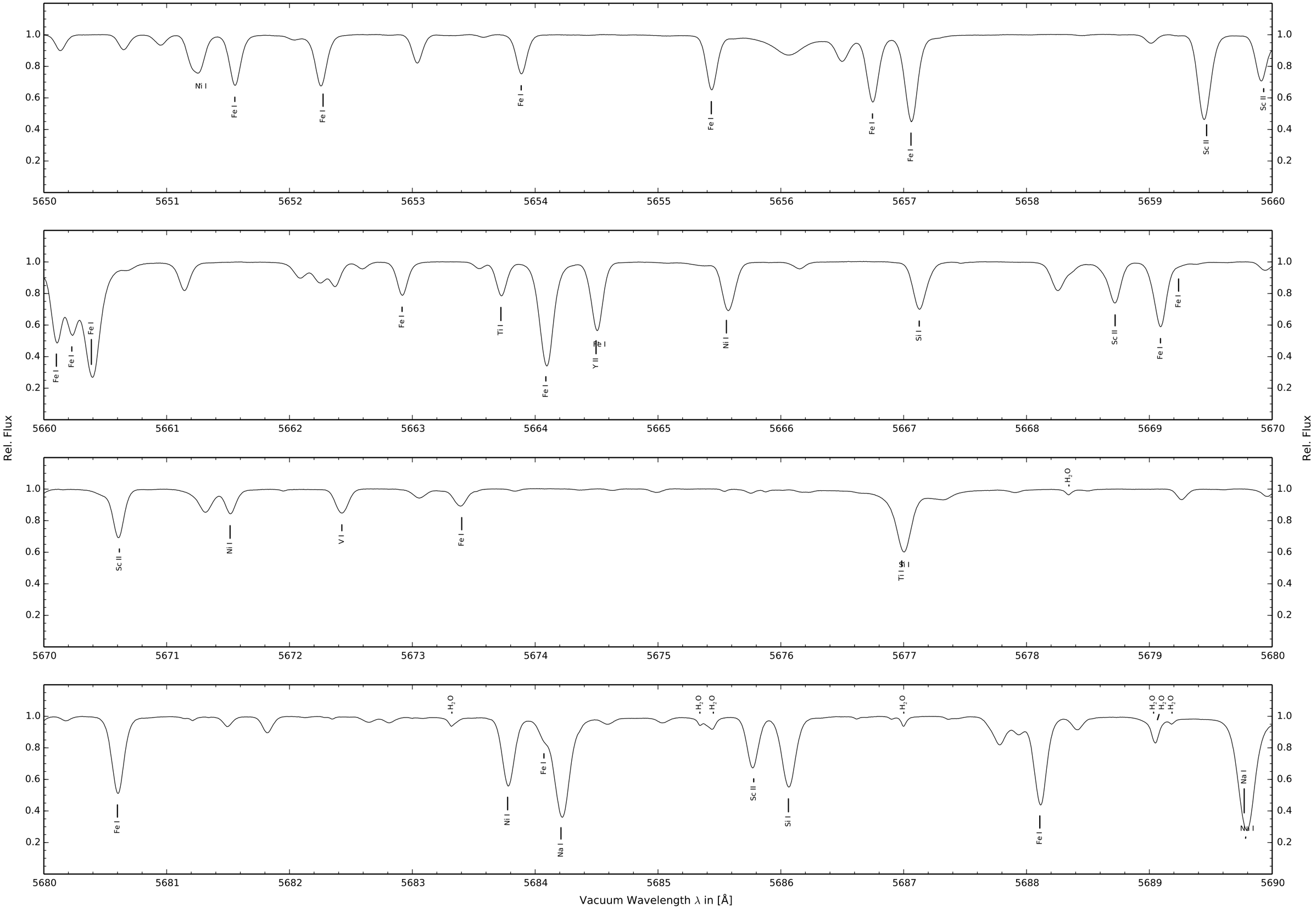

Rel. Flux
Ce I
Fe I
Fe I
Fe I
Fe II
Fe I
Fe I
Fe I
Fe I
Fe I
Ni I
Fe I
Fe I
Fe I
Fe I
Fe I
Fe I
Ti I
Fe I
Fe I
Fe I
Vacuum Wavelength λ in [Å]

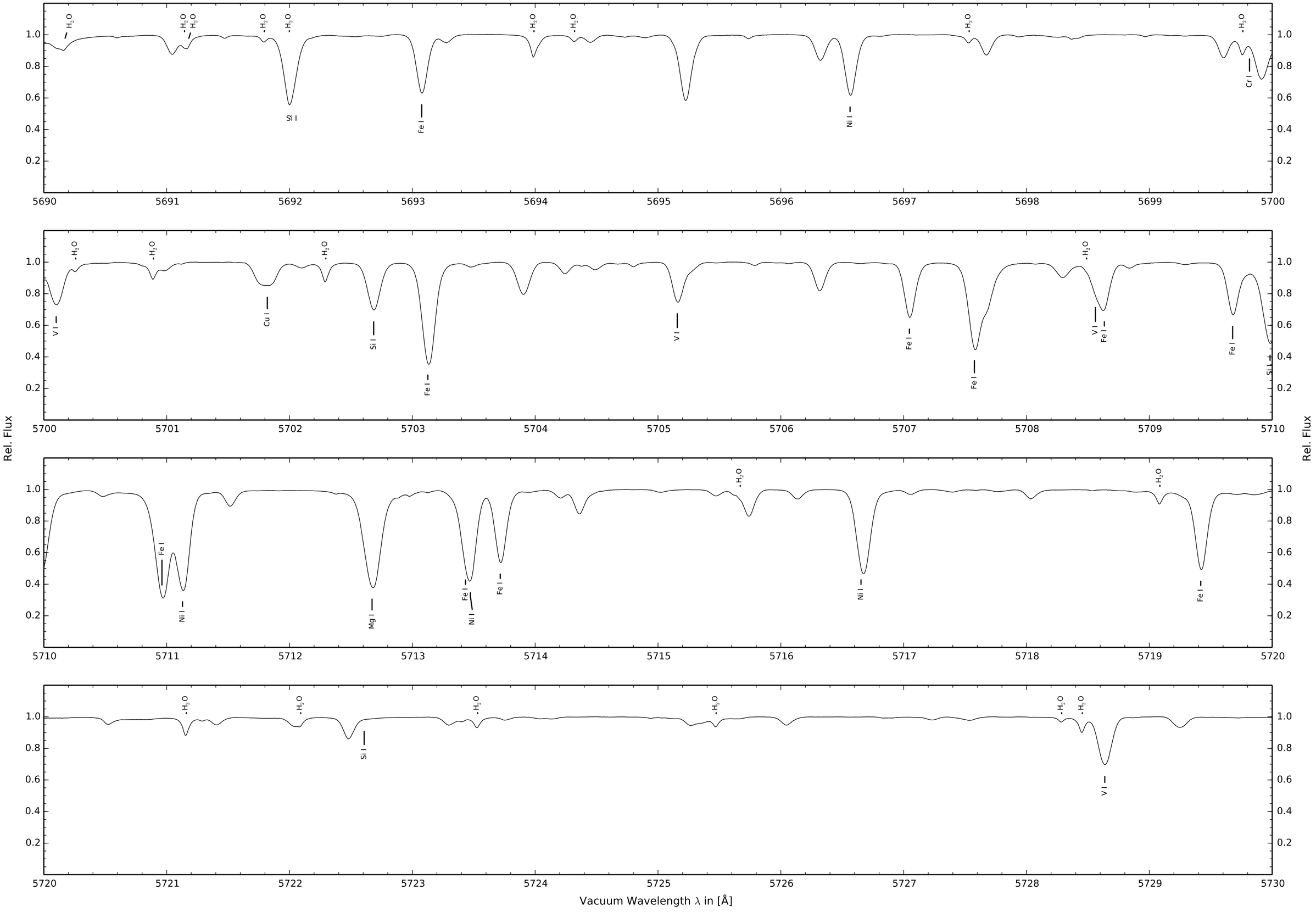
Rel. Flux

Fe I
Fe I
Fe I
Ni I
Ca I
Si I
Fe I
Fe I
Fe I
Fe I
Ni I
Ca I
Ni I
Ni I
Ca I
Ni I
Si I
Fe I
Ca I
Ni I
Fe I
Fe I
Ca I
Fe I
Ca I
Fe I

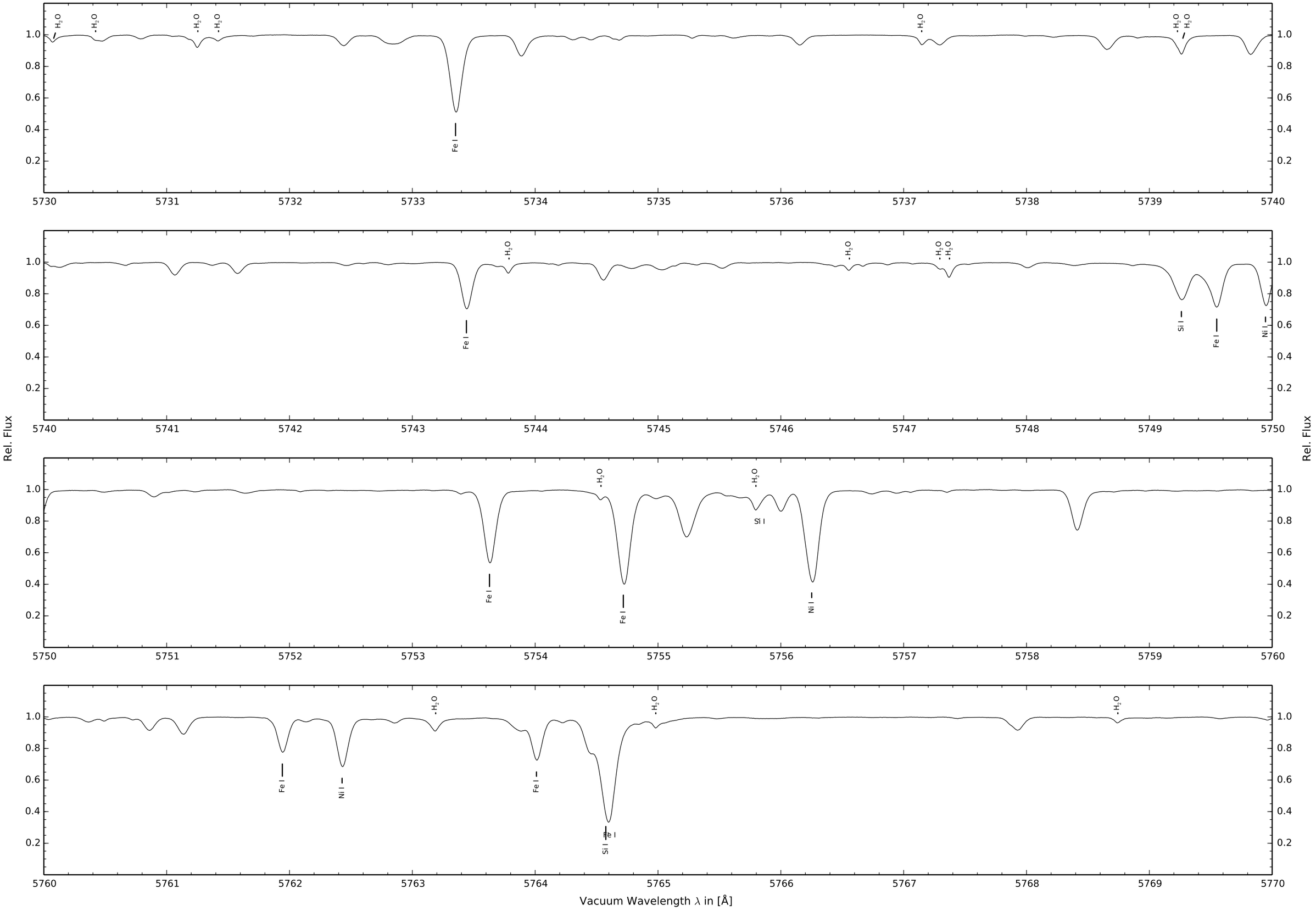
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Fe I
Fe I
Ni I
Fe I
Fe I
Fe I
Fe I
Ni I
V I
Fe I
Sc II
Fe I
Ni I
Fe I
Fe I
Ti I
Si I
Fe I
Fe I
Ni I
Fe I
Vacuum Wavelength λ in [Å]


Rel. Flux
Ni I
Fe I
Fe I
Fe I
Fe I
Fe I
Fe I
Sc II
Fe I
Fe I
Fe I
Ti I
Fe I
Y II
Fe I
Ni I
Si I
Sc II
Fe I
Fe I
Sc II
Ni I
V I
Fe I
Ti I
Si I
- H2O
Fe I
Ni I
Fe I
Na I
Sc II
Si I
Fe I
Na I
Na I
Vacuum Wavelength λ in [Å]



Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Fe I
Ni I
Cr I
V I
Cu I
Mg I


Rel. Flux
1.0
0.8
0.6
0.4
0.2
H2O
Fe I
Si I
Ni I
5730
5731
5732
5733
5734
5735
5736
5737
5738
5739
5740
5741
5742
5743
5744
5745
5746
5747
5748
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5751
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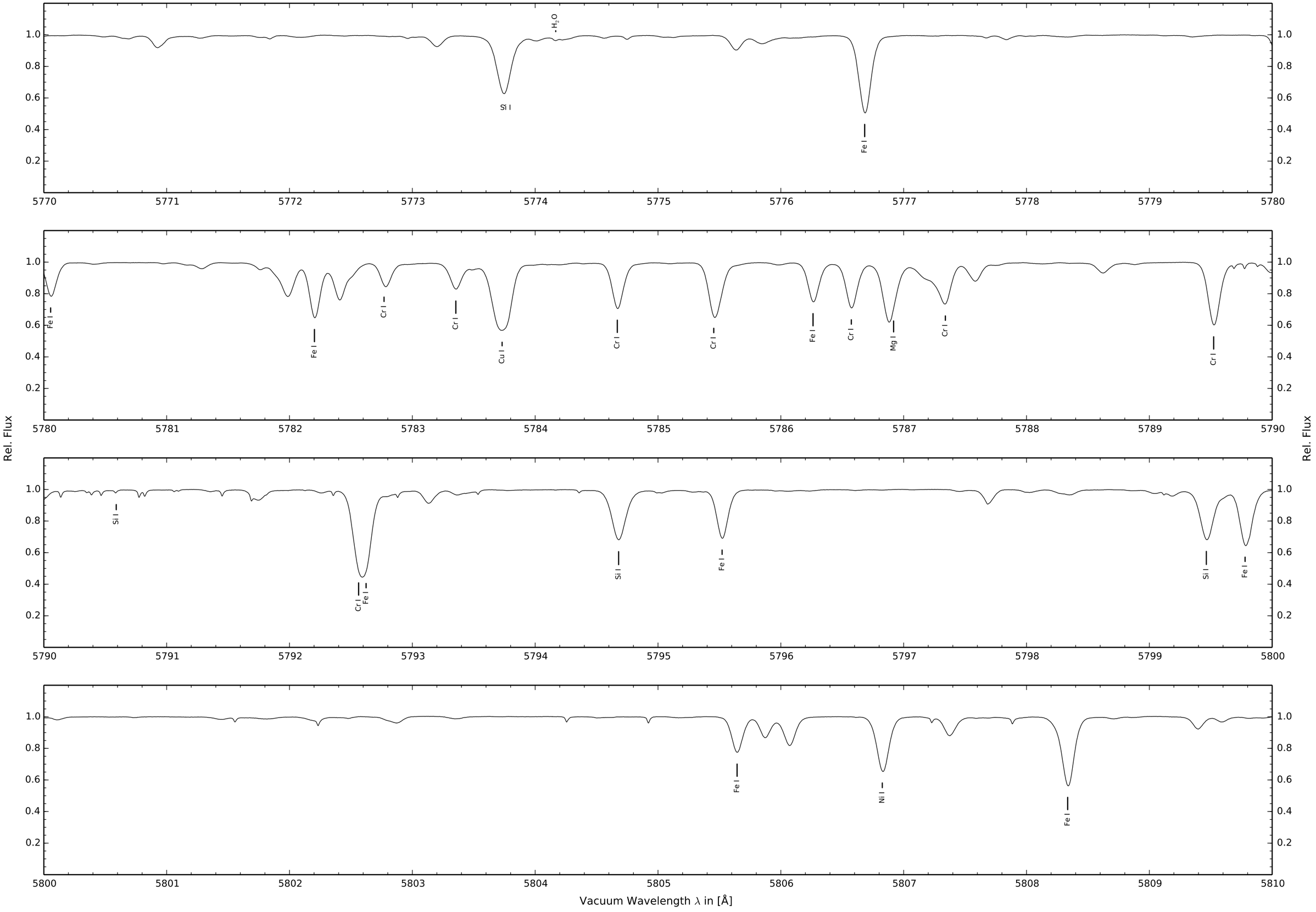
5766
5767
5768
5769
5770
Vacuum Wavelength λ in [Å]


Rel. Flux
Si I
H_2O
Fe I
Cr I
Cu I
Mg I
Ni I
Vacuum Wavelength λ in [Å]

Si I
Fe I
Fe I
Fe I
Ni I
Fe I
Ni I
Fe I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]

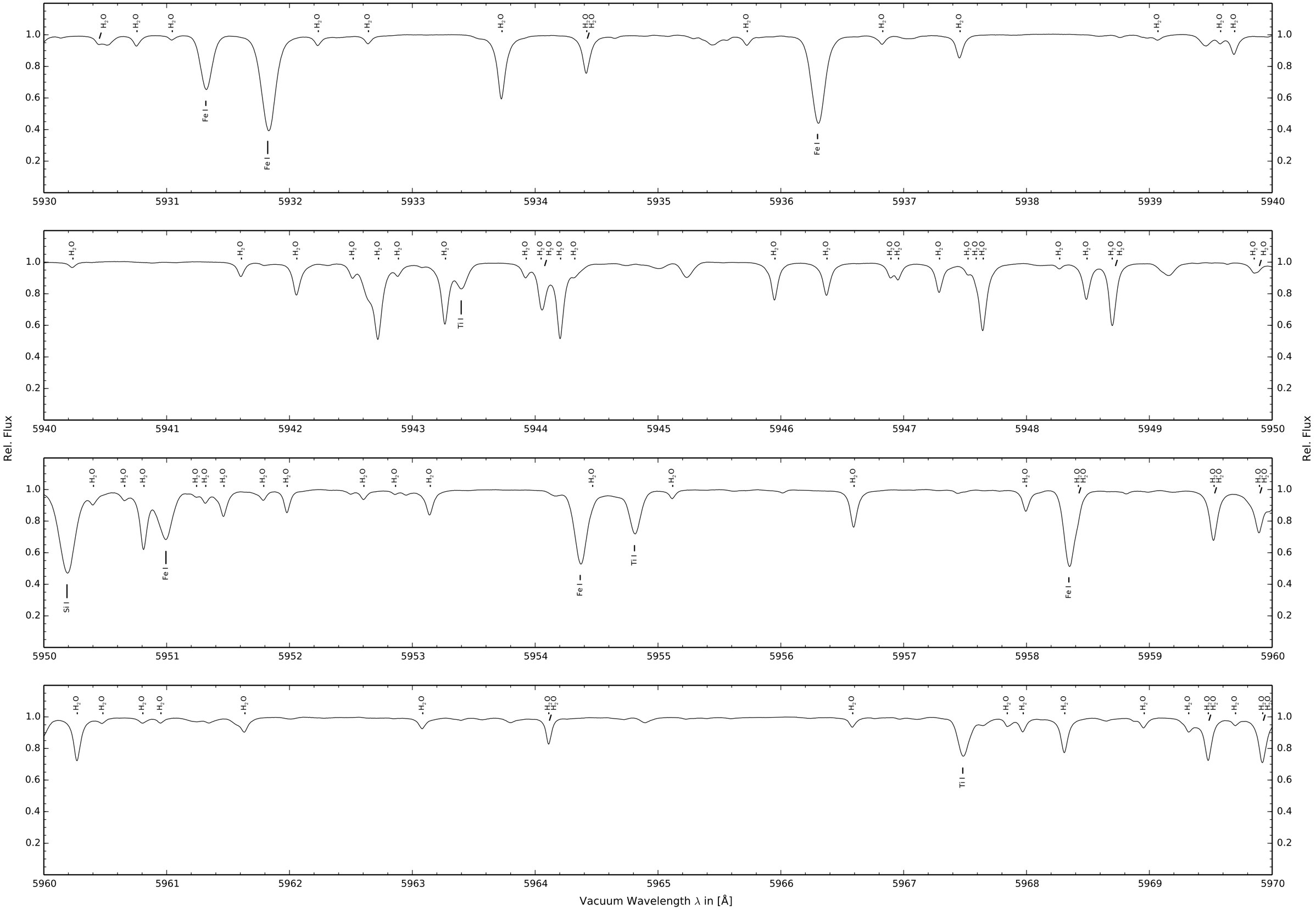
Rel. Flux

Fe I
Ba II
Fe I
Fe I
Ca I
Ni I
H_2O
Fe I
Fe I
H_2O
H_2O
Ti I
Ca I
H_2O
H_2O
Fe I
Vacuum Wavelength λ in [Å]

Rel. Flux

Na I
Fe I
Ni I
Na I
Ti I
Fe I
Fe I
Fe I
Fe I
Ti I
Fe I

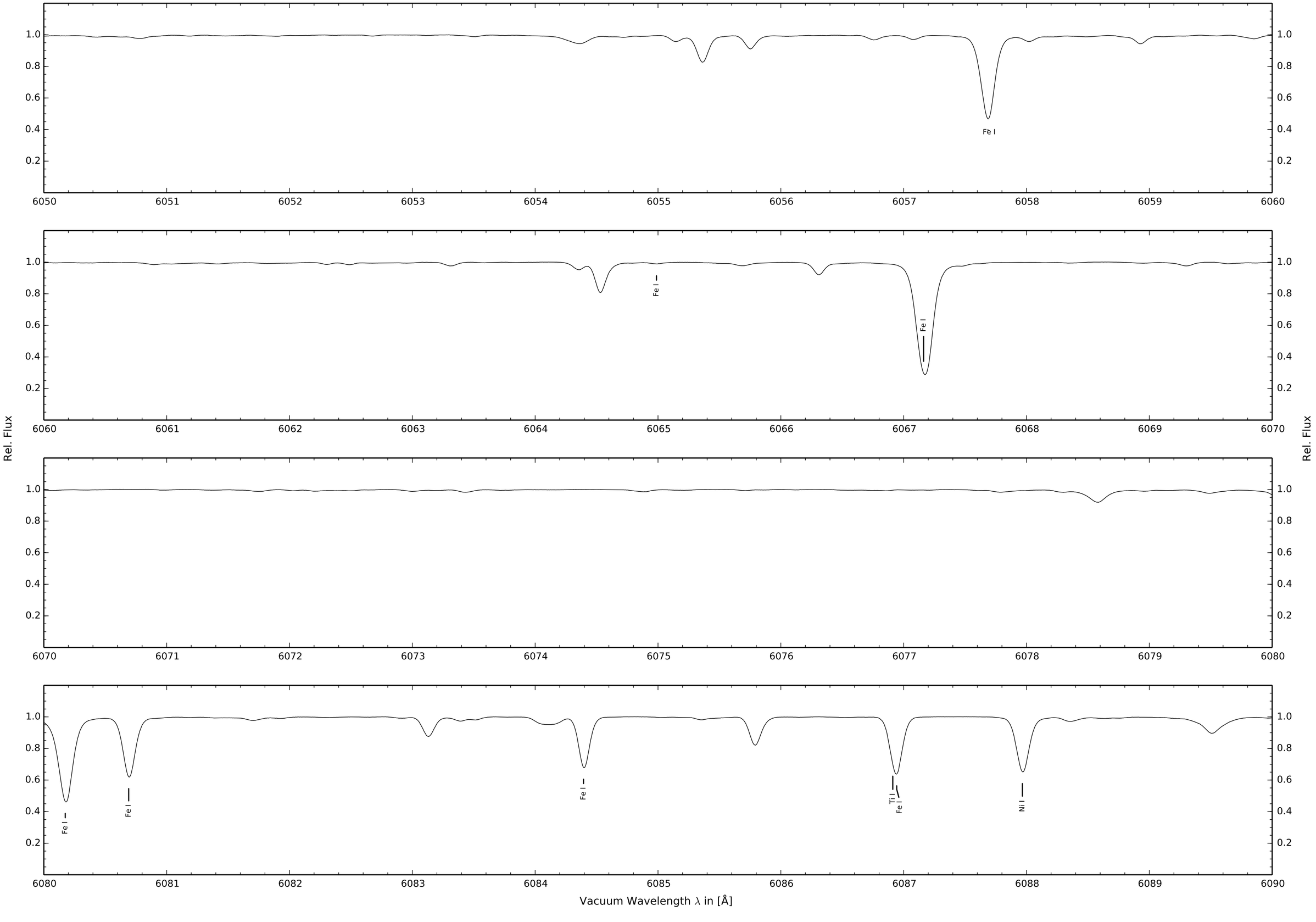
Vacuum Wavelength λ in [Å]

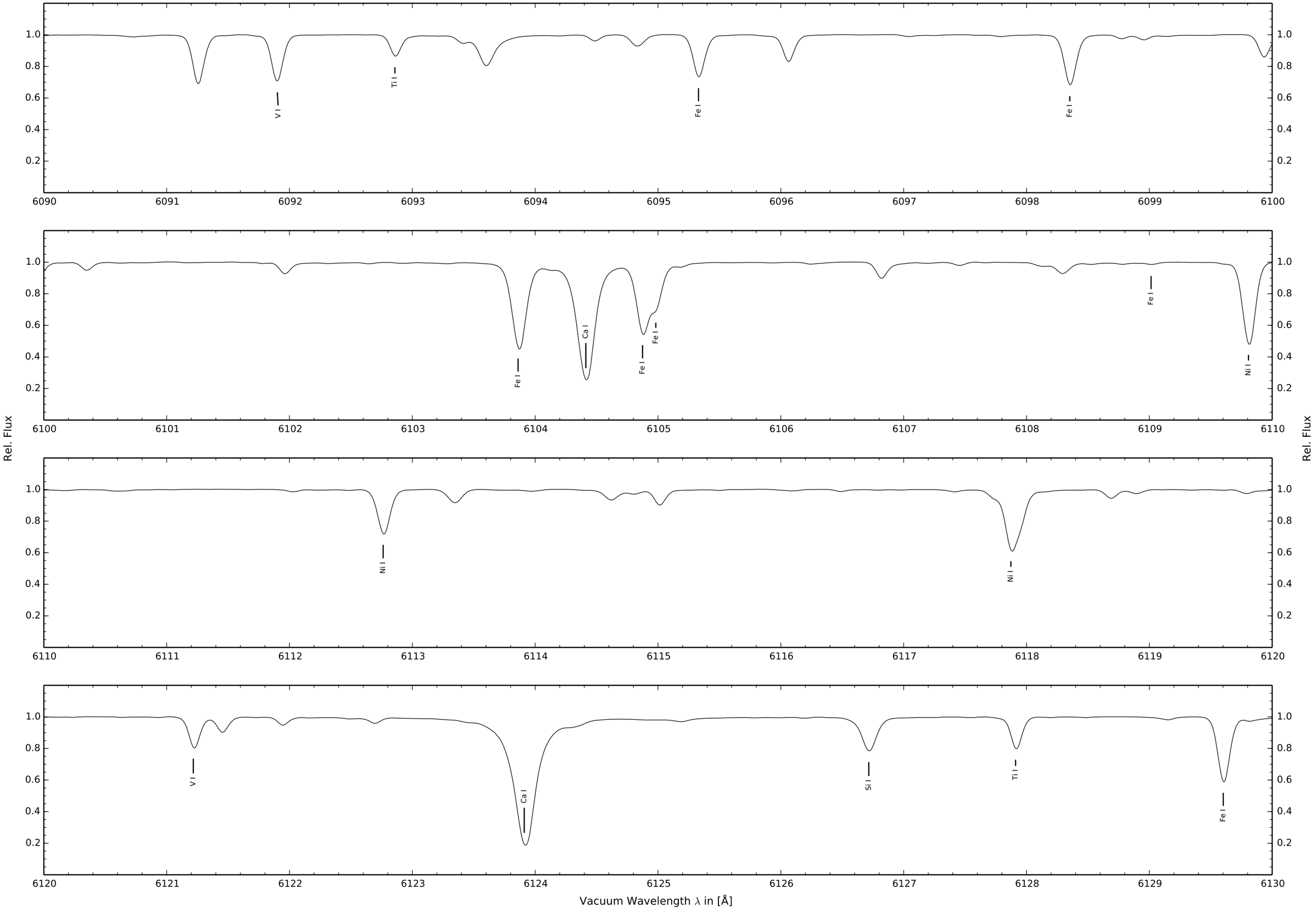

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ti I
Si I

Rel. Flux

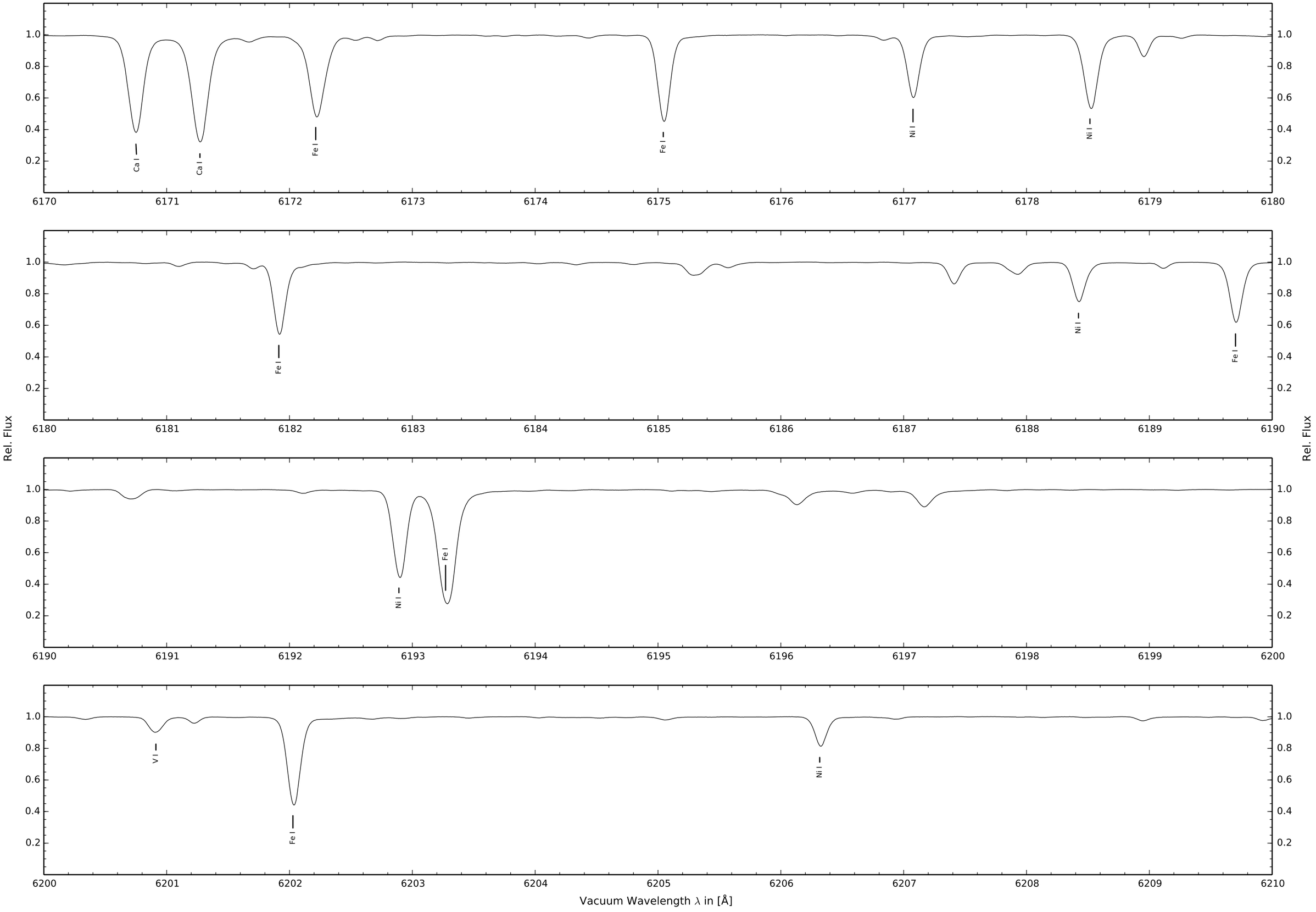
Vacuum Wavelength λ in [Å]

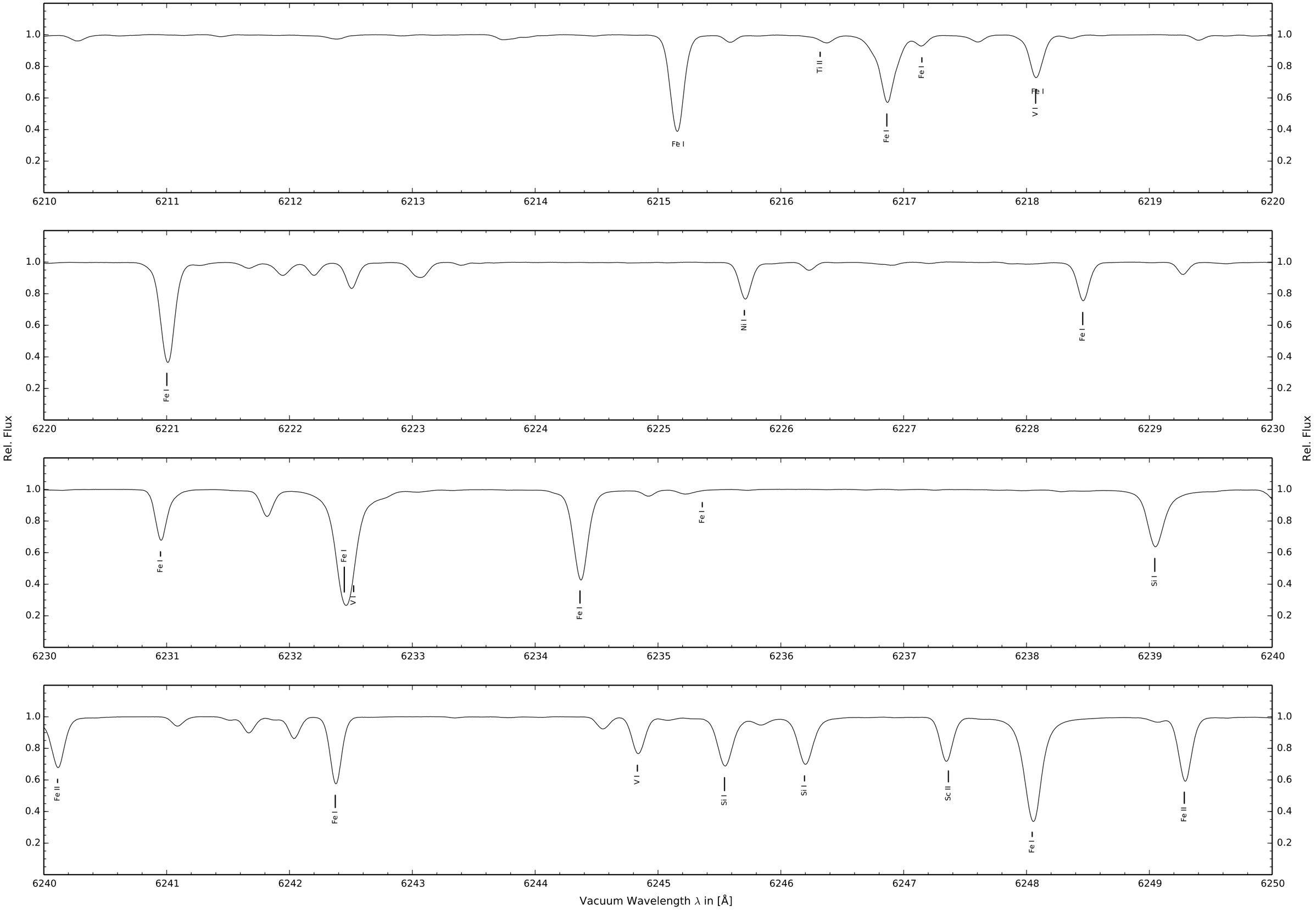
Rel. Flux
1.0
0.8
0.6
0.4
0.2
6010
6011
6012
6013
6014
6015
6016
6017
6018
6019
6020
6021
6022
6023
6024
6025
6026
6027
6028
6029
6030
6031
6032
6033
6034
6035
6036
6037
6038
6039
6040
6041
6042
6043
6044
6045
6046
6047
6048
6049
6050
H_2O
Fe I
Mn I
Si I
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Fe I
Fe I
Fe I
Fe I
Ti I
Fe I
Ni I
Vacuum Wavelength λ in [Å]


Rel. Flux
1.0
0.8
0.6
0.4
0.2
6090
6091
6092
6093
6094
6095
6096
6097
6098
6099
6100
V I
Ti I
Fe I
Fe I
6100
6101
6102
6103
6104
6105
6106
6107
6108
6109
6110
Fe I
Ca I
Fe I
Fe I
Fe I
Ni I
6110
6111
6112
6113
6114
6115
6116
6117
6118
6119
6120
Ni I
Ni I
6120
6121
6122
6123
6124
6125
6126
6127
6128
6129
6130
V I
Ca I
Si I
Ti I
Fe I
Vacuum Wavelength λ in [Å]

Rel. Flux
Ni I
Fe I
Ni I
Fe I
Fe I
Fe I
Fe I
Ba II
Fe I
Si I
Si I
Fe II
Fe I
Fe I
Fe II
Fe I
Na I
Si I
Fe I
Na I
Ca I
Ca I
Ni I
Fe I
Ca I
Fe I
Ca I
Vacuum Wavelength λ in [Å]

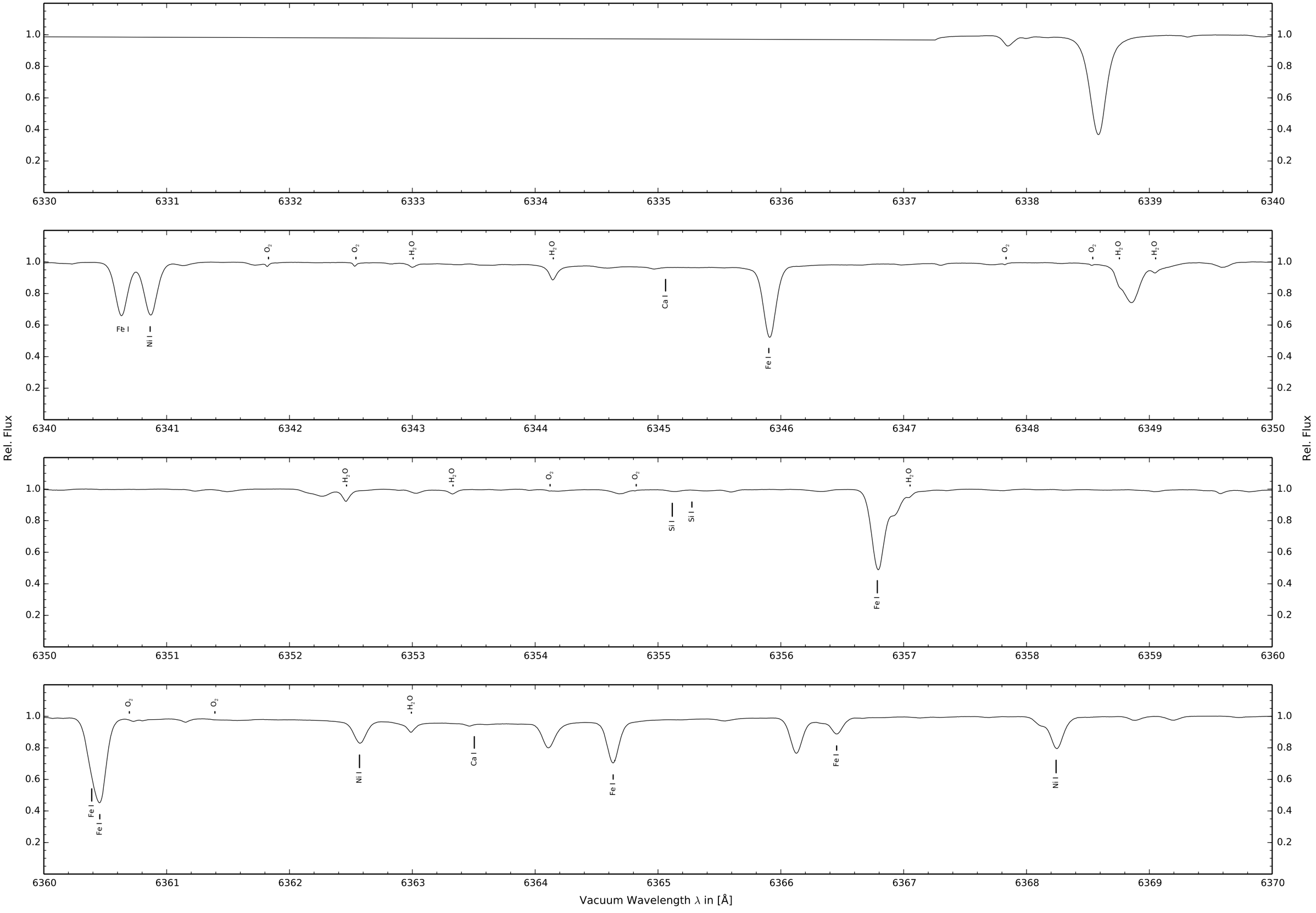

Rel. Flux
Ca I
Ca I
Fe I
Fe I
Ni I
Ni I
Fe I
Ni I
Fe I
Ni I
Fe I
V I
Fe I
Ni I
Vacuum Wavelength λ in [Å]

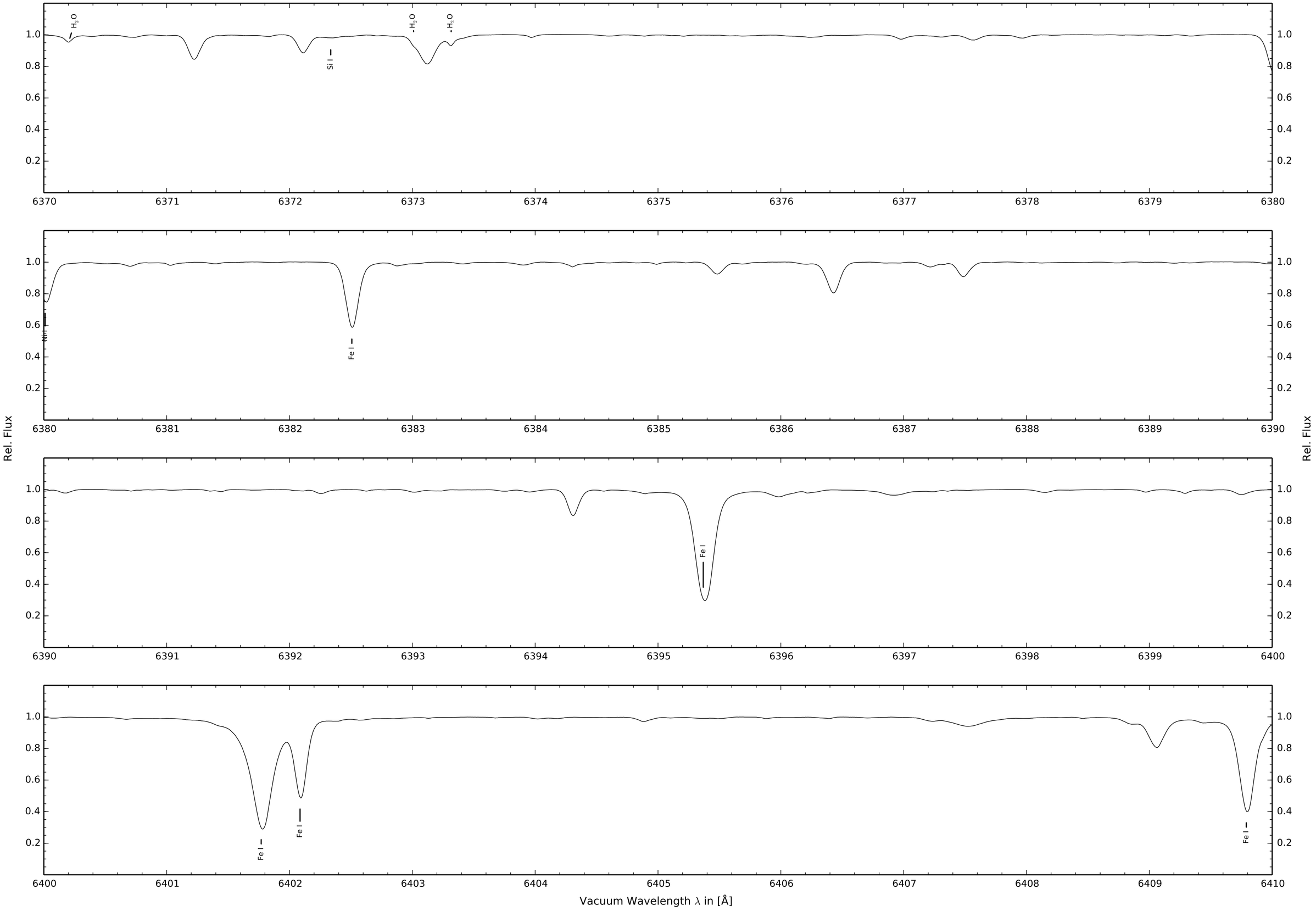

Rel. Flux
Fe I
Ti II
Fe I
Fe I
V I
Fe I
Fe I
Ni I
Fe I
Fe I
Fe I
V I
Fe I
Fe I
Si I
Fe II
Fe I
V I
Si I
Si I
Sc II
Fe I
Fe II
Vacuum Wavelength λ in [Å]

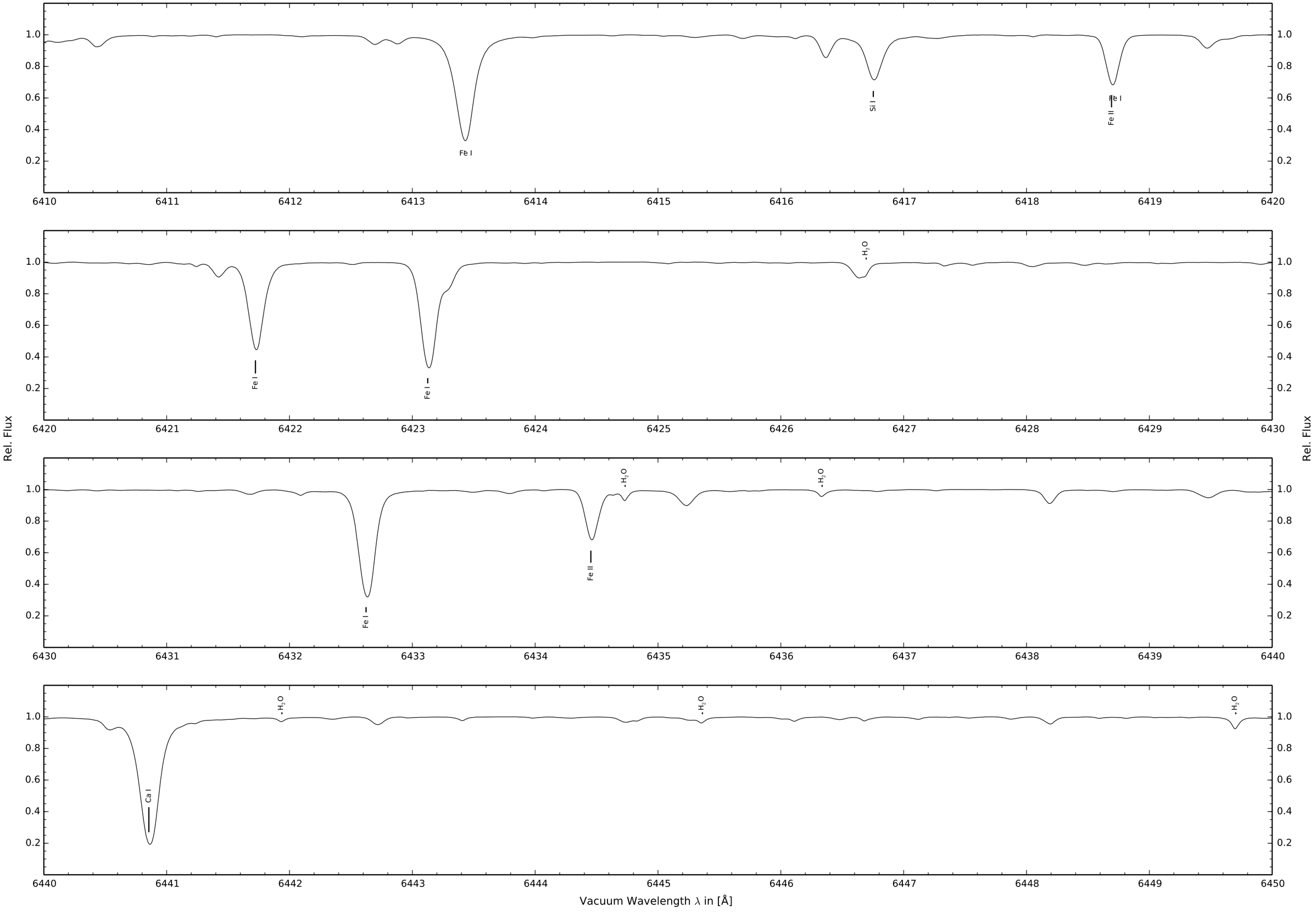
Rel. Flux

V I
Fe I
Si I
Fe I
Ni I
Fe I
Ti I
Ti I
H_2O
Ti I
Fe I
H_2O
Fe I
Fe I
H_2O
Fe I
H_2O
H_2O
H_2O

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
Fe I
Ni I
Ca I
Mg I

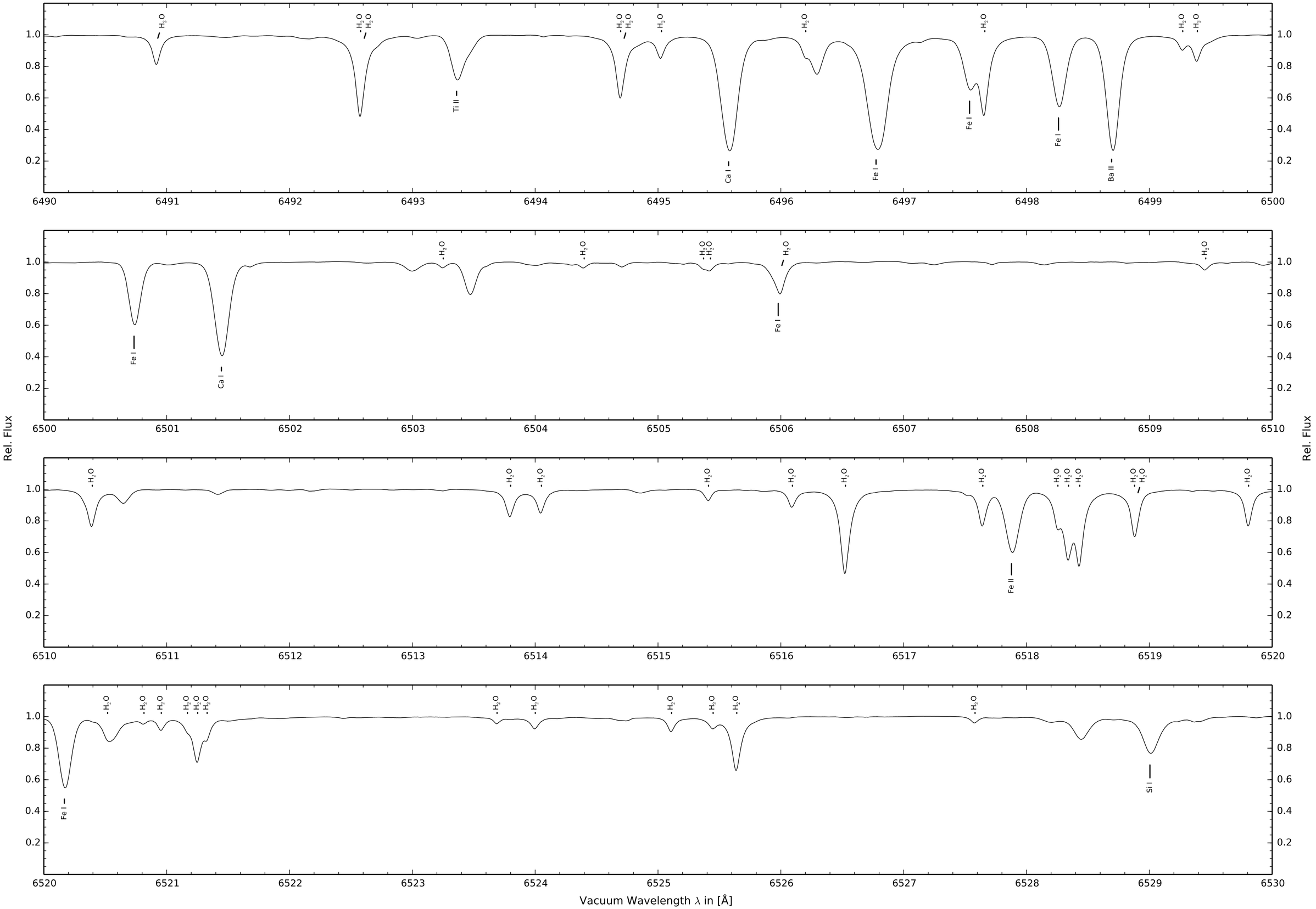

Rel. Flux
Fe I
Ni I
- O2
- H2O
Ca I
Si I
Vacuum Wavelength λ in [Å]

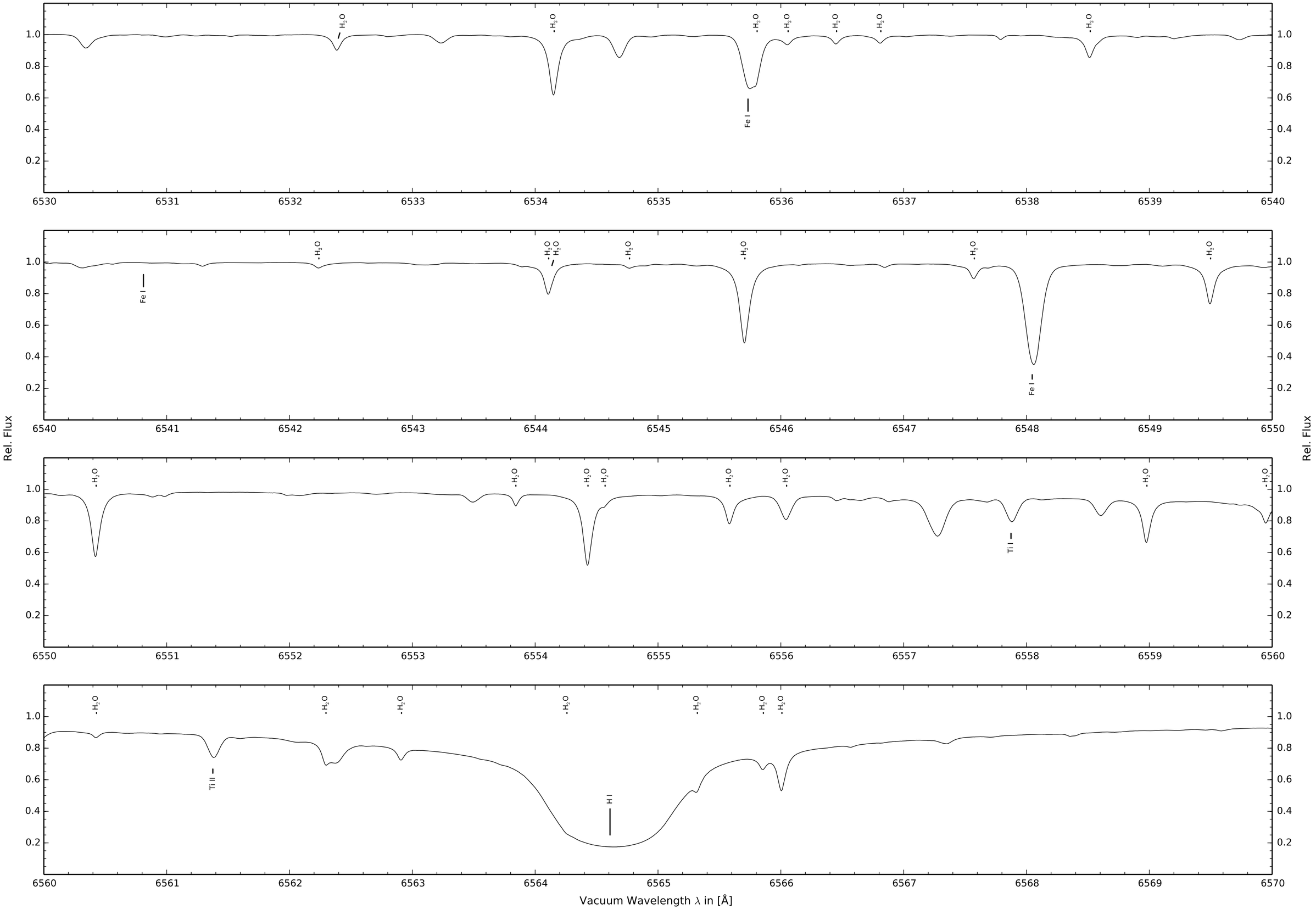

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Ni I
Fe I

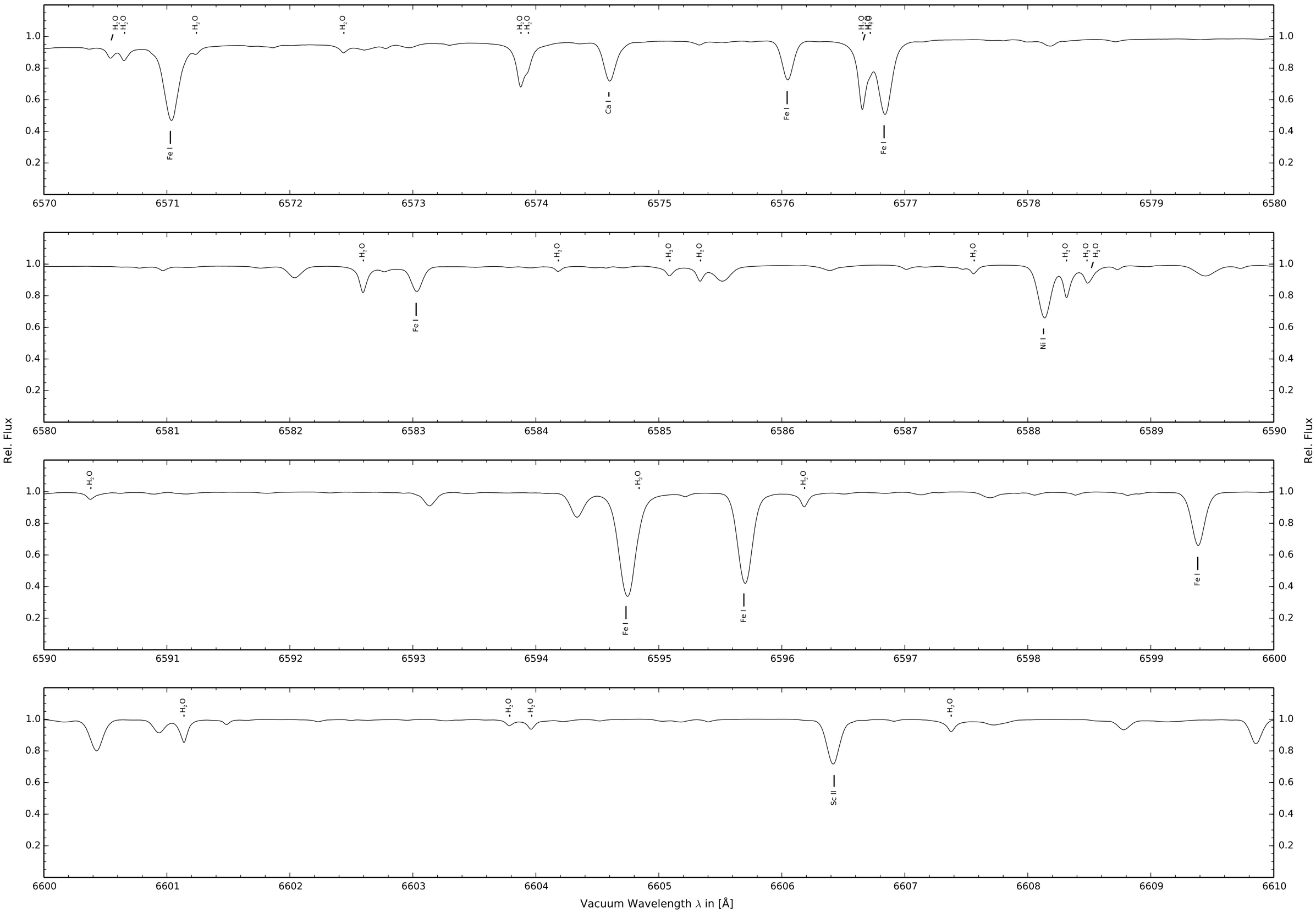

Rel. Flux
Fe I
Si I
Fe II
Fe I
Fe I
Fe I
- H_2O
Fe I
- H_2O
Fe II
- H_2O
- H_2O
- H_2O
- H_2O
Ca I
Vacuum Wavelength λ in [Å]

Rel. Flux

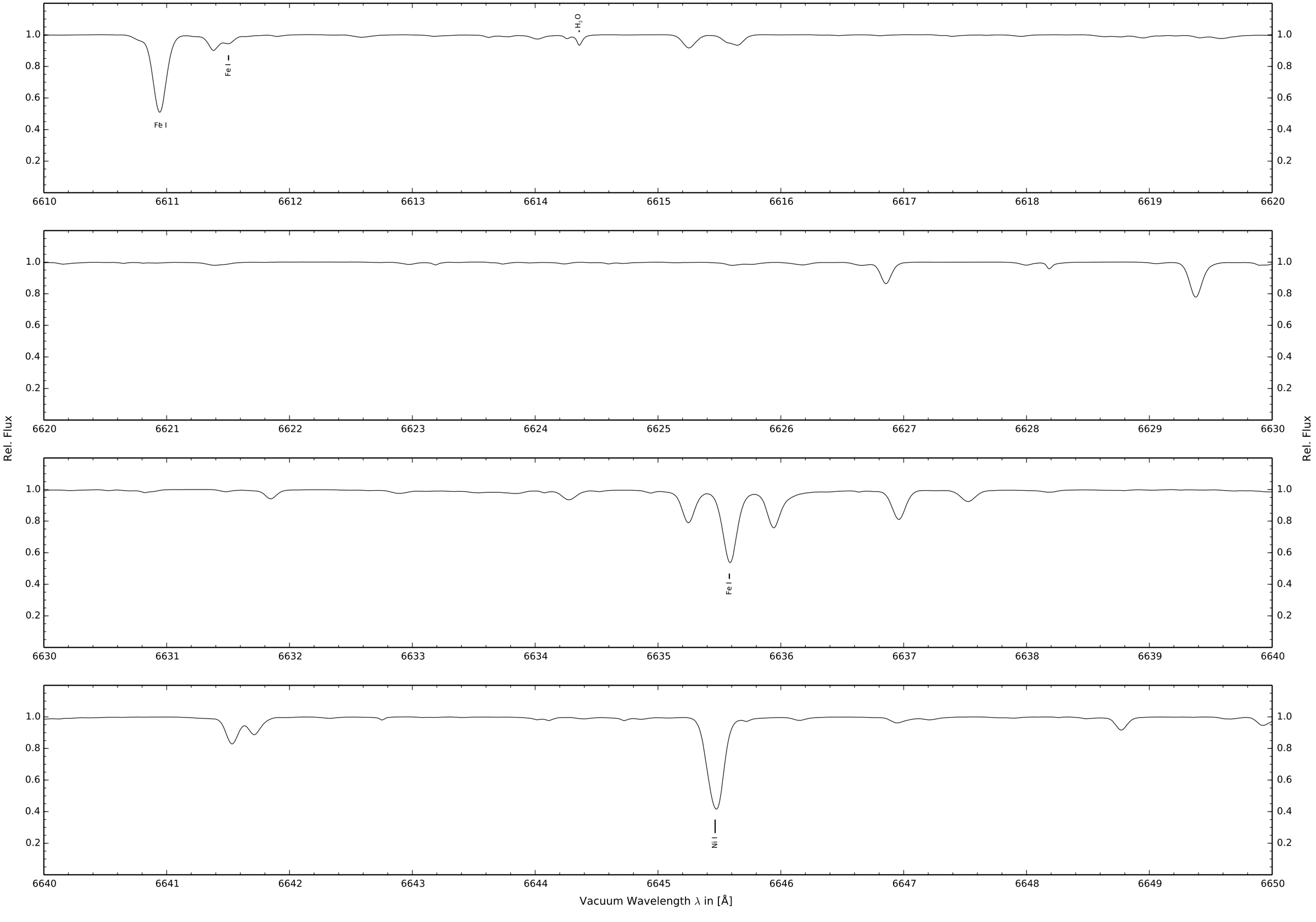
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Ti II
Ca I
Fe I
Ba II
Fe II
Si I
H2O

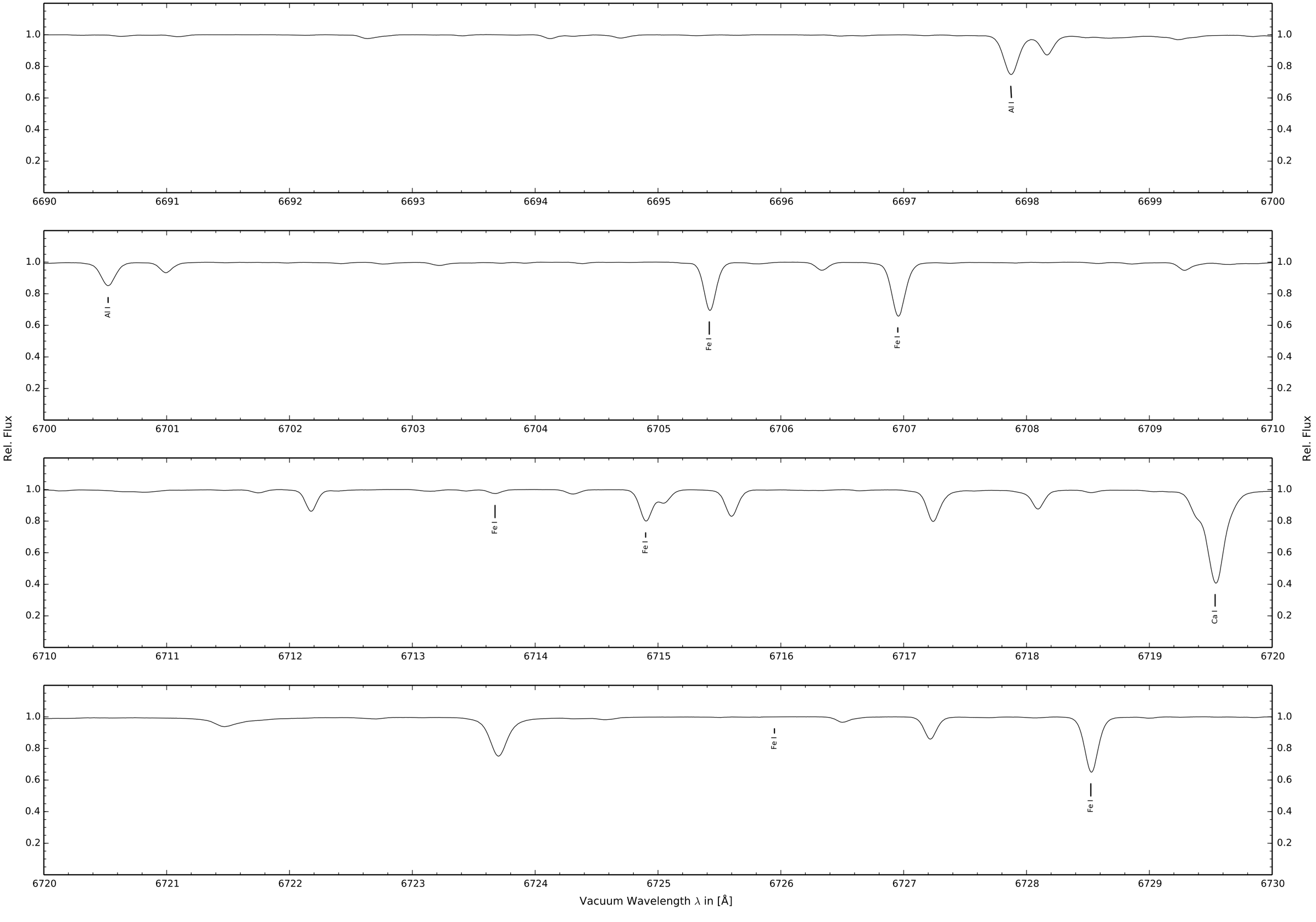

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ti I
Ti II
H I

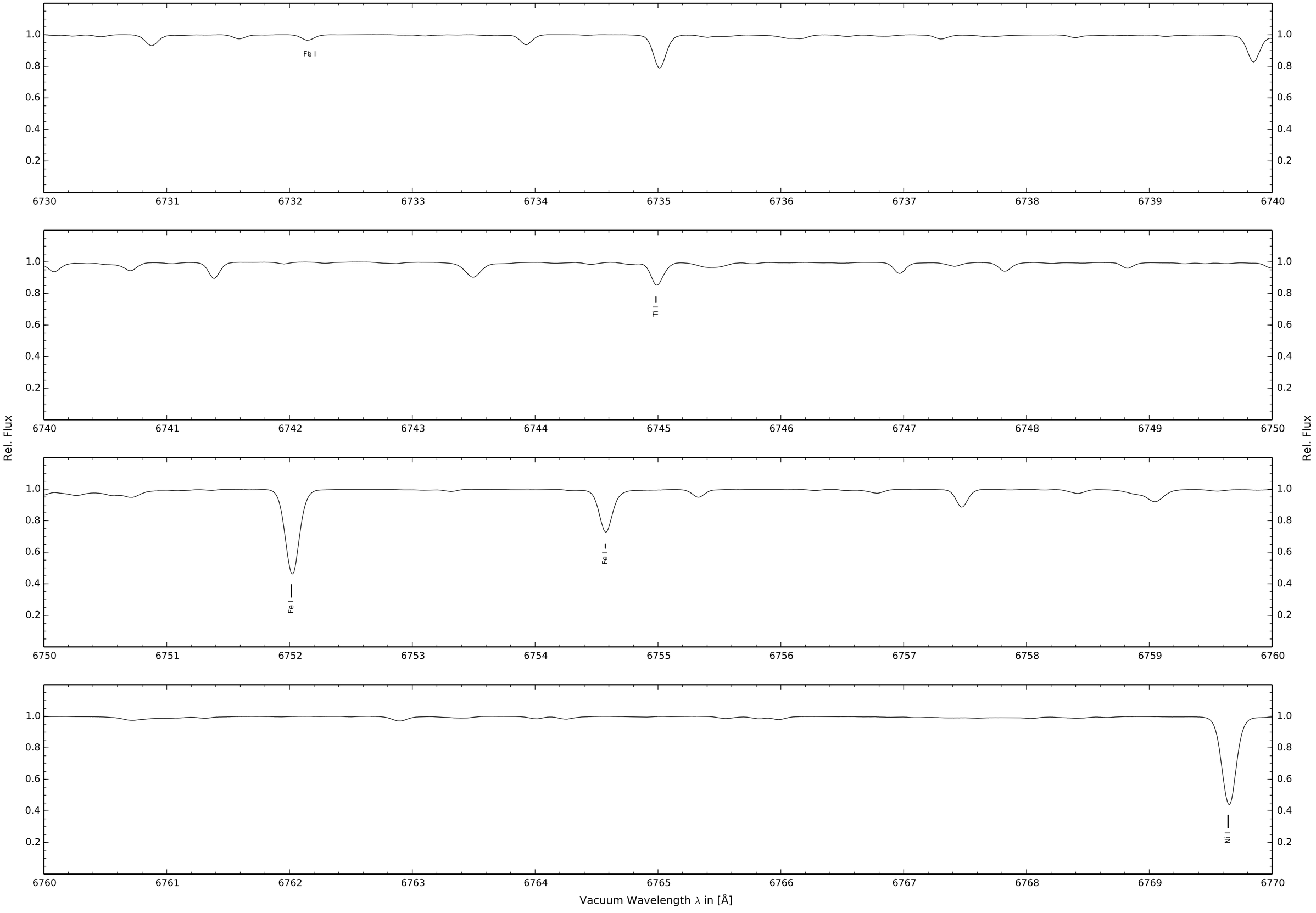


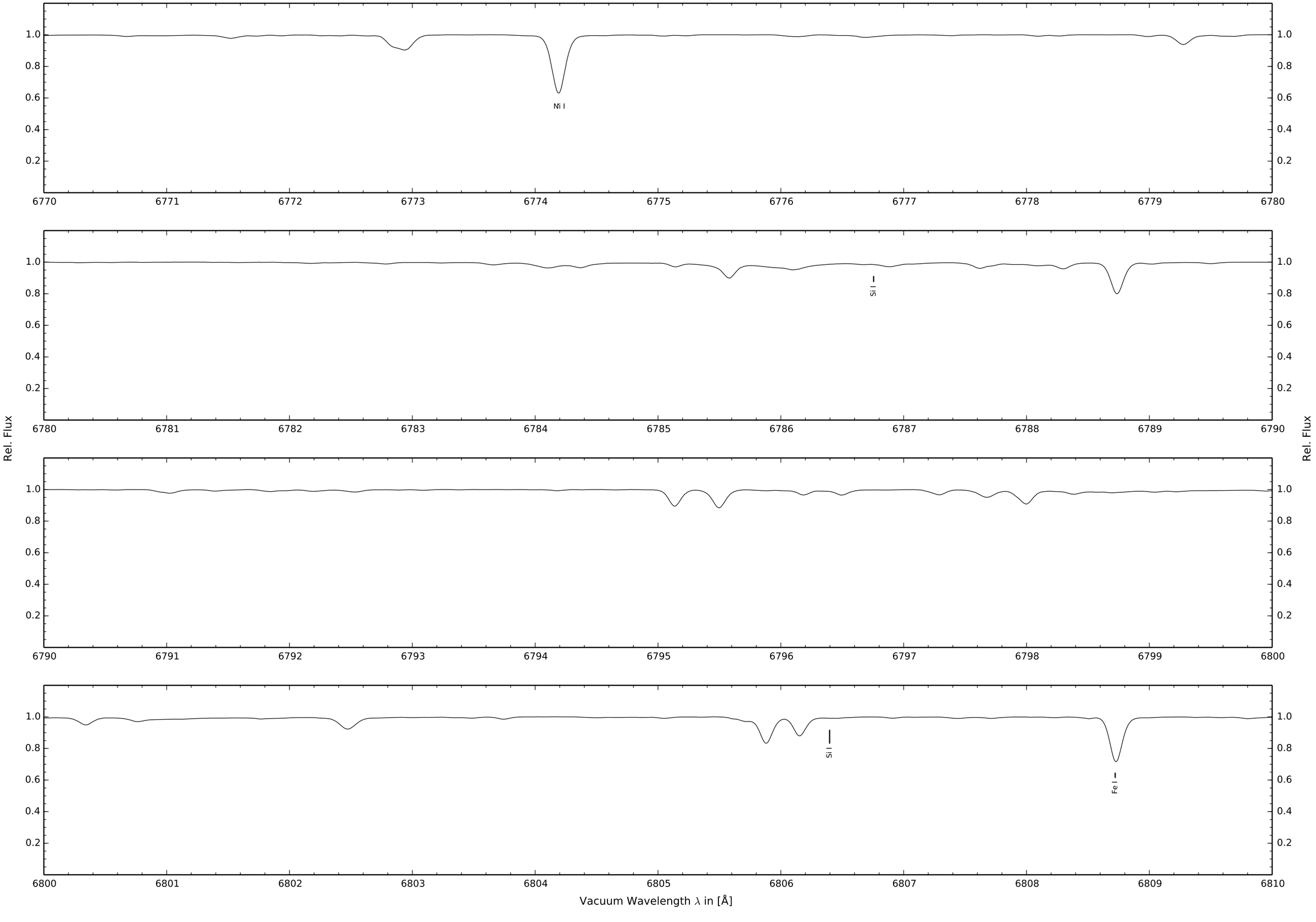
Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Ca I
Ni I
Sc II
H2O


Fe I
Fe I
H_2O
Fe I
Ni I
Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux
1.0
0.8
0.6
0.4
0.2
6650
6651
6652
6653
6654
6655
6656
6657
6658
6659
6660
Fe I
6660
6661
6662
6663
6664
6665
6666
6667
6668
6669
6670
6670
6671
6672
6673
6674
6675
6676
6677
6678
6679
6680
Fe I
6680
6681
6682
6683
6684
6685
6686
6687
6688
6689
6690
Vacuum Wavelength λ in [Å]


Rel. Flux
Al I
Al I
Fe I
Fe I
Fe I
Fe I
Fe I
Ca I
Fe I
Vacuum Wavelength λ in [Å]


Fe I
Ti I
Fe I
Fe I
Ni I
Rel. Flux
Vacuum Wavelength λ in [Å]


Ni I
Si I
Si I
Fe I
Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux

Fe I

Fe I

Fe I

Ni I

Fe I

Fe I

Fe I

Vacuum Wavelength λ in [Å]

Rel. Flux

Fe I

O_2

H_2O

Cr I

Fe I

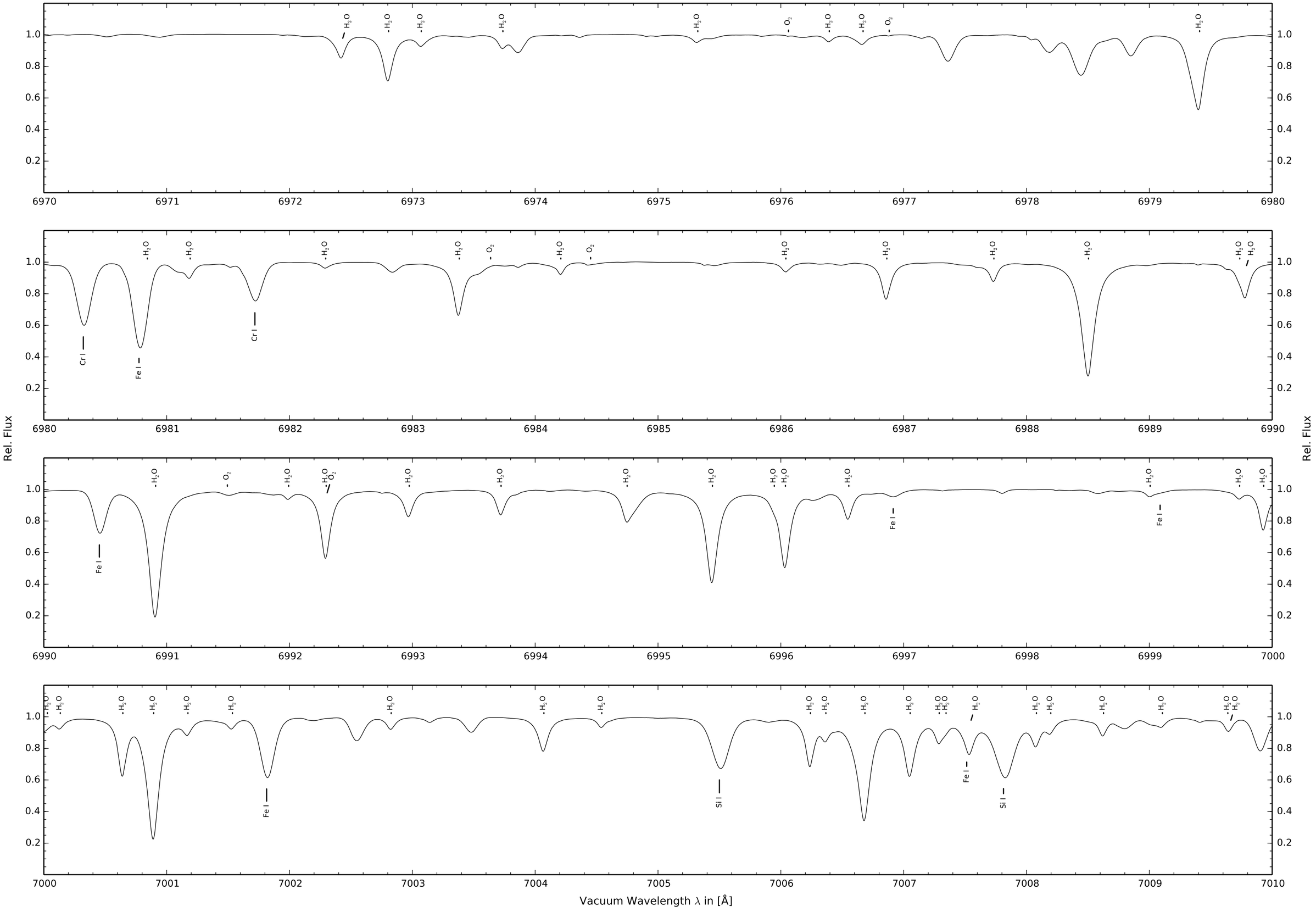
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

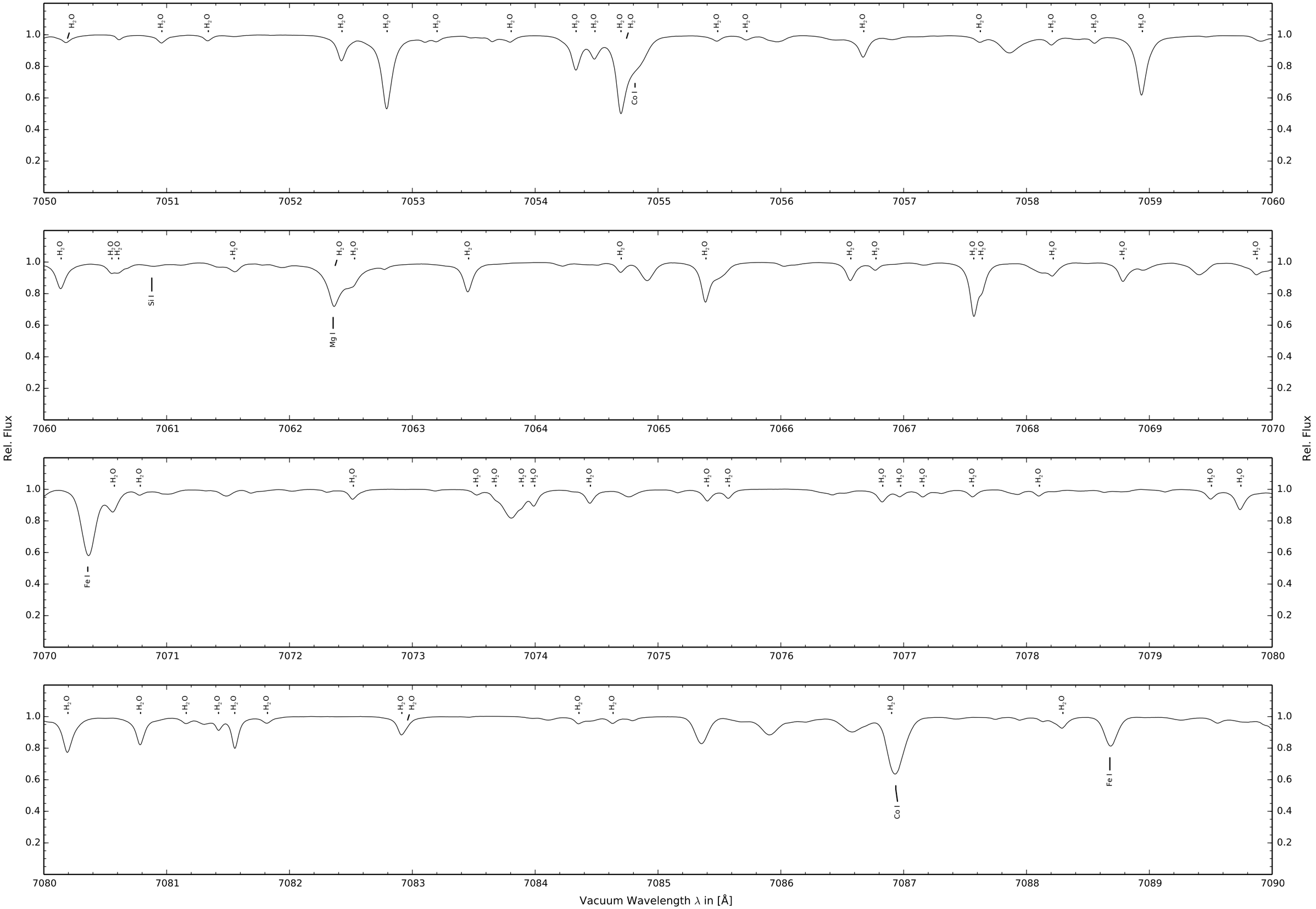
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
Cr I
Fe I
Si I

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Mg I
Co I
Fe I

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Fe I

Ca I

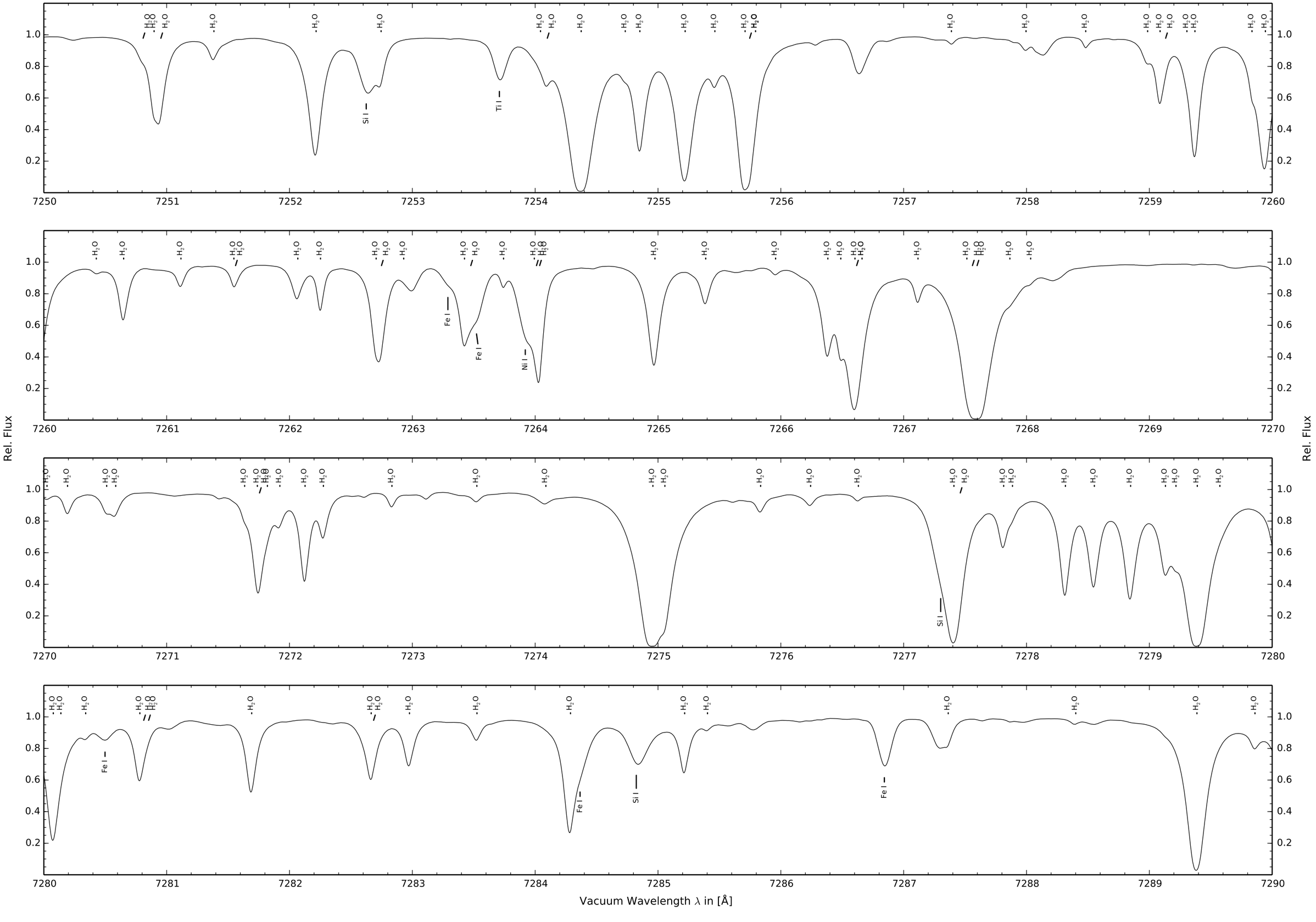
Vacuum Wavelength λ in [Å]

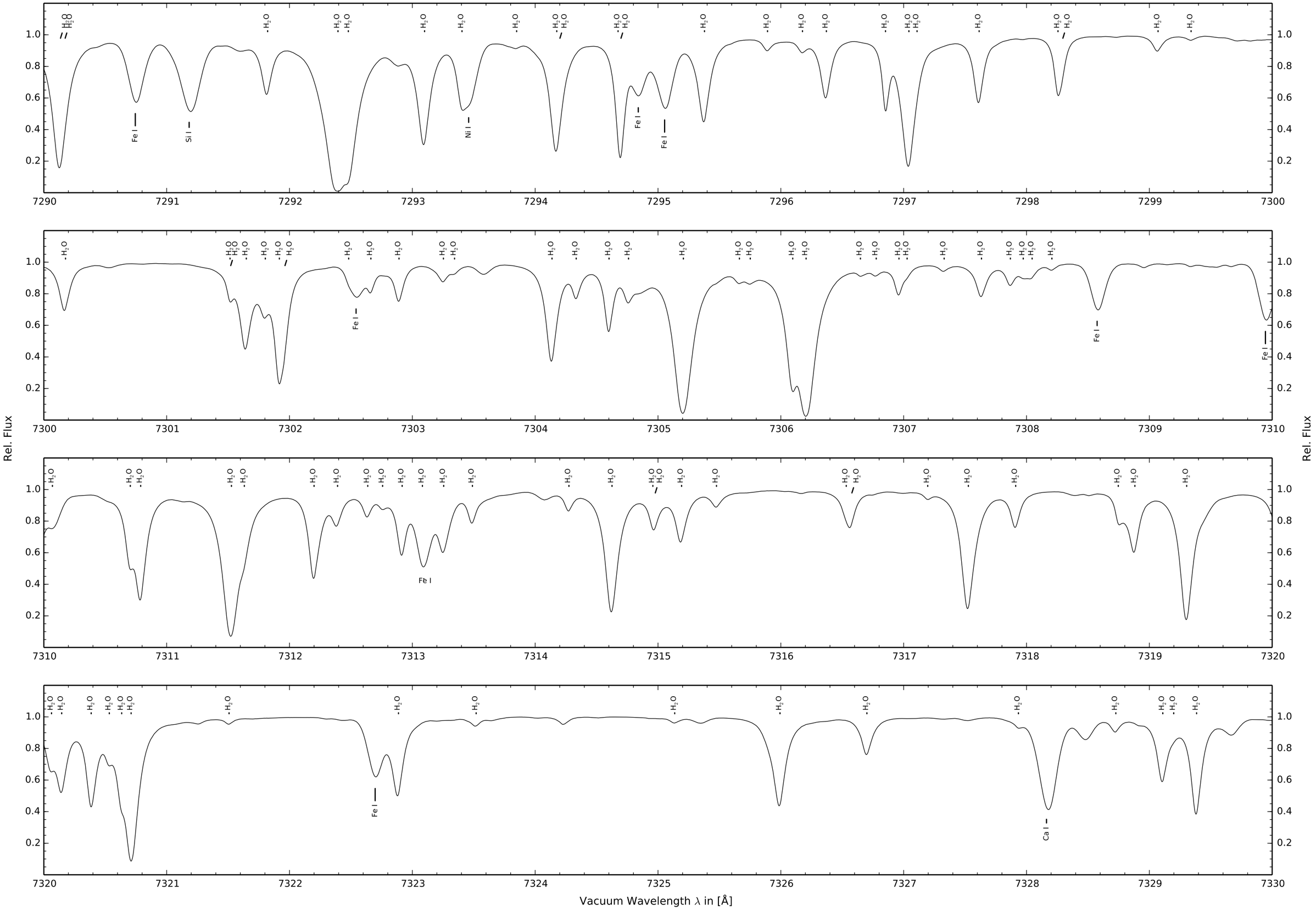
Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

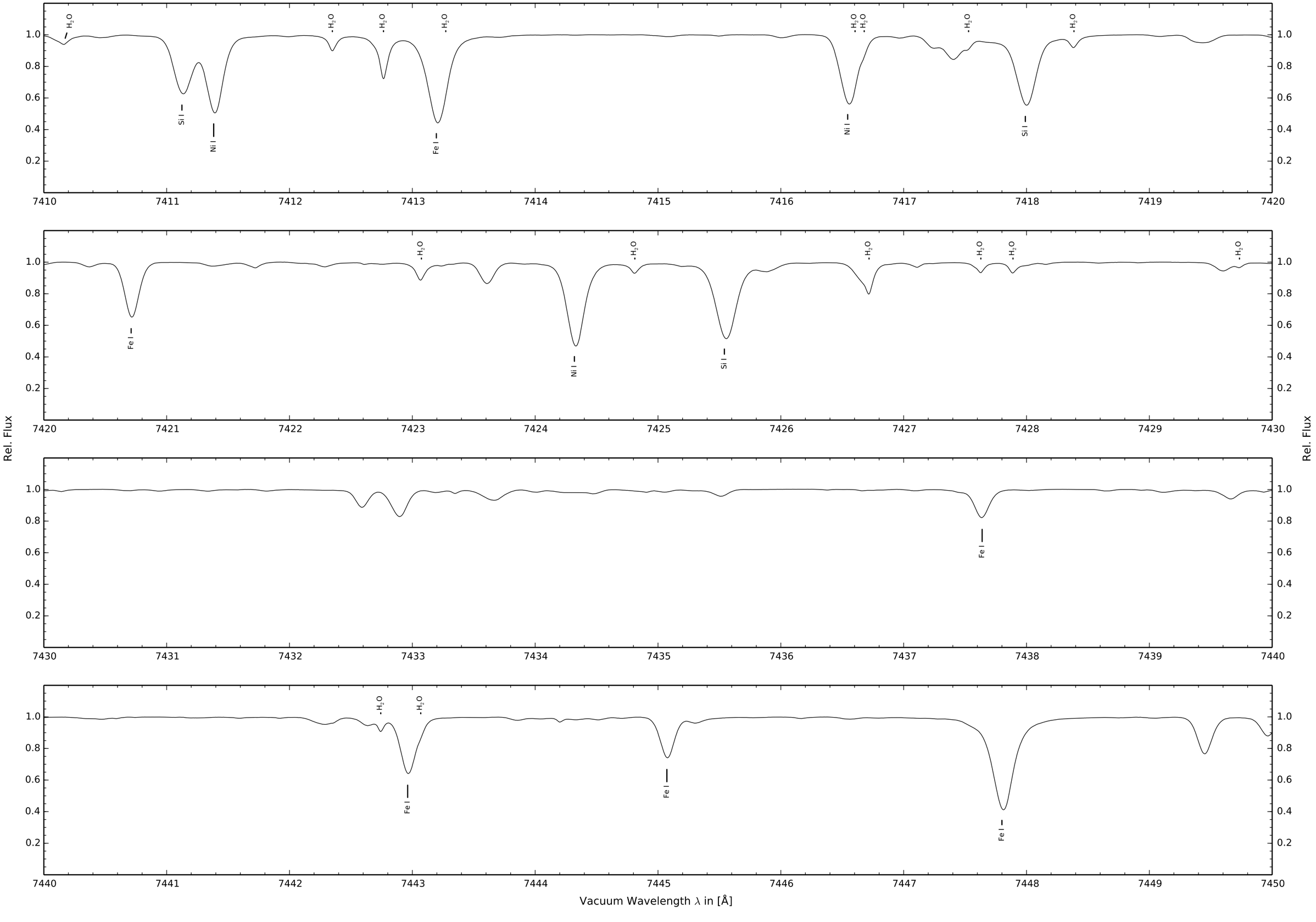

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Ti I
Fe I
Ni I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Si I
Ni I
Ca I

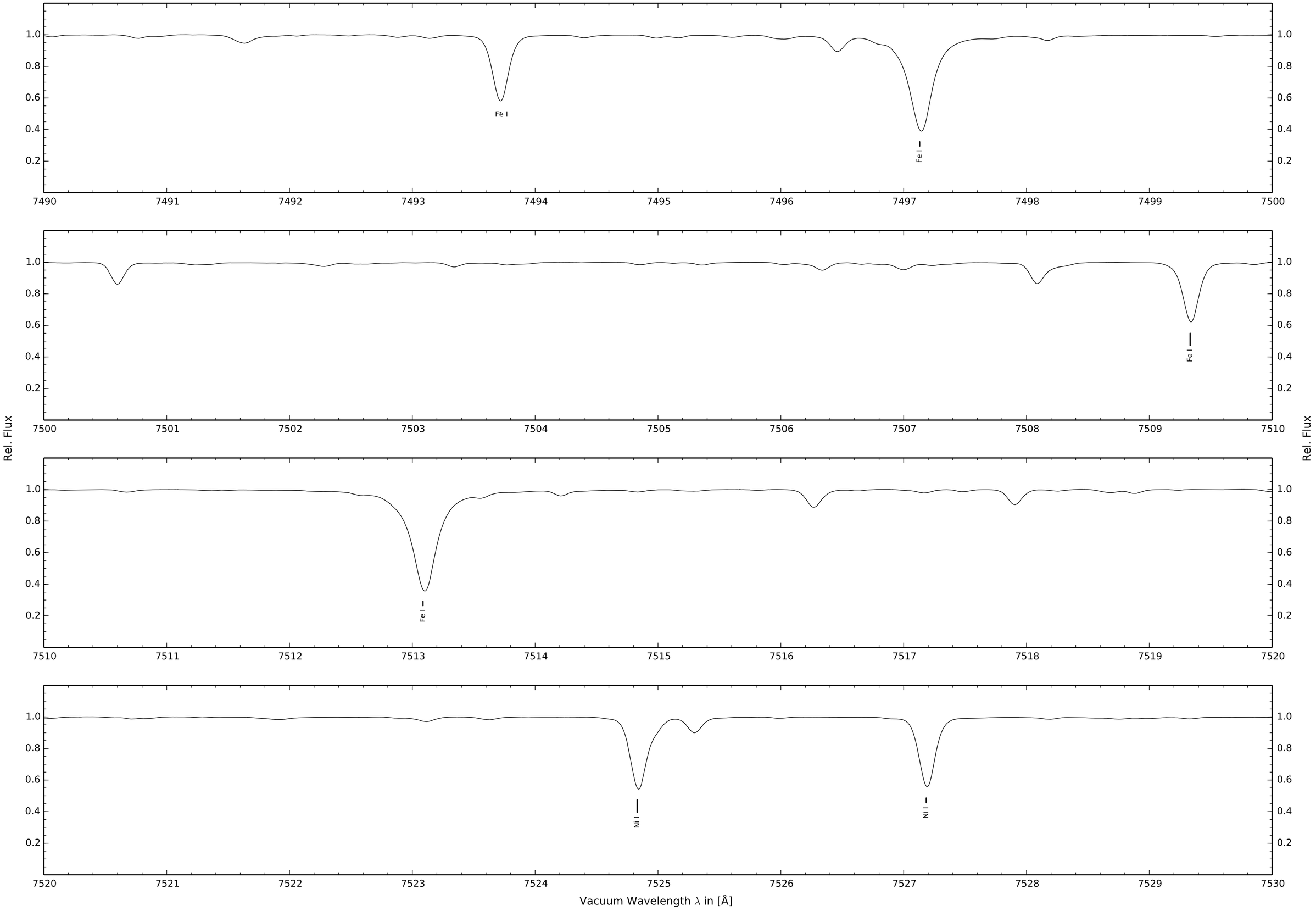
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ti I
Cr I

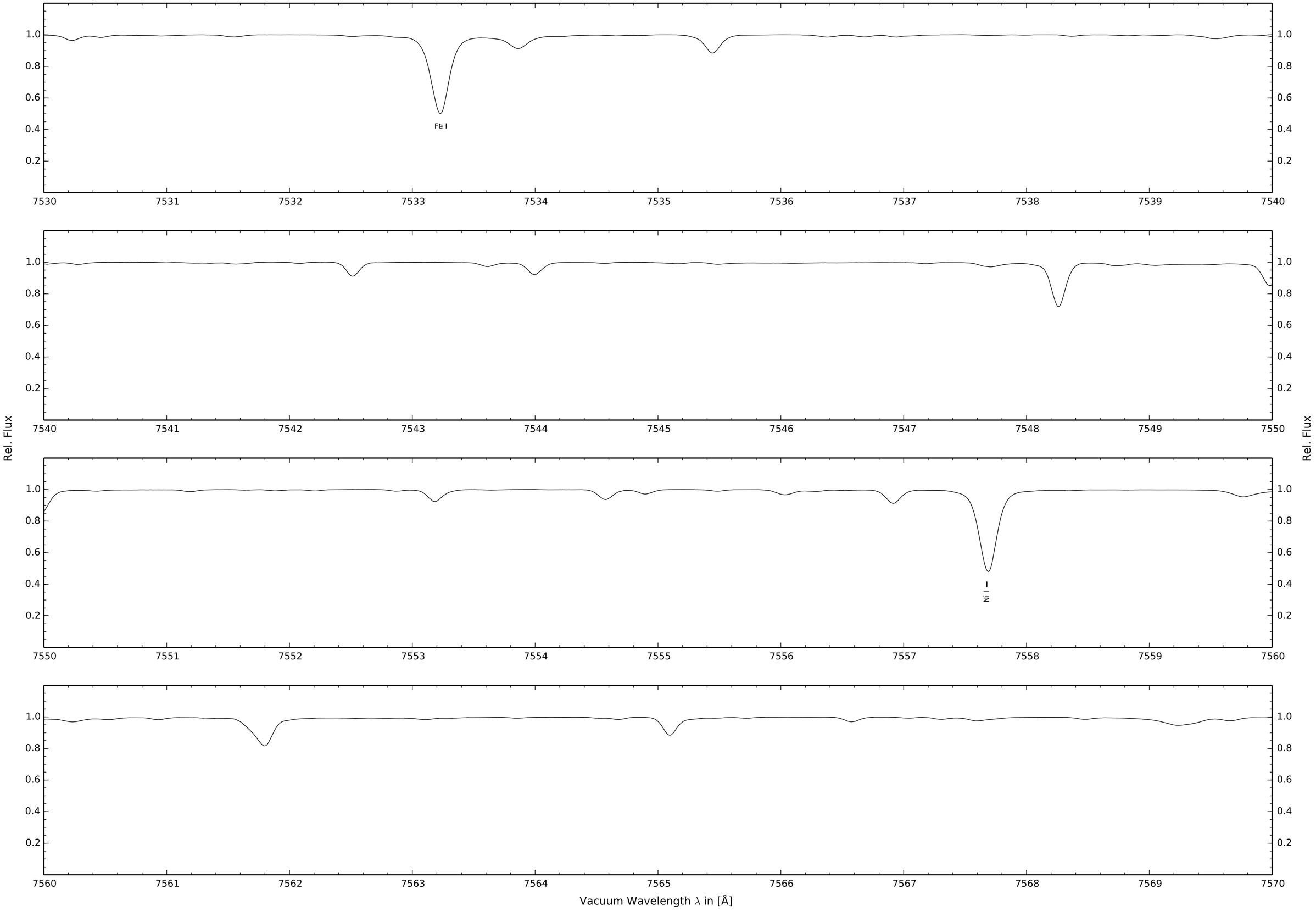
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Ni I
Fe I

H2O
Cr I
Fe II
Rel. Flux
Vacuum Wavelength λ in [Å]

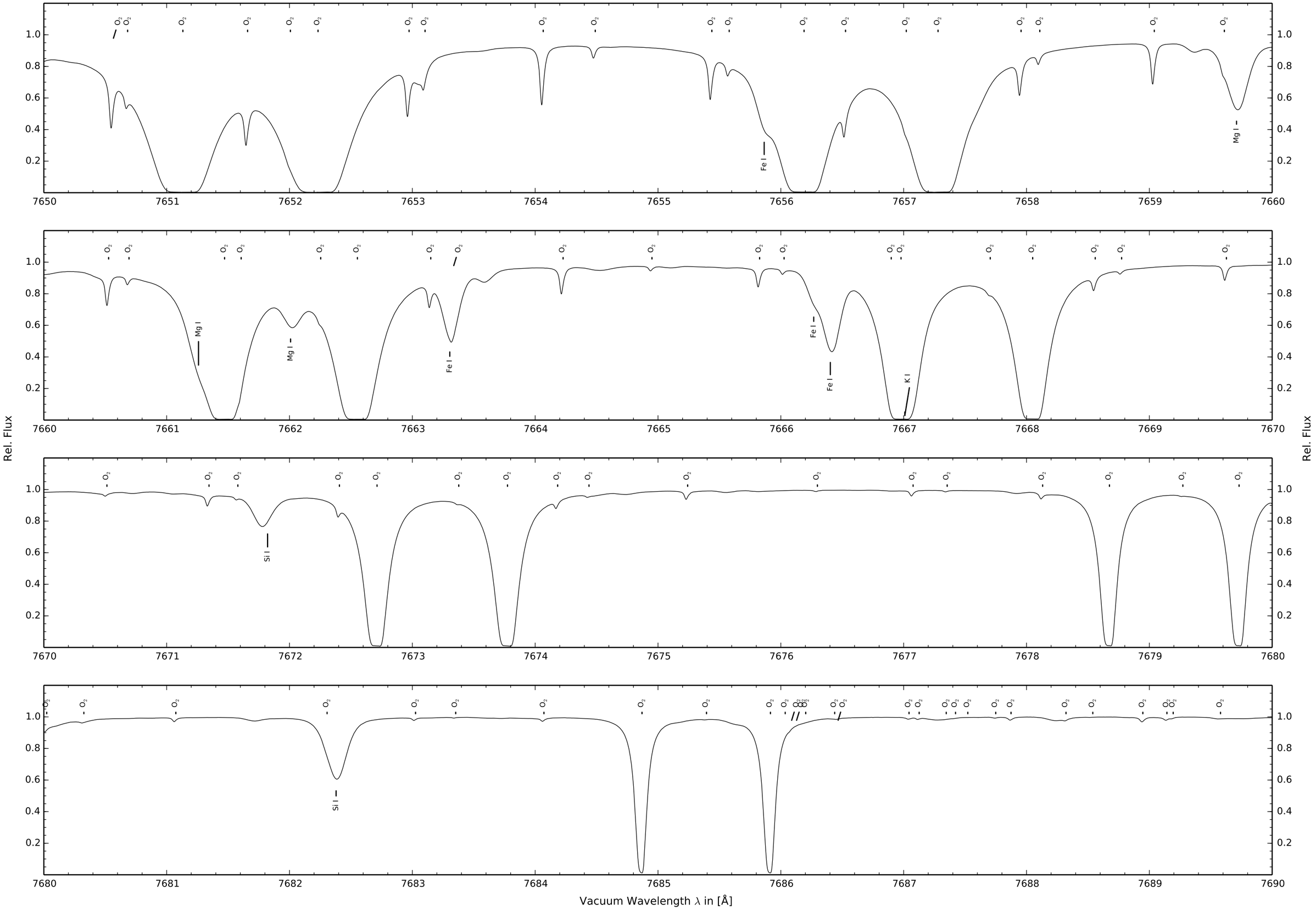

Fe I
Fe I
Fe I
Ni I
Ni I
Rel. Flux
Vacuum Wavelength λ in [Å]


Fe I
Ni I
Rel. Flux
Vacuum Wavelength λ in [Å]

Fe I
Ni I
Fe I
Fe I
Fe I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
O2
Mg I
Fe I
K I
Si I

Rel. Flux

Mg I

K I

Fe I

Fe II

Ni I

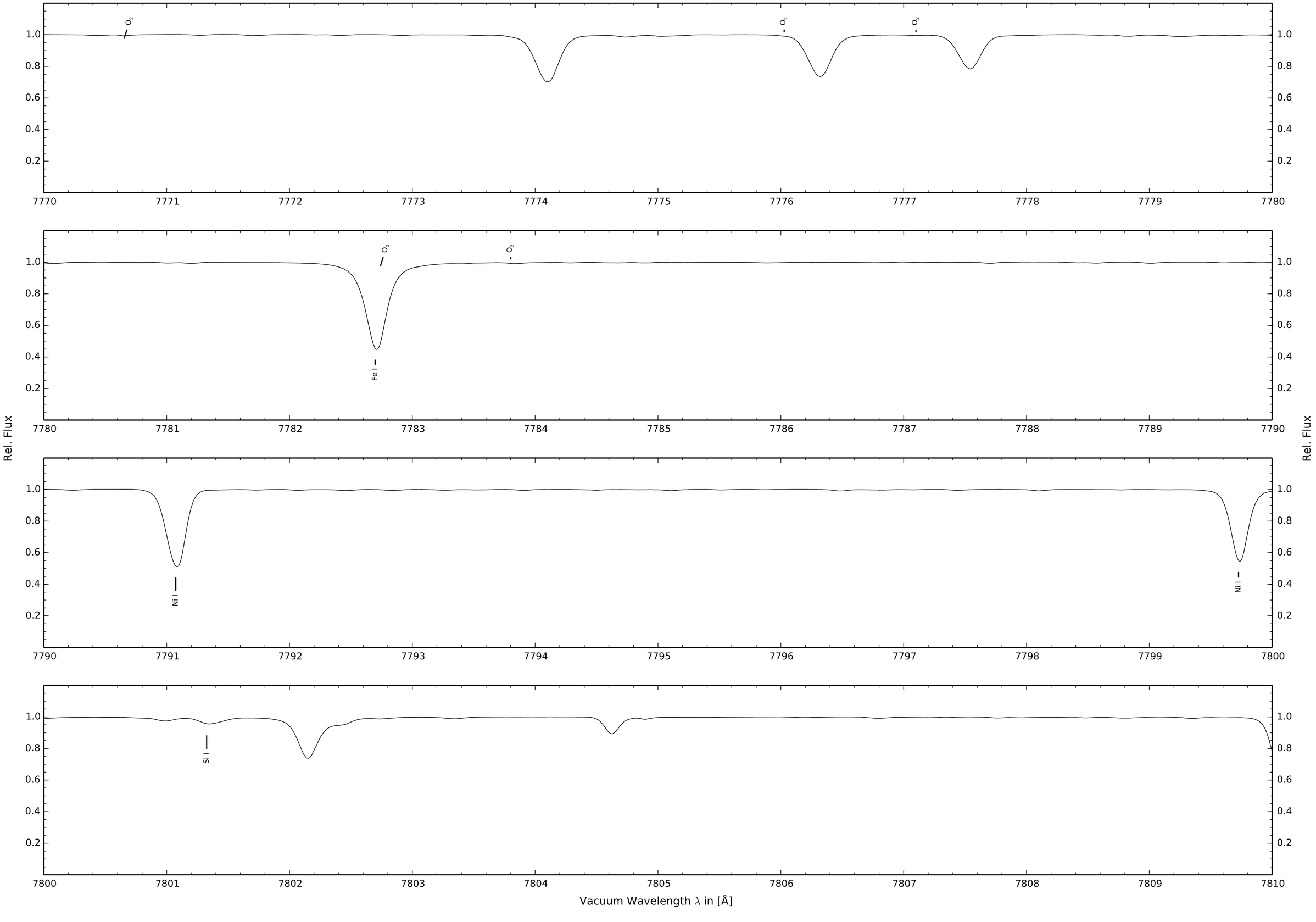
Ni I

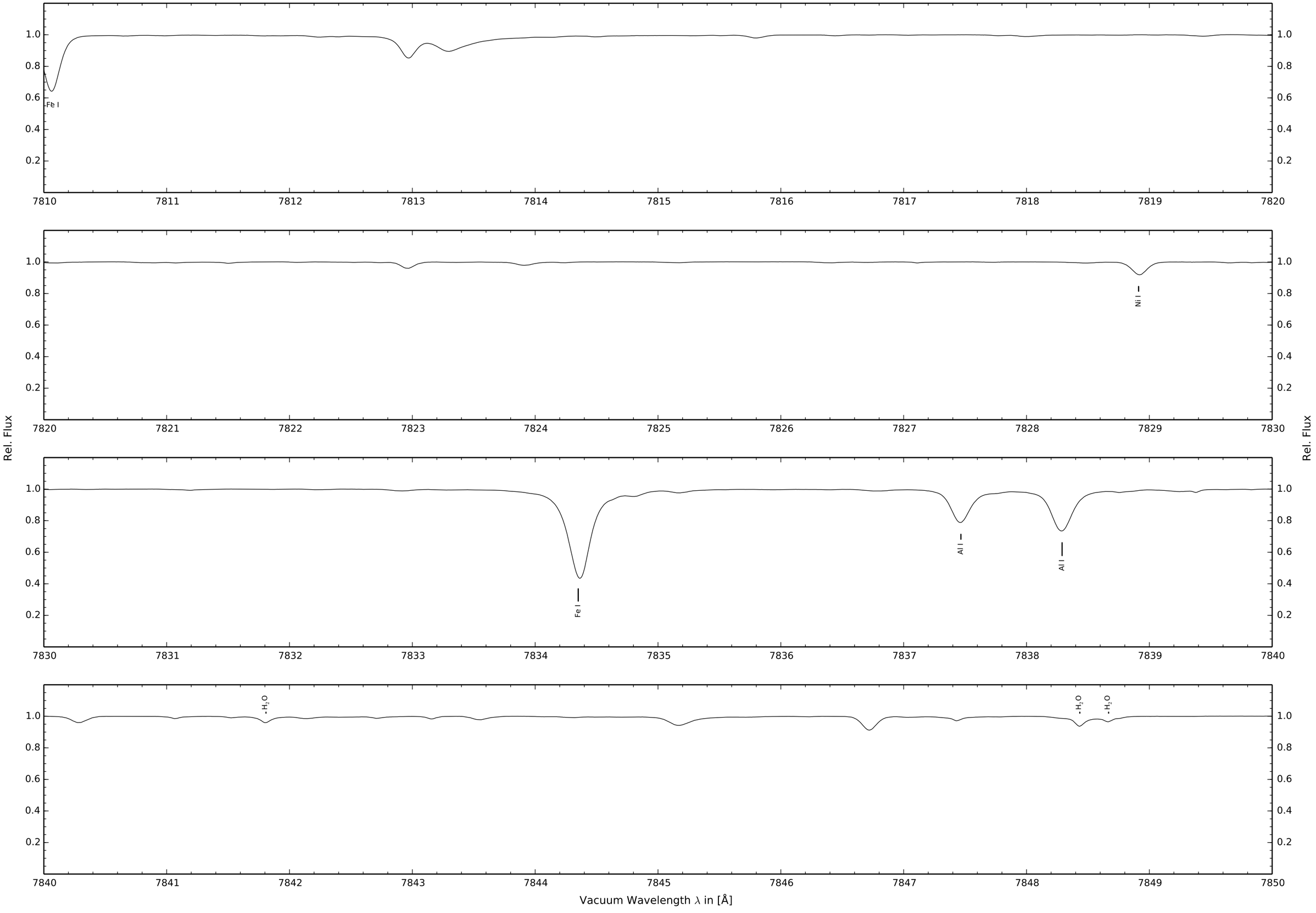
Fe I

Ni I

Vacuum Wavelength λ in [Å]

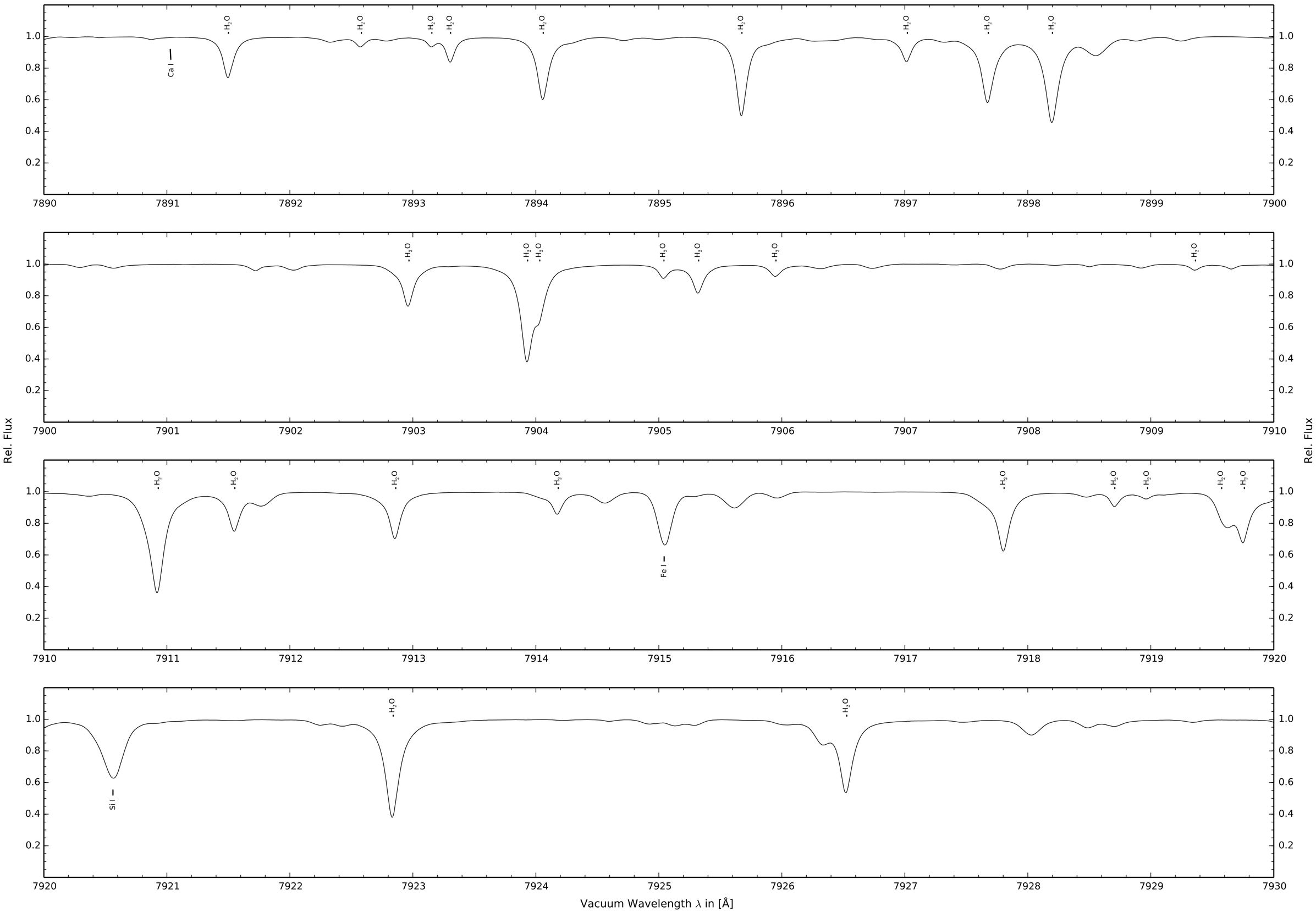
Rel. Flux
Vacuum Wavelength λ in [Å]
O2
Fe I
Ni I


O2
O2
O2
O2
O2
Fe I
Ni I
Ni I
Si I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Ni I
Fe I
Al I
Al I
$-H_2O$
$-H_2O$
$-H_2O$
Vacuum Wavelength λ in [Å]

Rel. Flux

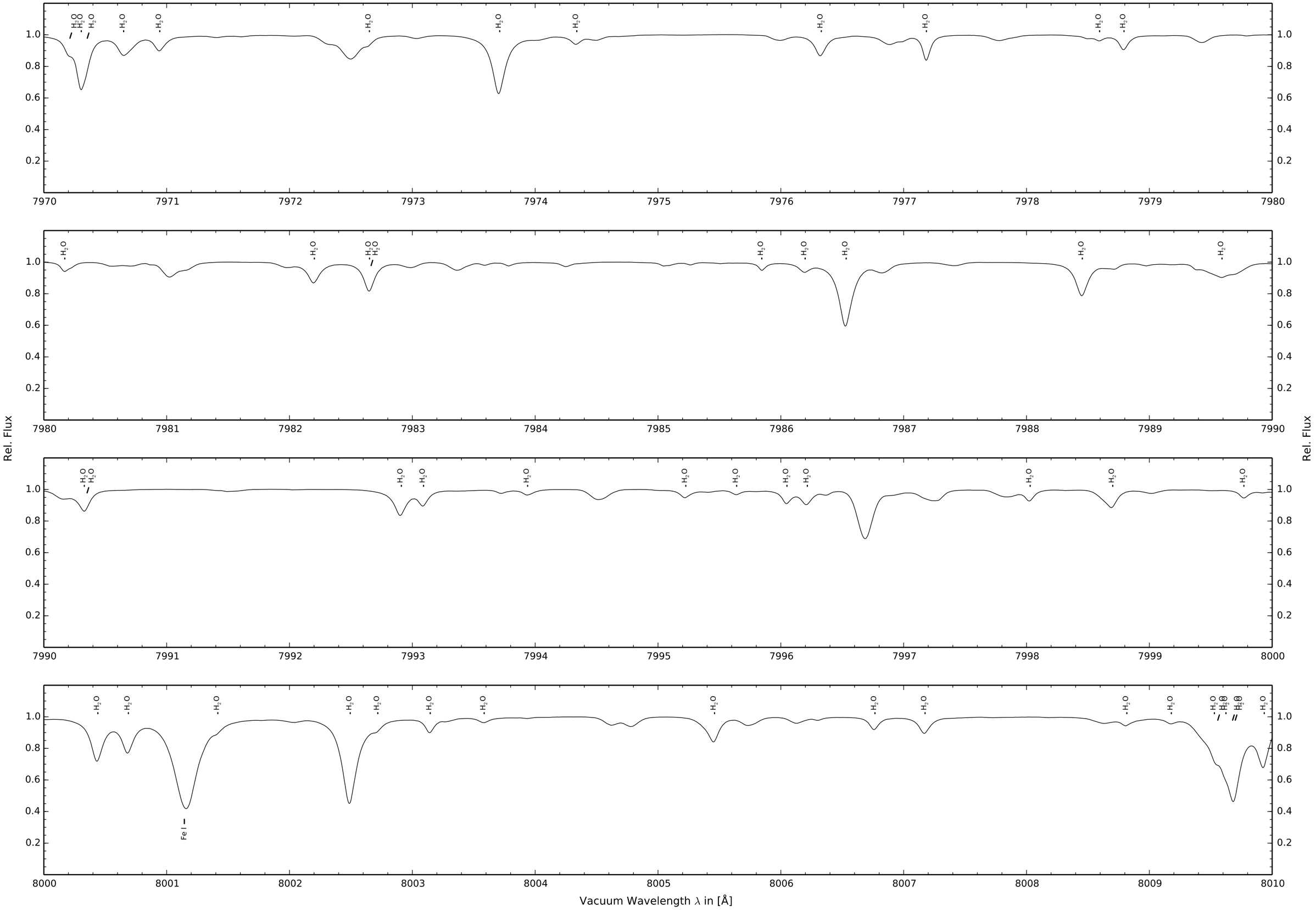
Vacuum Wavelength λ in [Å]



Rel. Flux
Ca I
Fe I
Si I
H2O
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

Rel. Flux

Vacuum Wavelength λ in [Å]

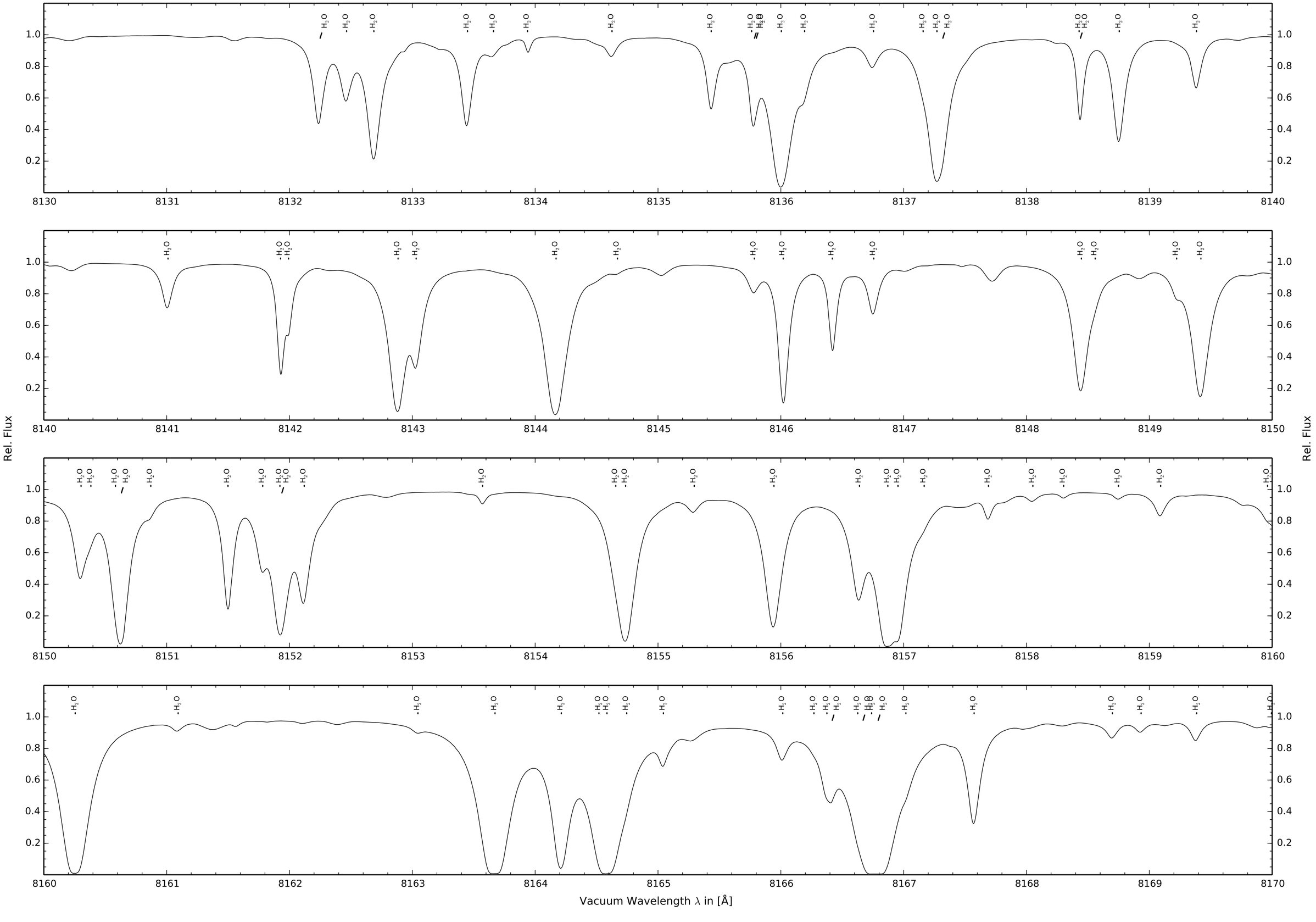
Rel. Flux

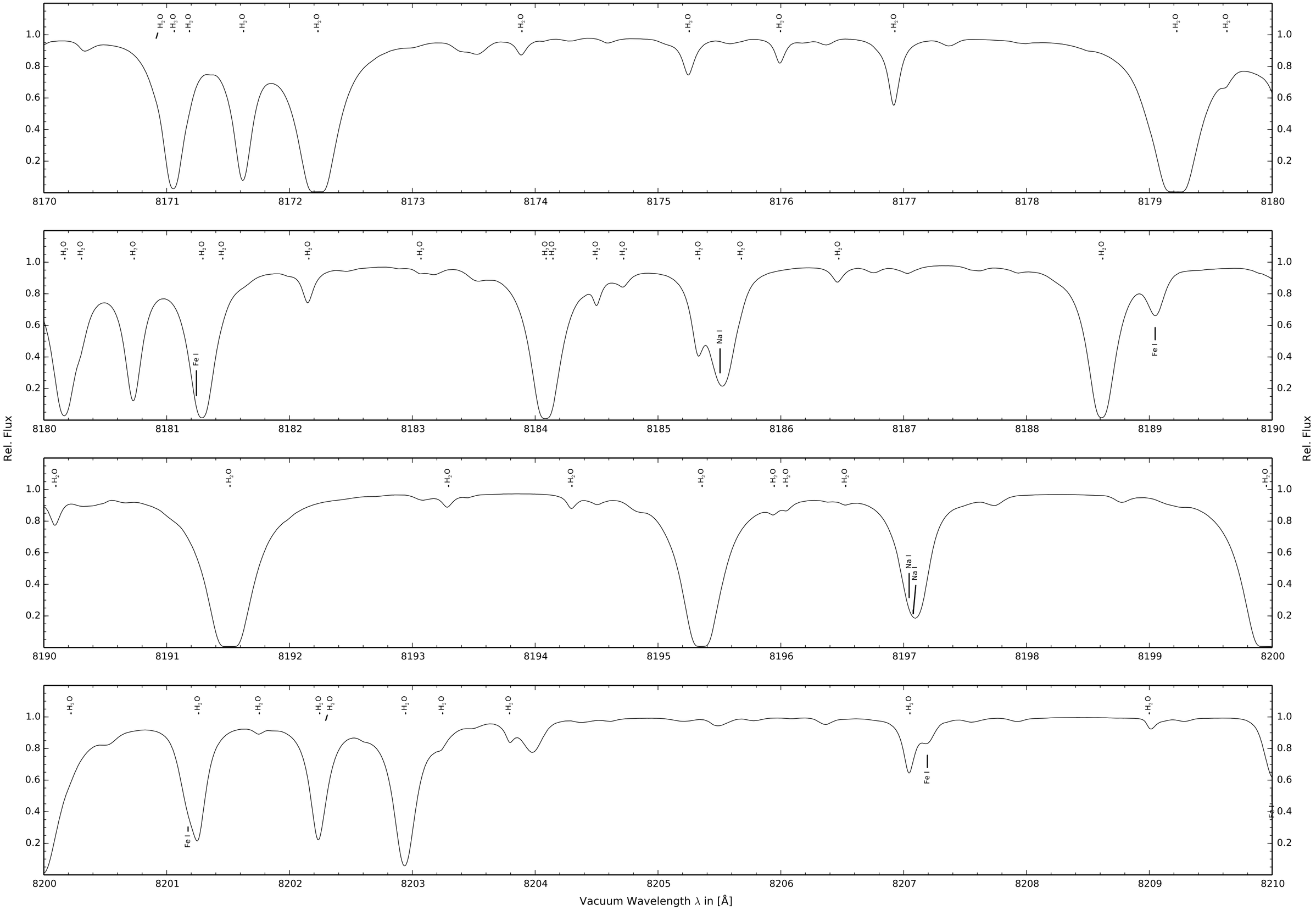
Vacuum Wavelength λ in [Å]

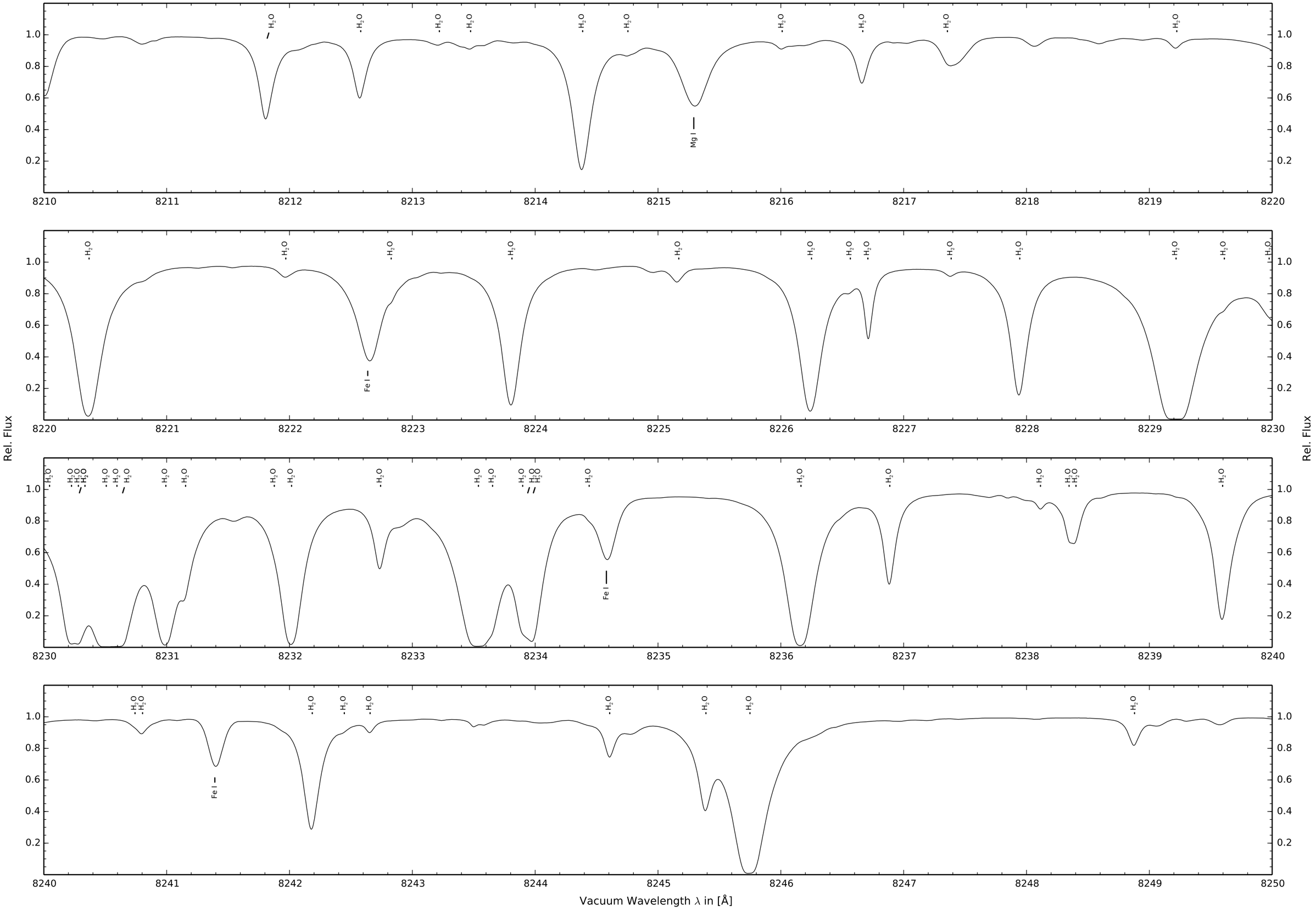
Rel. Flux

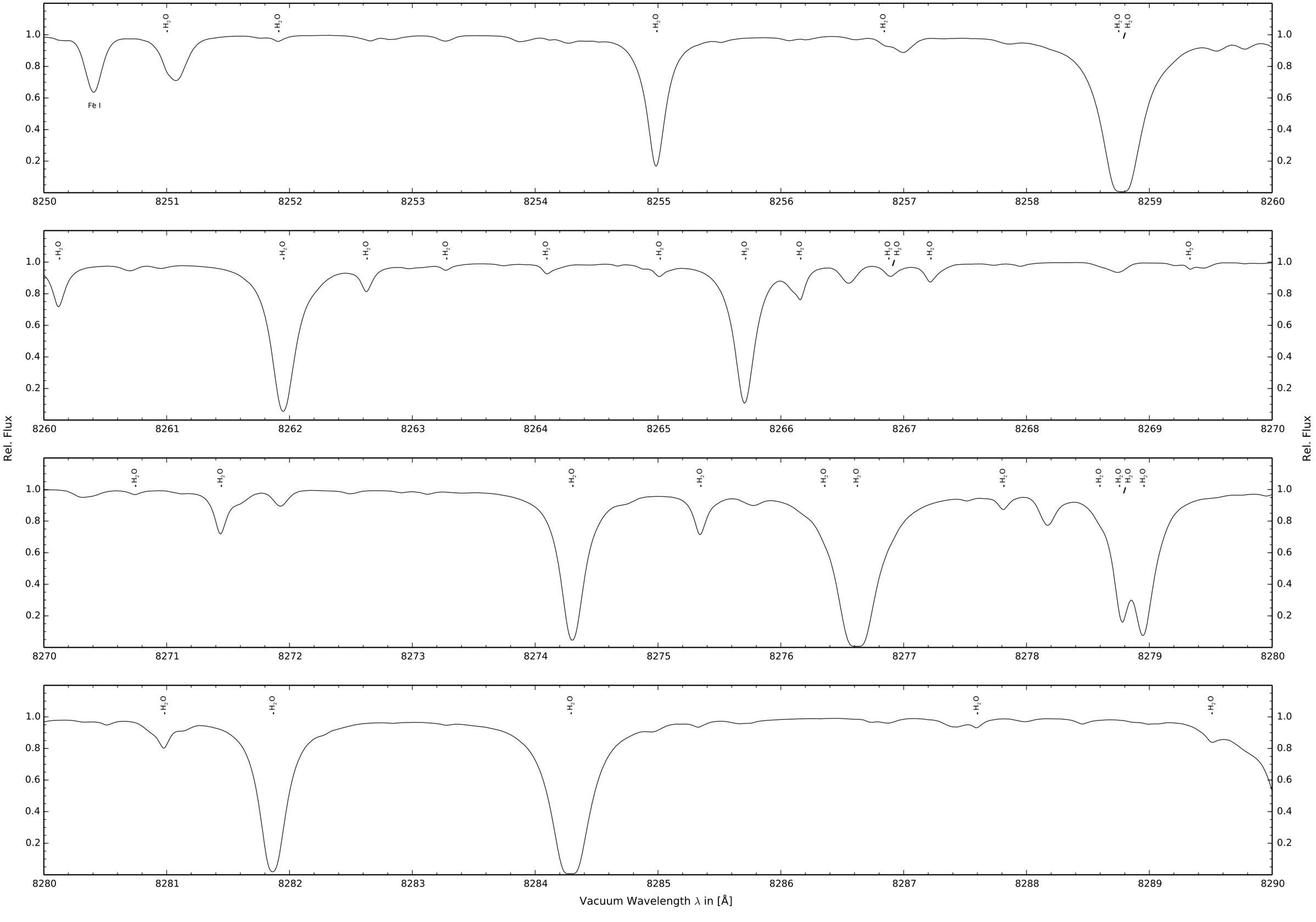
Cu I
Si I
Fe I
Mg I

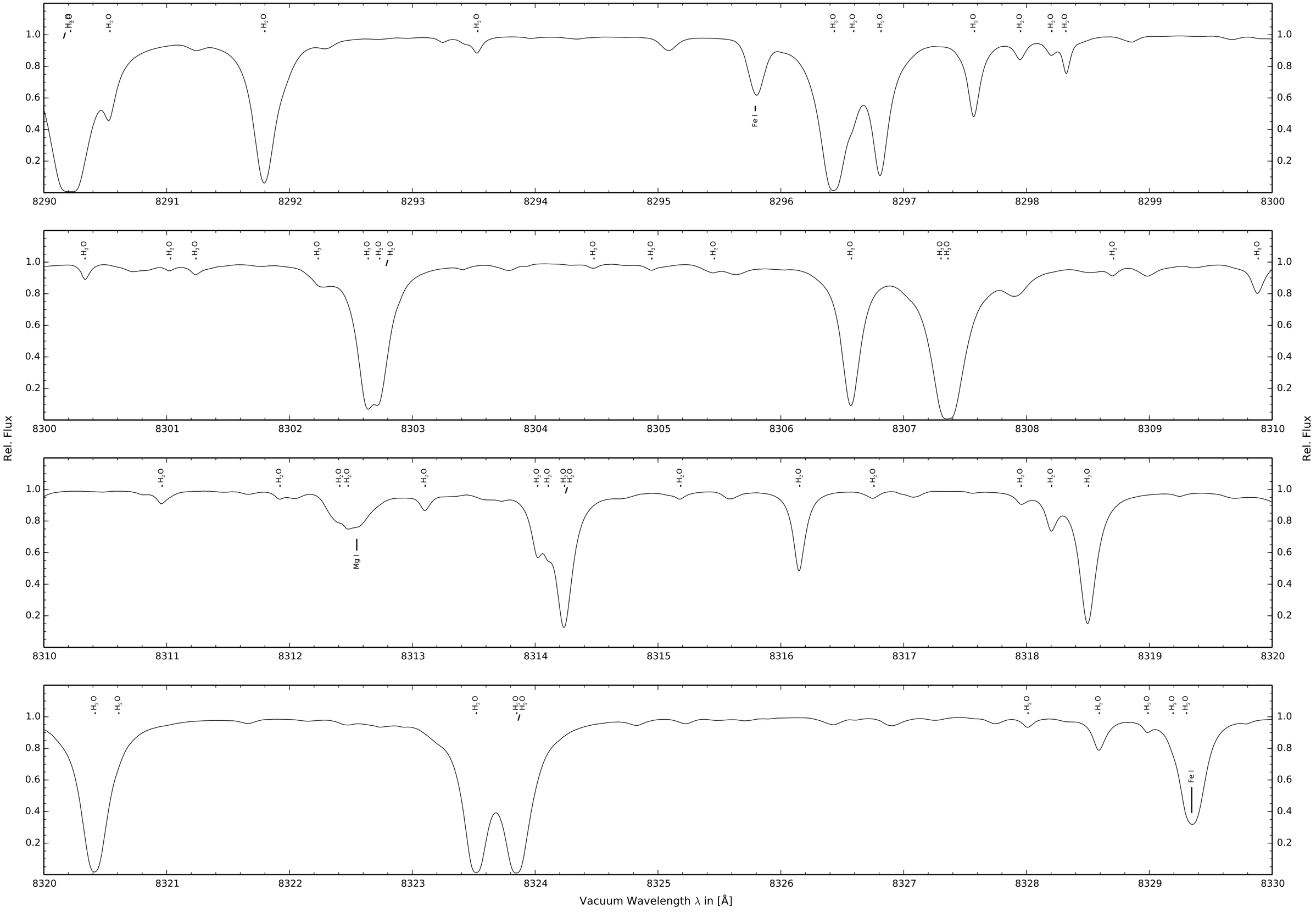
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Na I

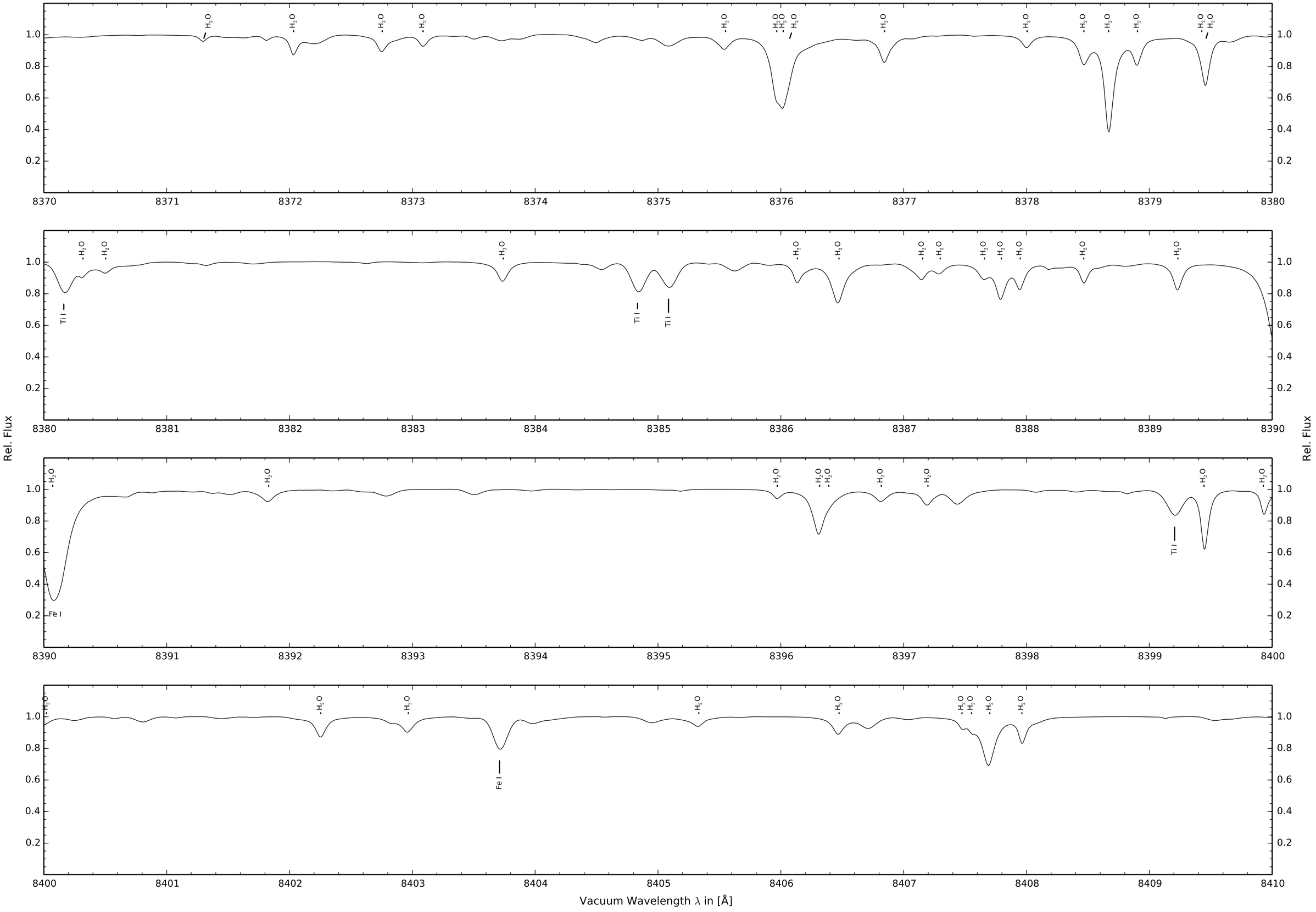

Rel. Flux
Vacuum Wavelength λ in [Å]
Mg I
Fe I
H2O

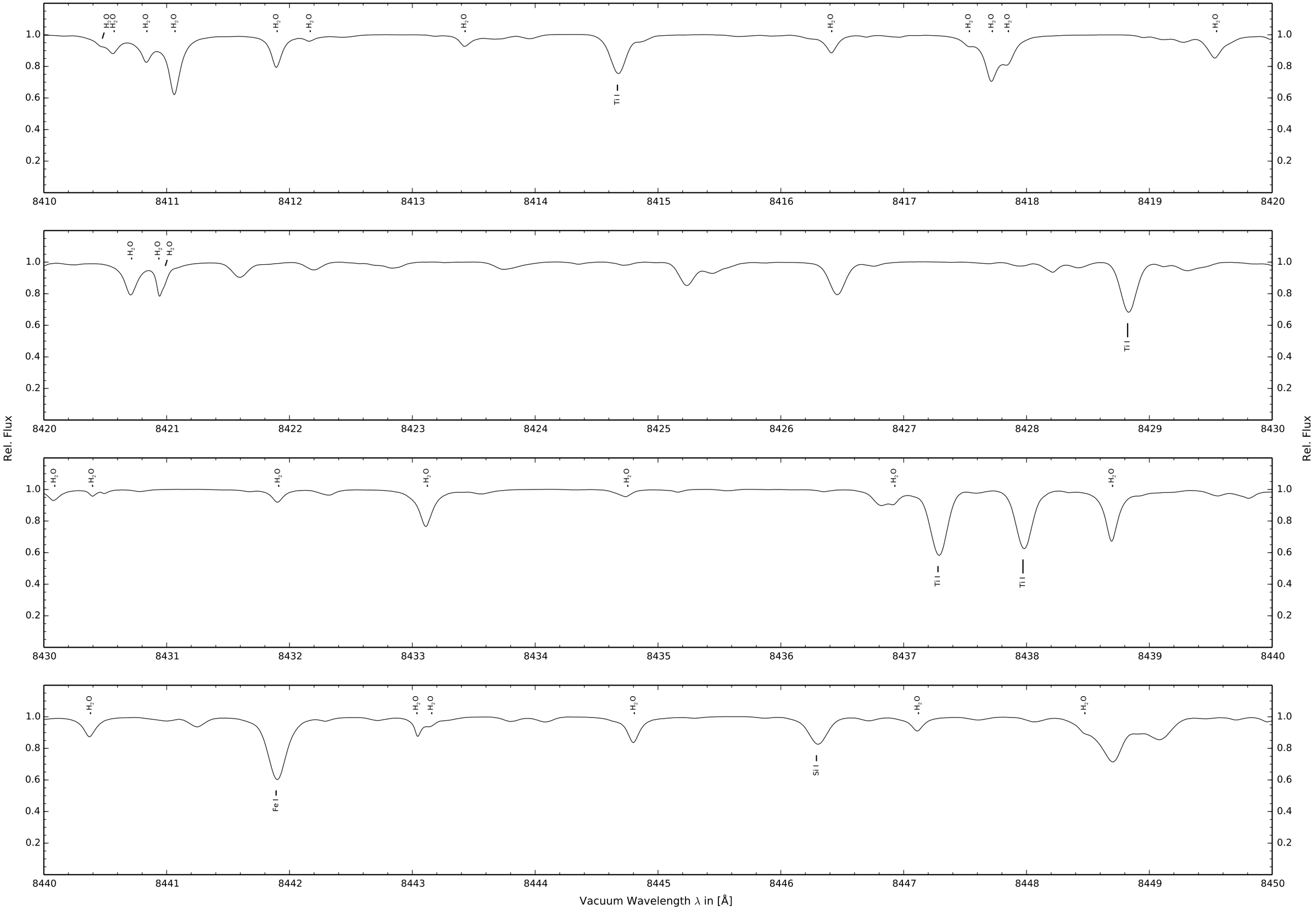

Fe I
-H2O
Rel. Flux
Vacuum Wavelength λ in [Å]

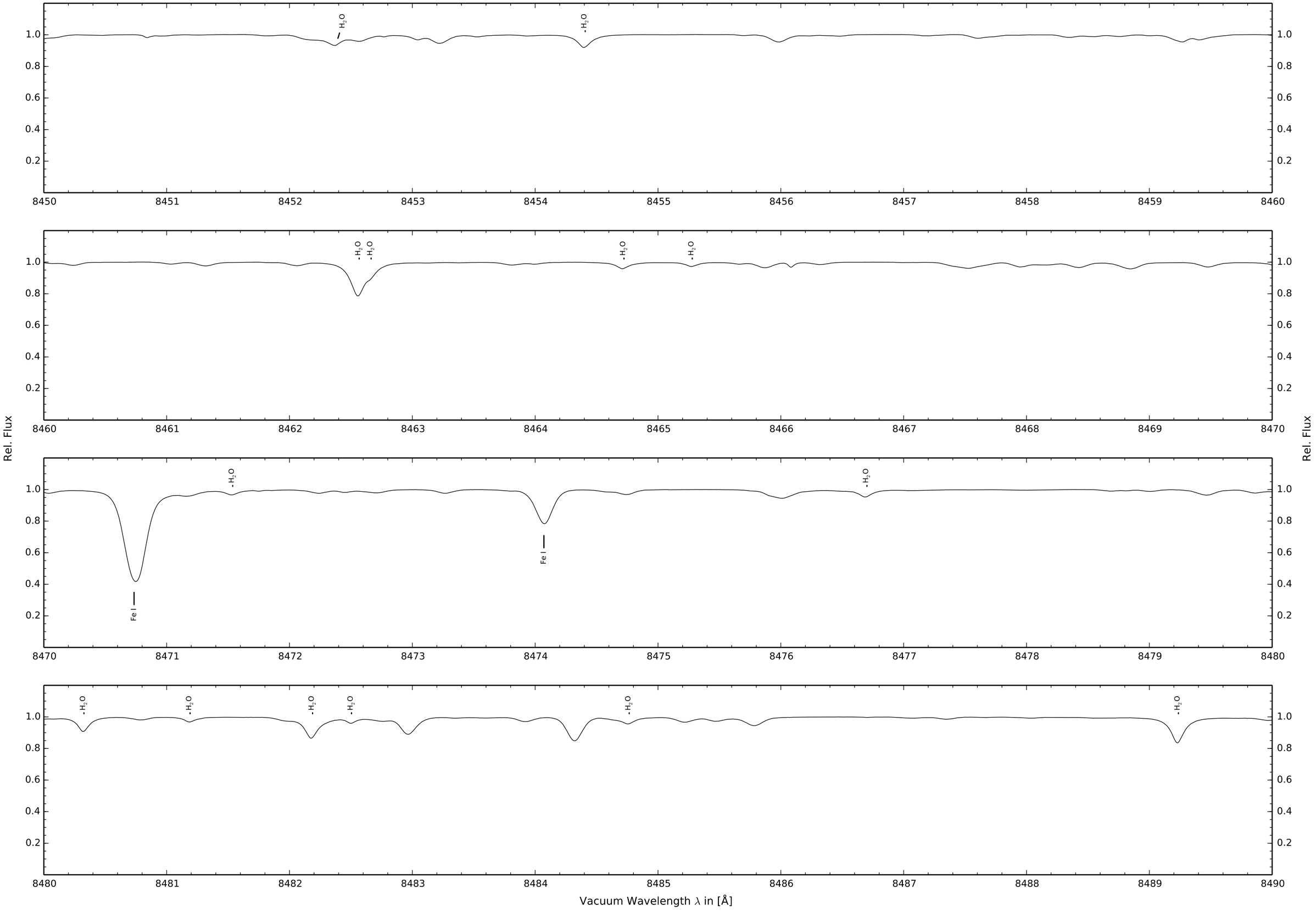

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Mg I
Fe I

Rel. Flux

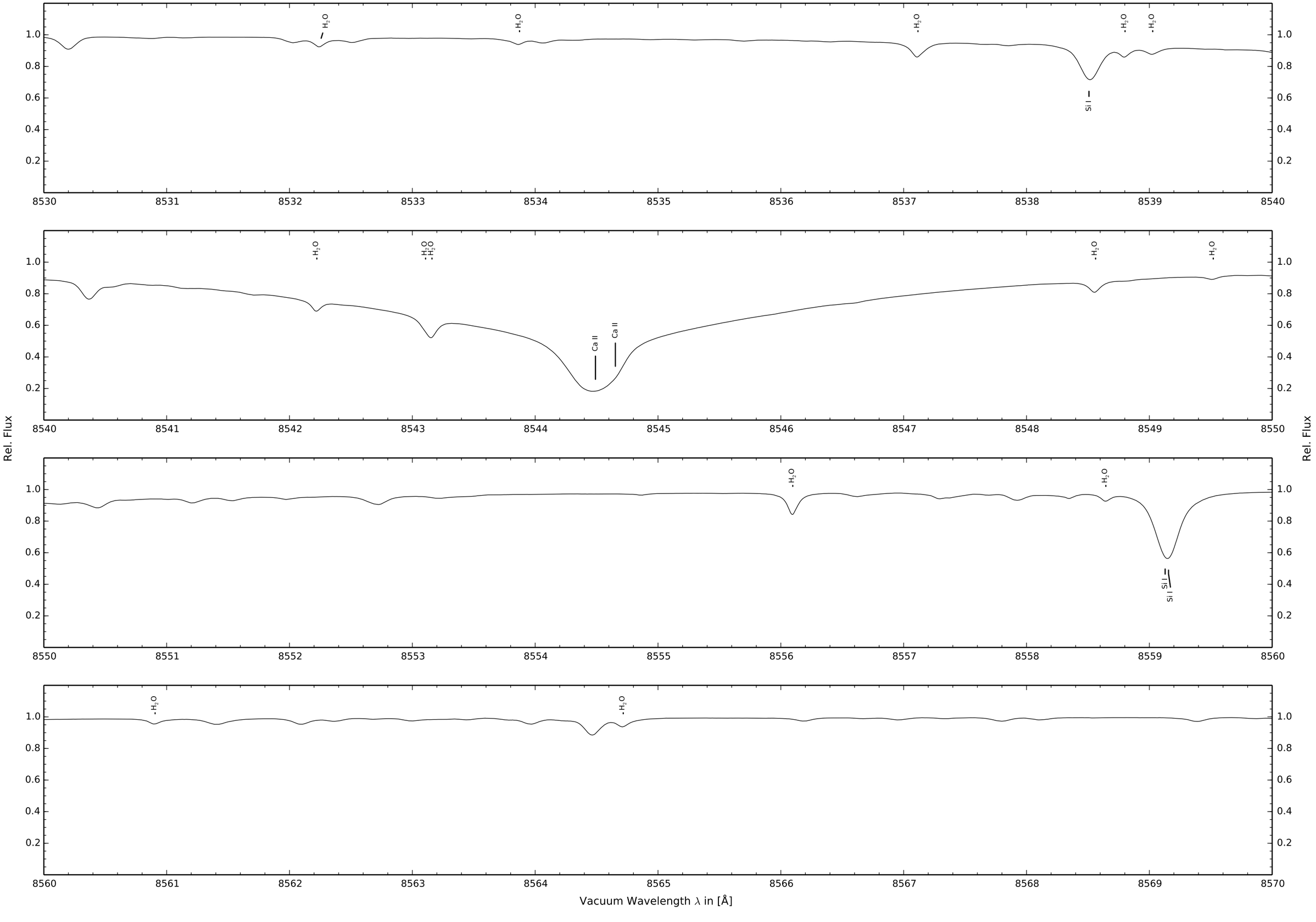
Vacuum Wavelength λ in [Å]

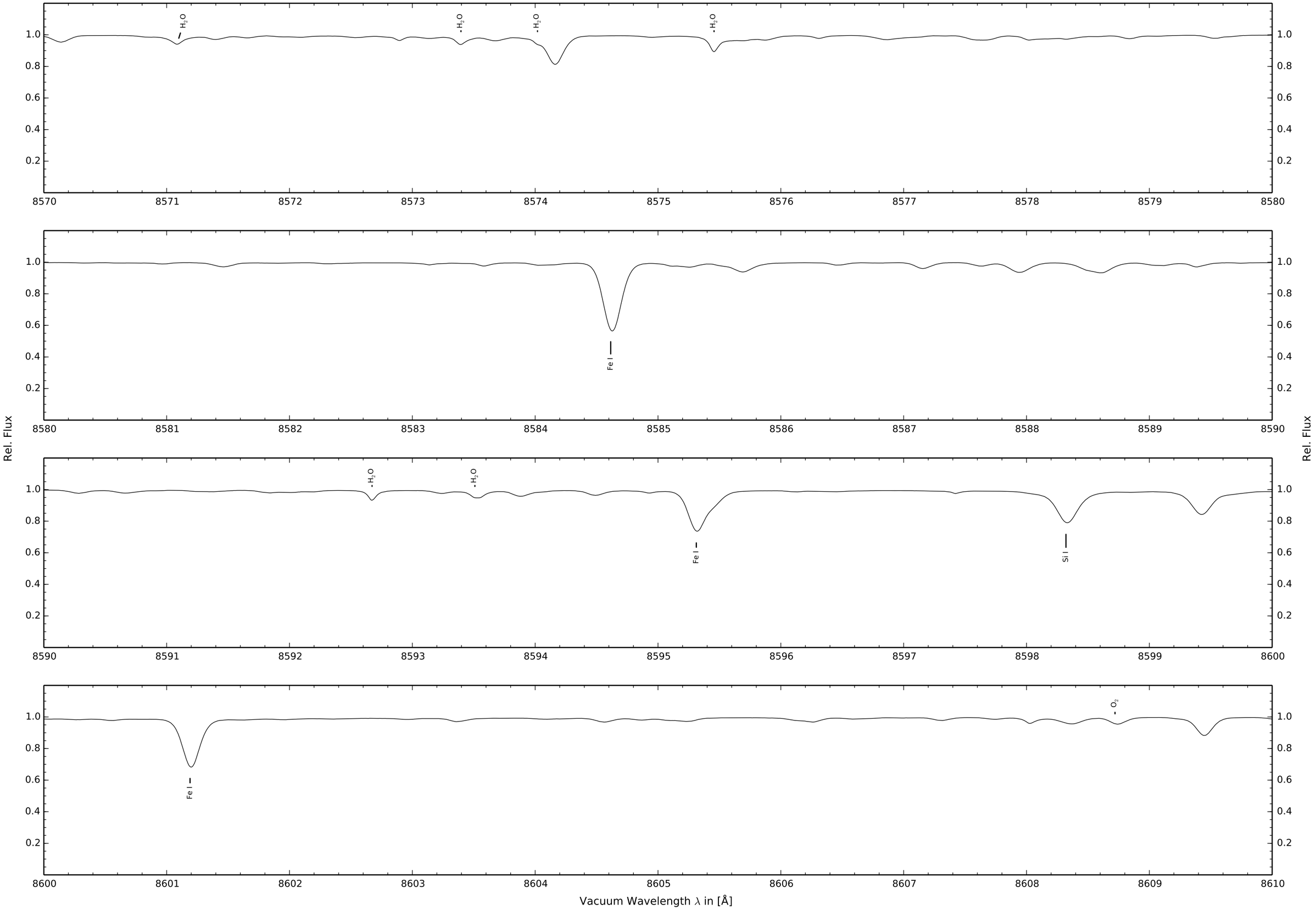

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ti I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ti I
Fe I
Si I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ca II
Si I
Fe I

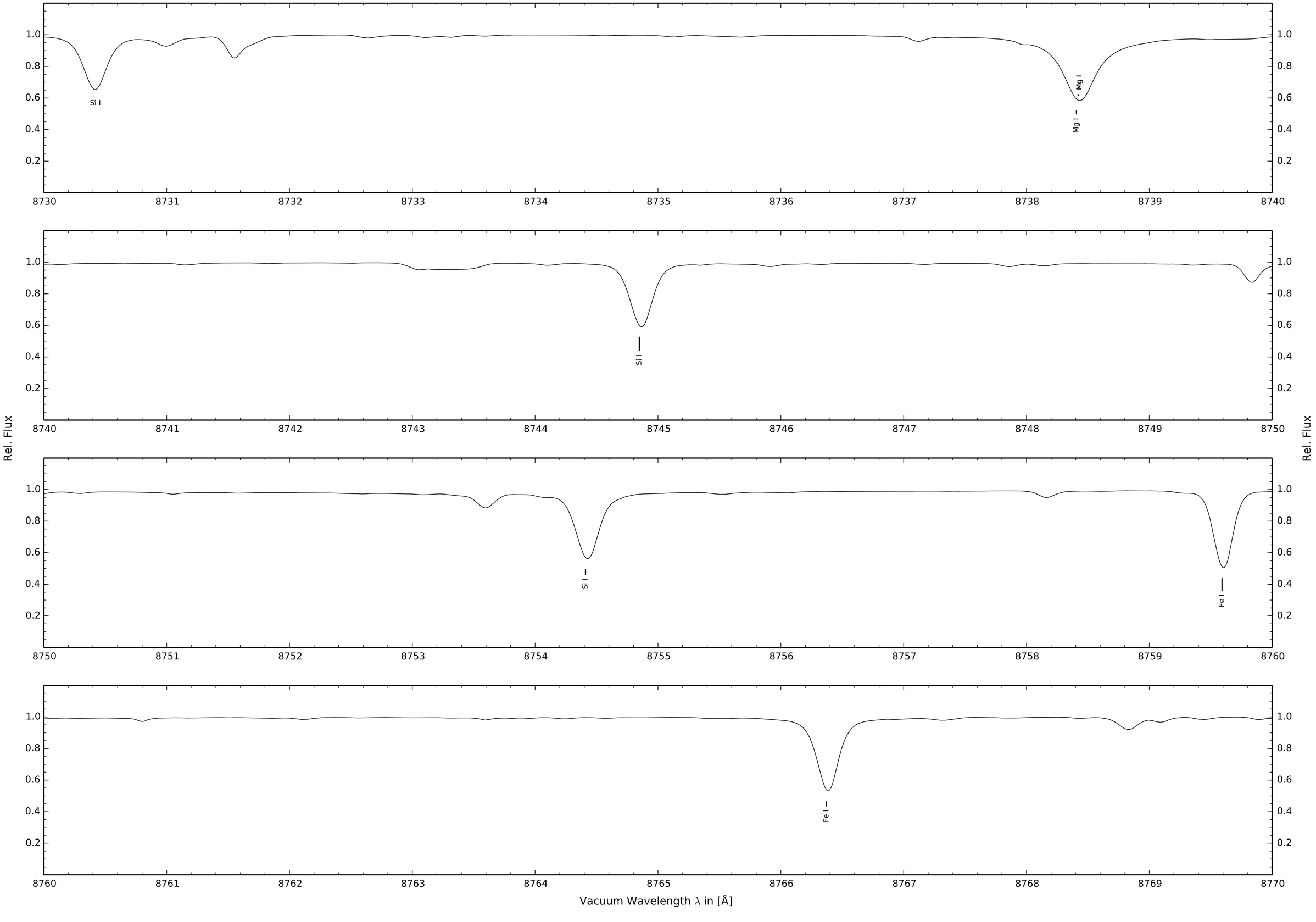

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ca II
Si I

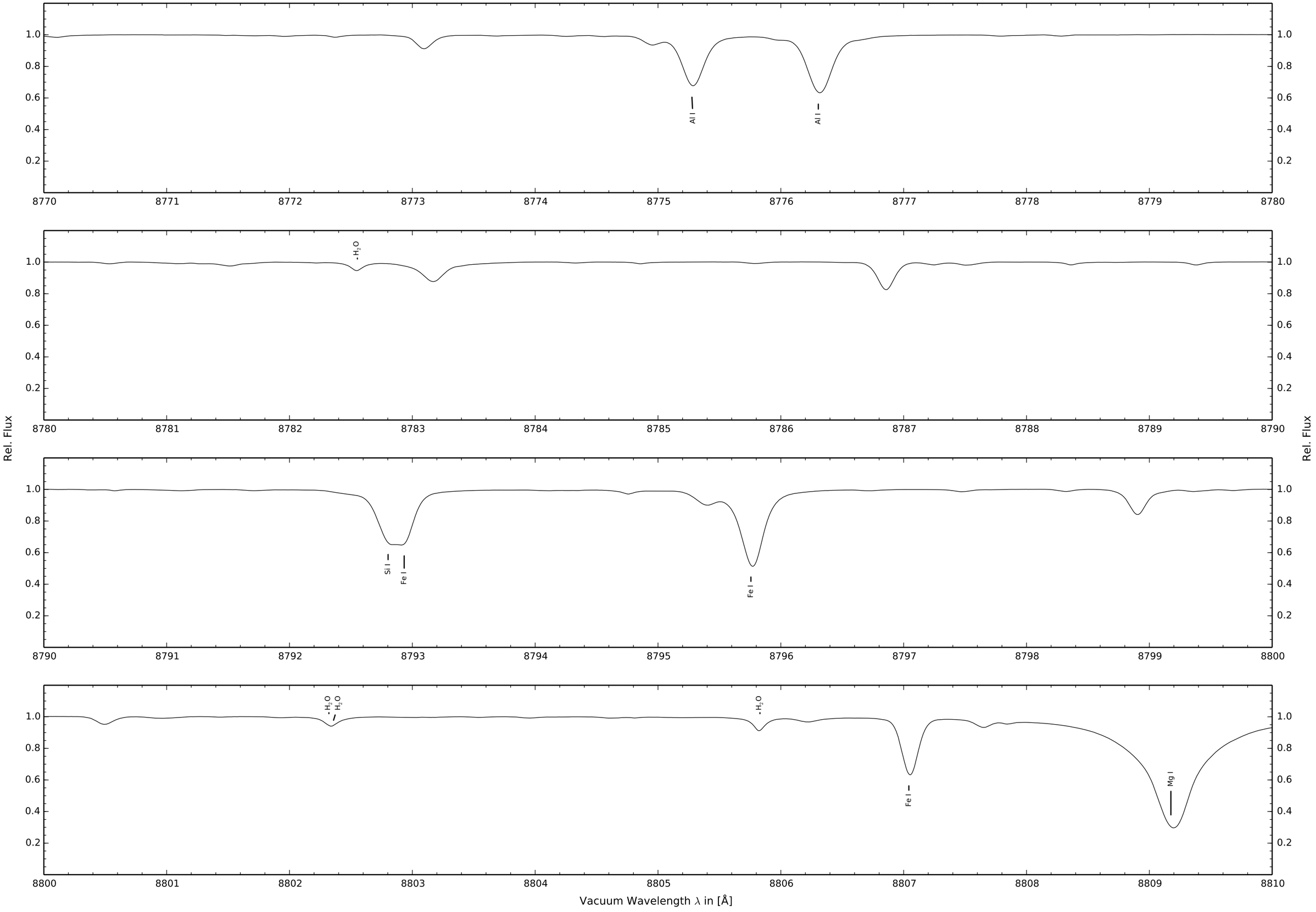

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Si I
O2

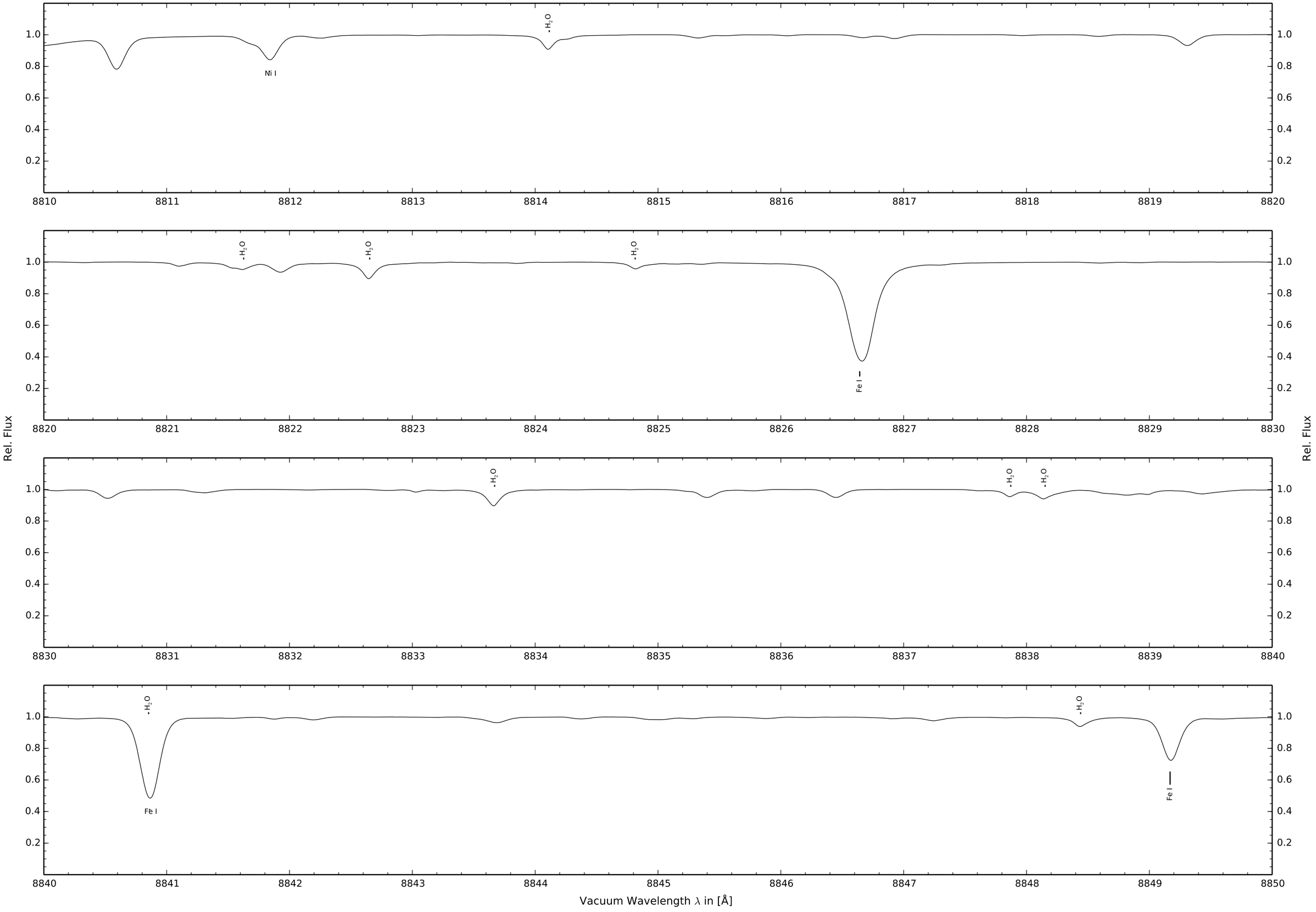
Rel. Flux
Vacuum Wavelength λ in [Å]
O2
Fe I

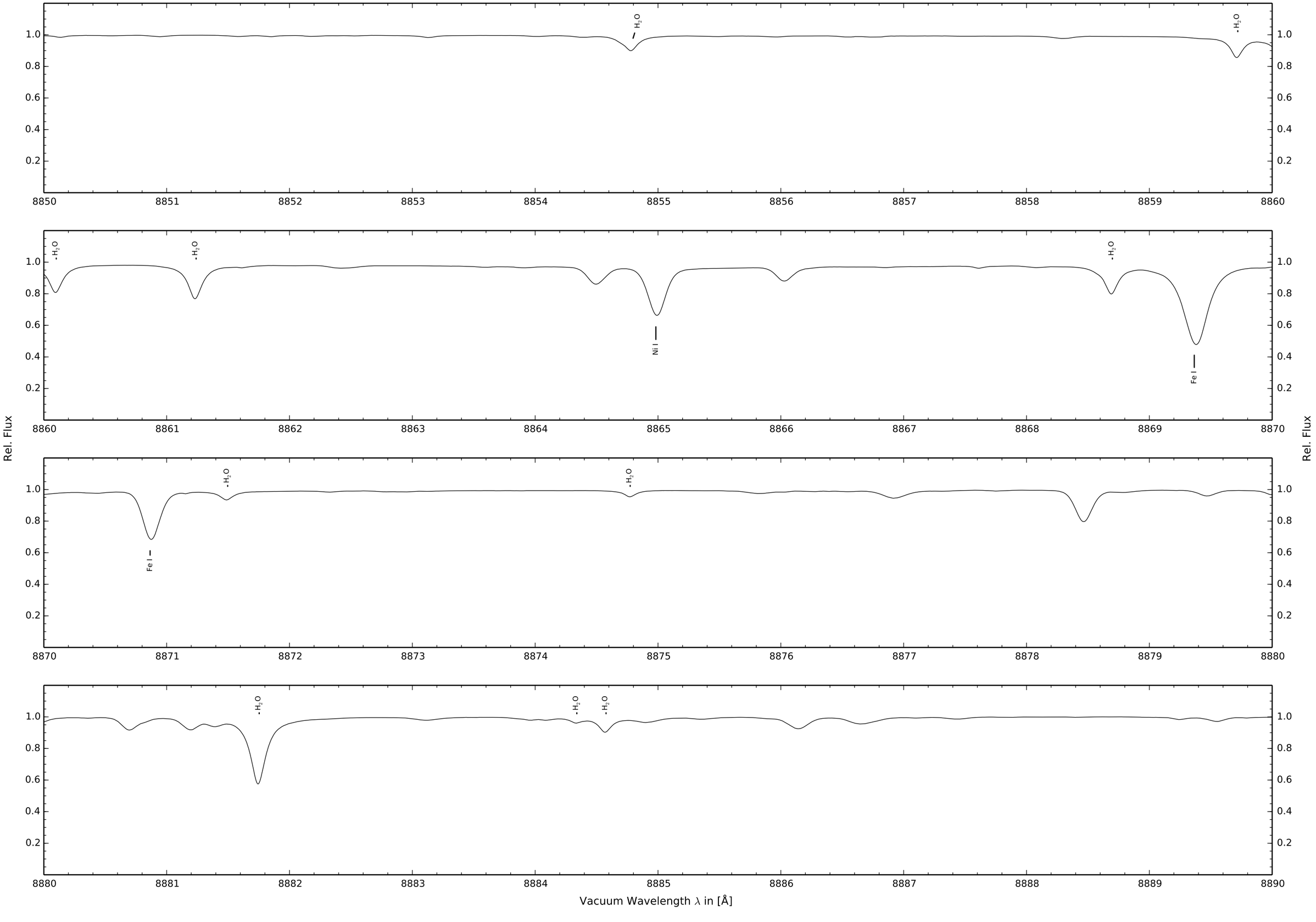
Si I
Fe I
Ca II
Ca II
Fe I
O2
Rel. Flux
Vacuum Wavelength λ in [Å]

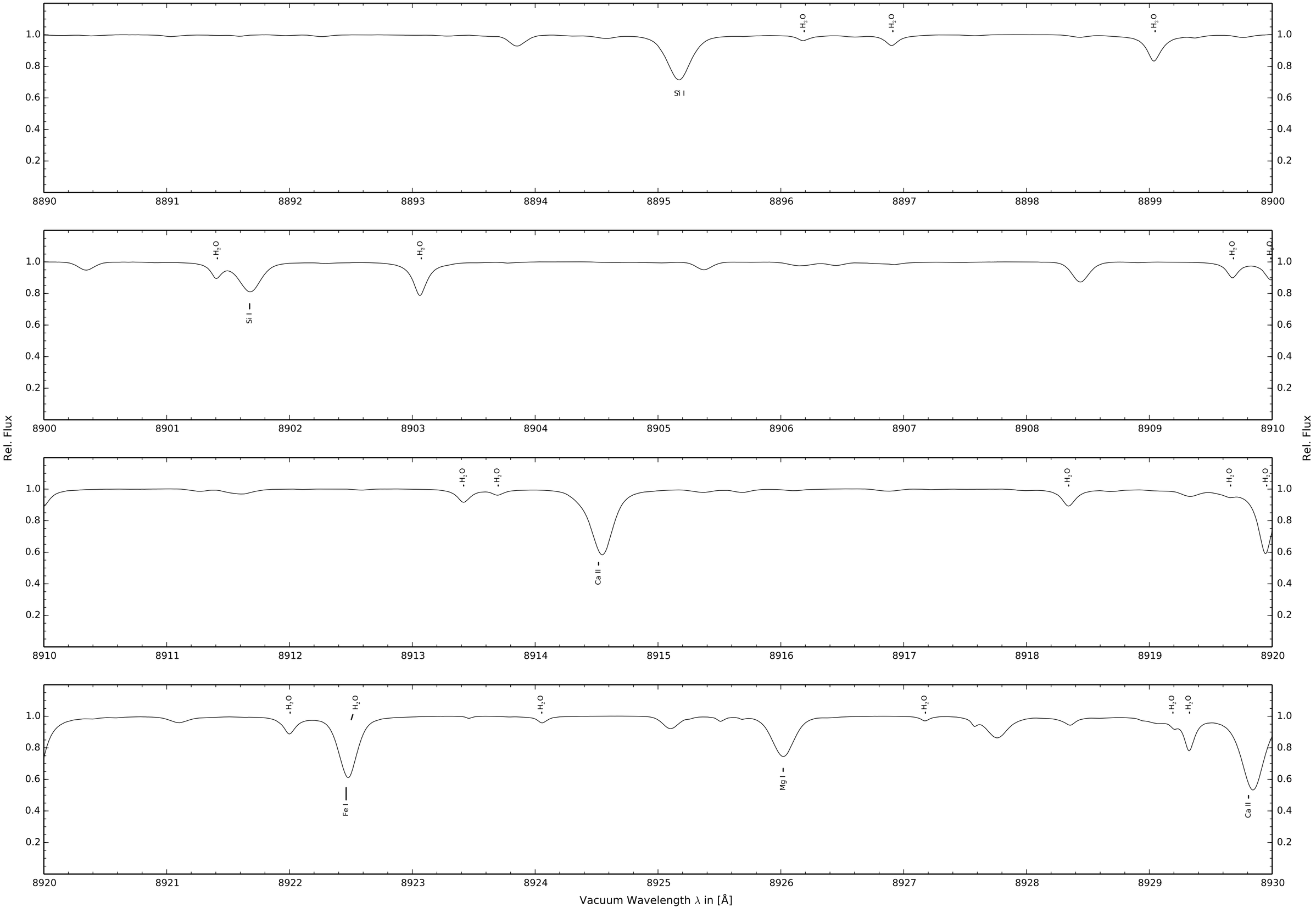
Rel. Flux
1.0
0.8
0.6
0.4
0.2
8690
8691
8692
8693
8694
8695
8696
8697
8698
8699
8700
8701
8702
8703
8704
8705
8706
8707
8708
8709
8710
8711
8712
8713
8714
8715
8716
8717
8718
8719
8720
8721
8722
8723
8724
8725
8726
8727
8728
8729
8730
Fe I
O2
Mg I
Vacuum Wavelength λ in [Å]

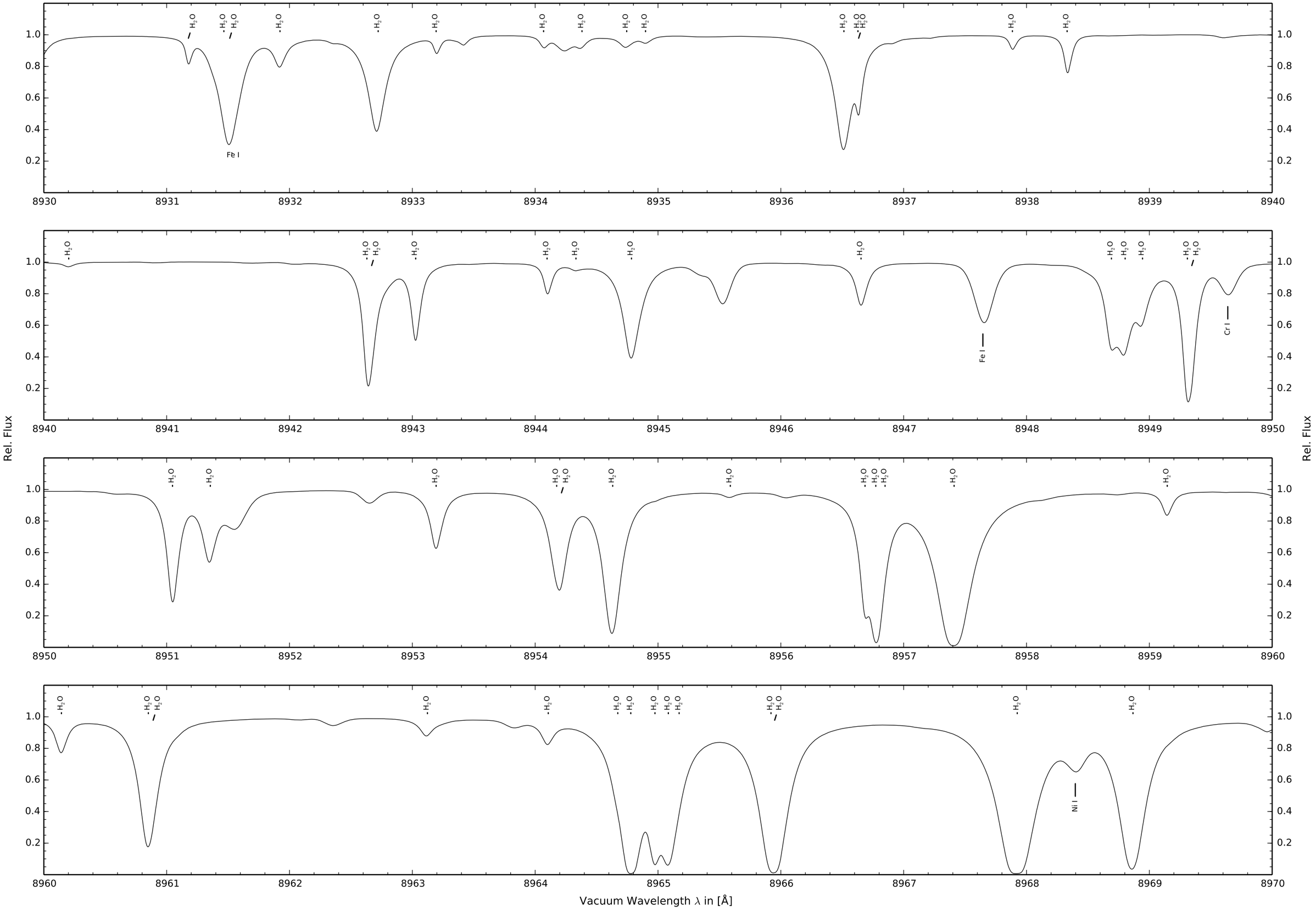

Si I
Mg I
Mg I
Si I
Si I
Fe I
Fe I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]

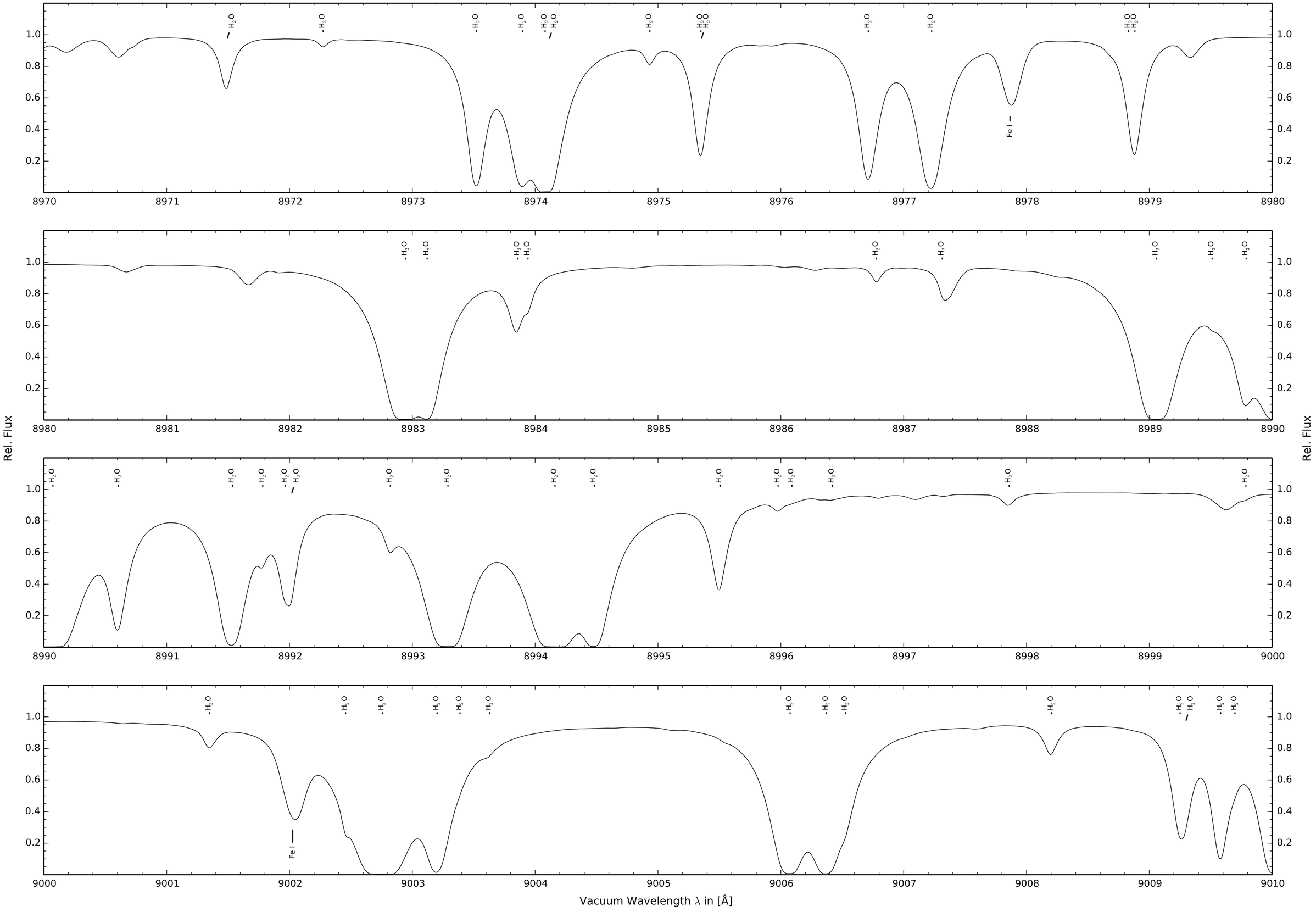

Rel. Flux
Al I
Al I
H_2O
Si I
Fe I
Fe I
H_2O
H_2O
H_2O
Fe I
Mg I
Vacuum Wavelength λ in [Å]


Rel. Flux
Ni I
- H_2O
Fe I
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ni I
Fe I

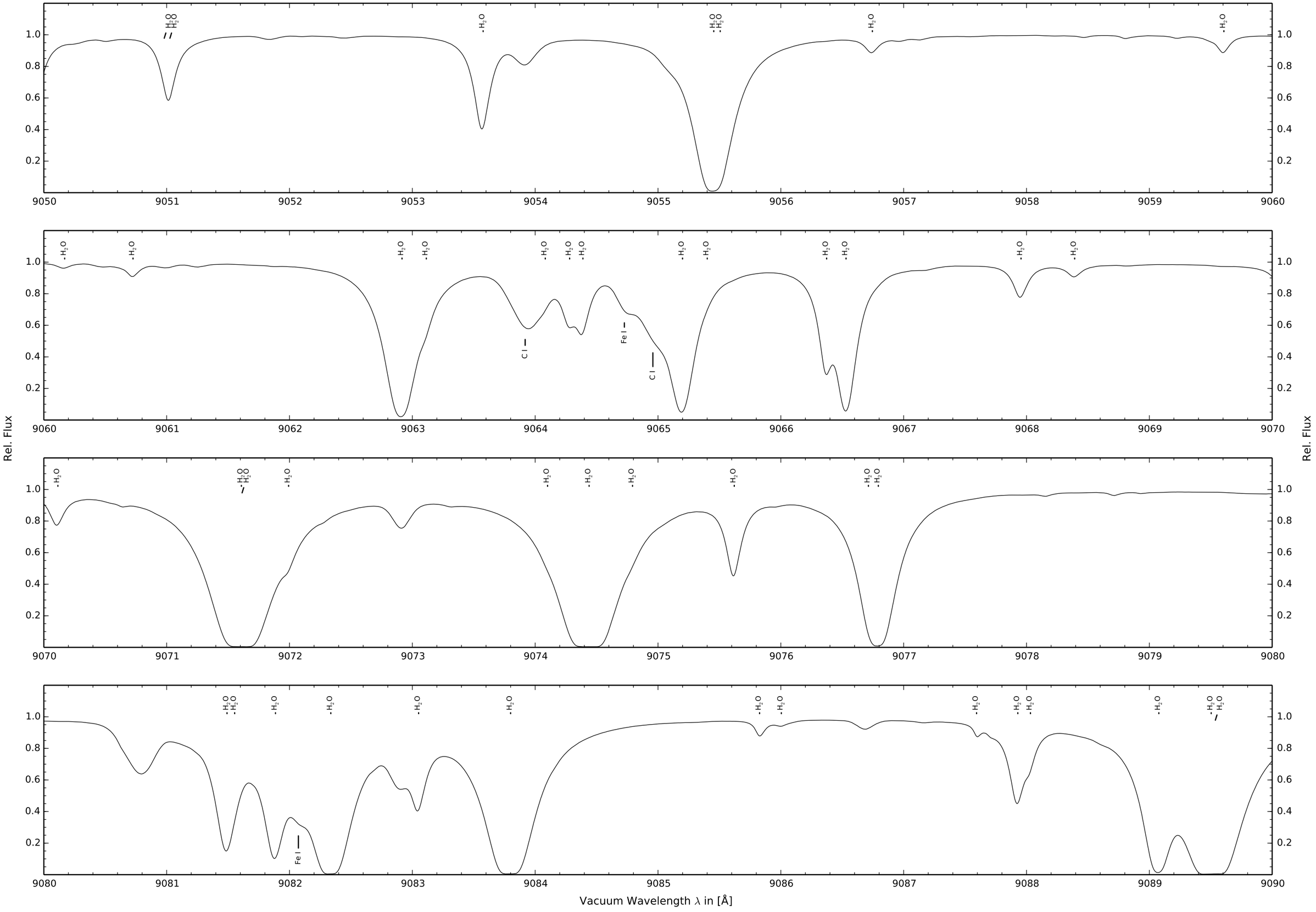

Rel. Flux
Si I
Si I
Fe I
Ca II
Mg I
Ca II
$-H_2O$
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Cr I
Ni I
H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
C I
Fe I

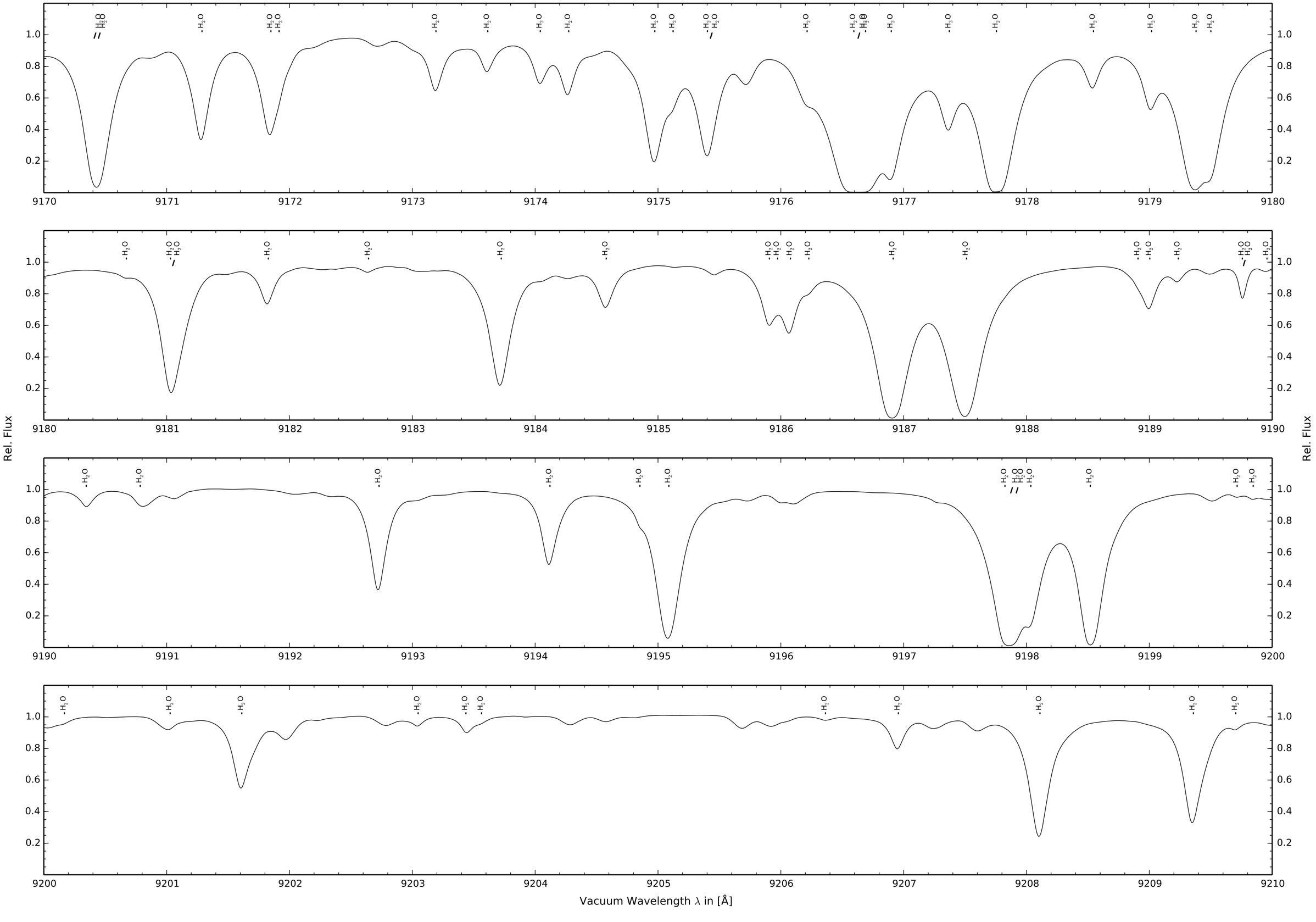
Rel. Flux

Fe I
C I
Fe I
C I
C I
Fe I

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
9170
9171
9172
9173
9174
9175
9176
9177
9178
9179
9180
9181
9182
9183
9184
9185
9186
9187
9188
9189
9190
9191
9192
9193
9194
9195
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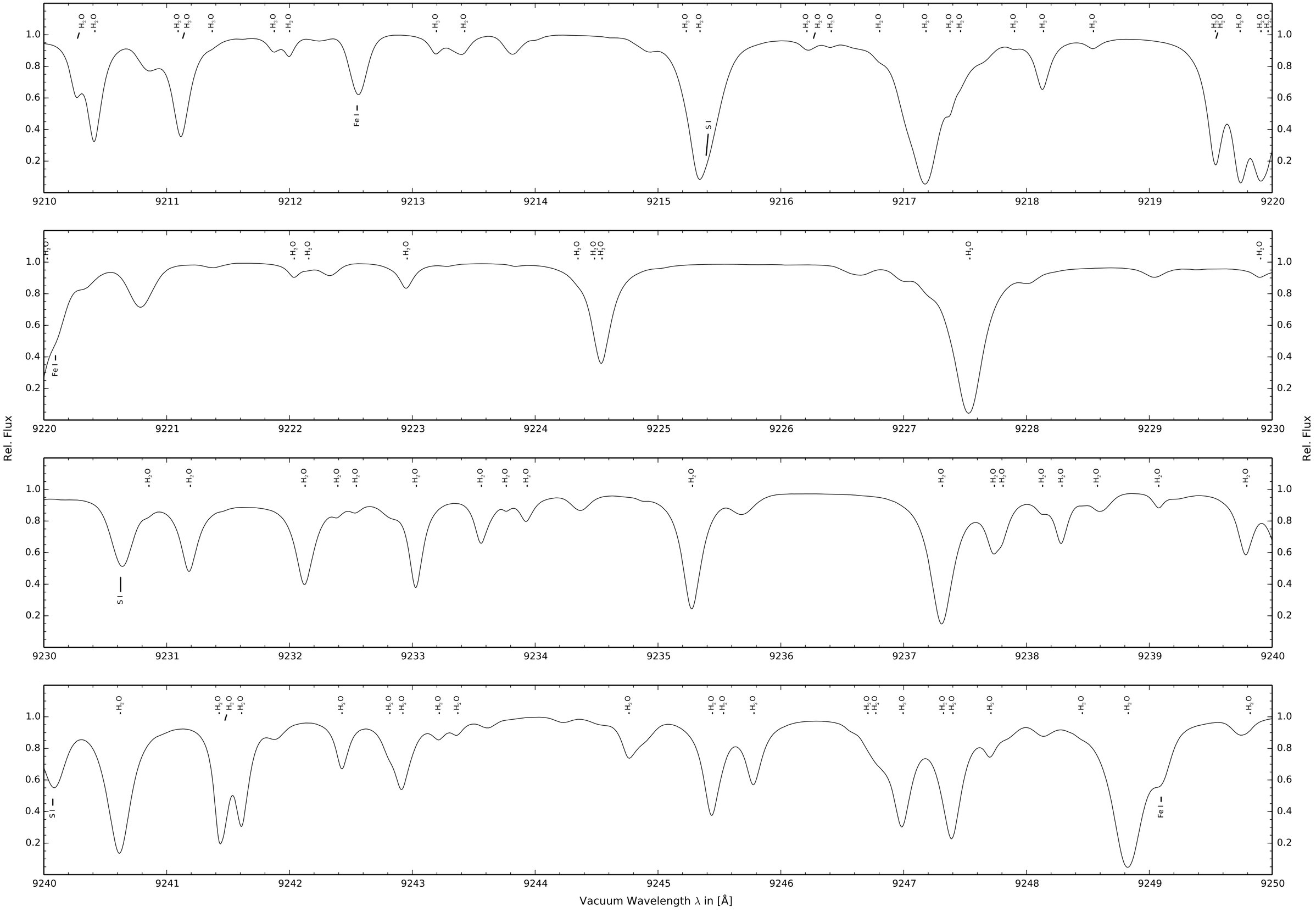
9207
9208
9209
9210


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
S I
H2O

Rel. Flux

Fe I

Fe I

Mg I

Vacuum Wavelength λ in [Å]

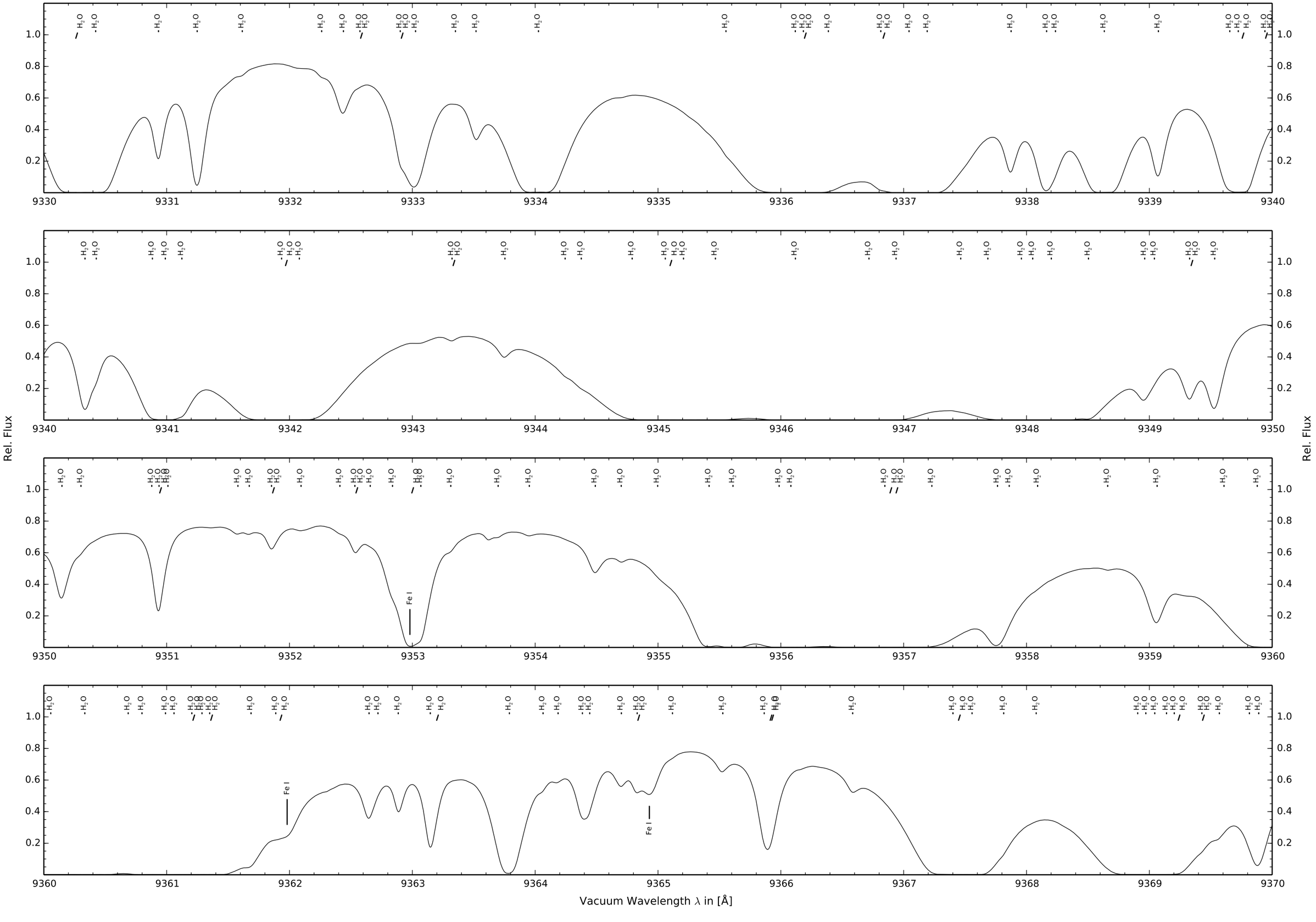
Rel. Flux

Cr I

Fe I

Fe I

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Fe I

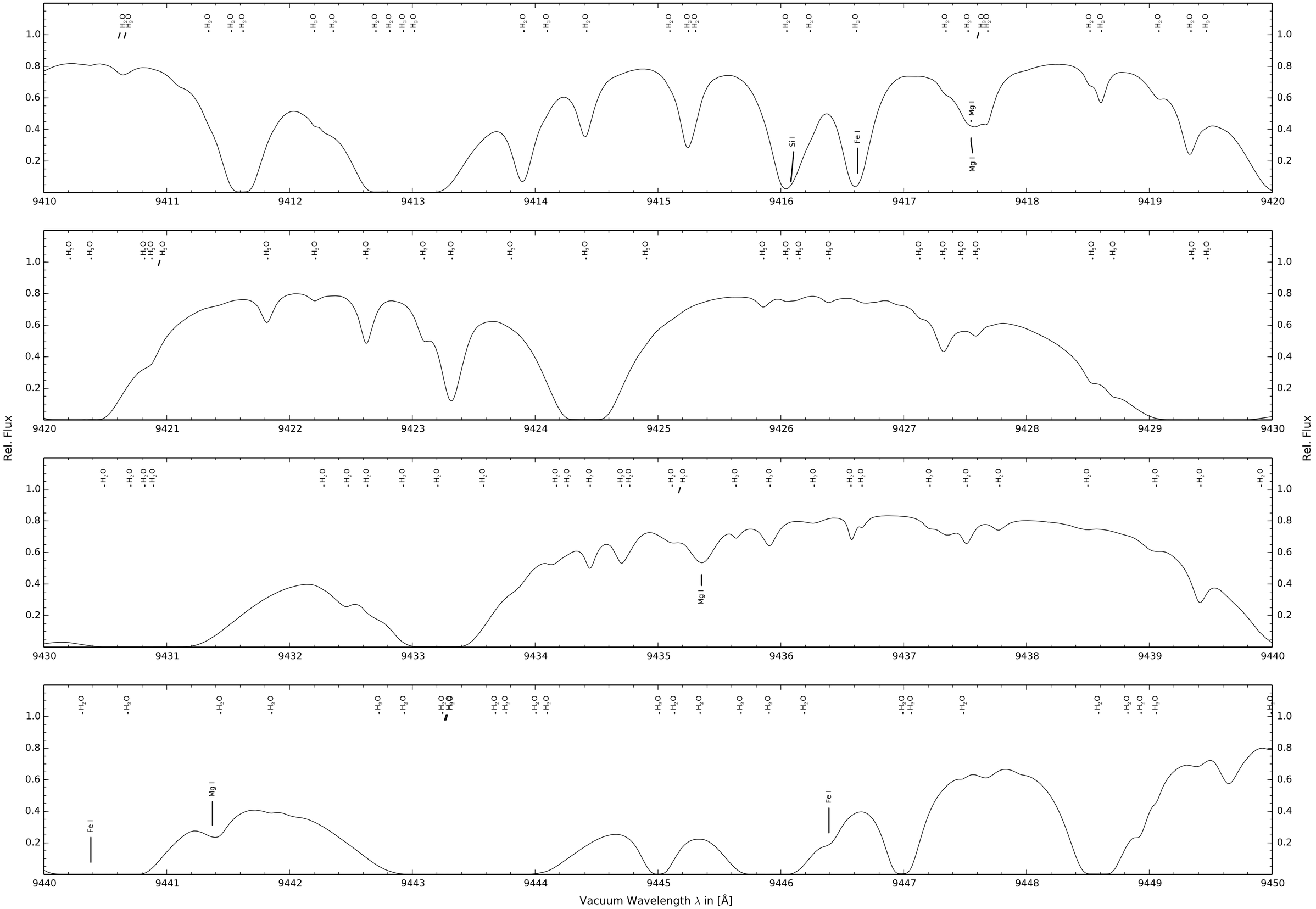
Rel. Flux

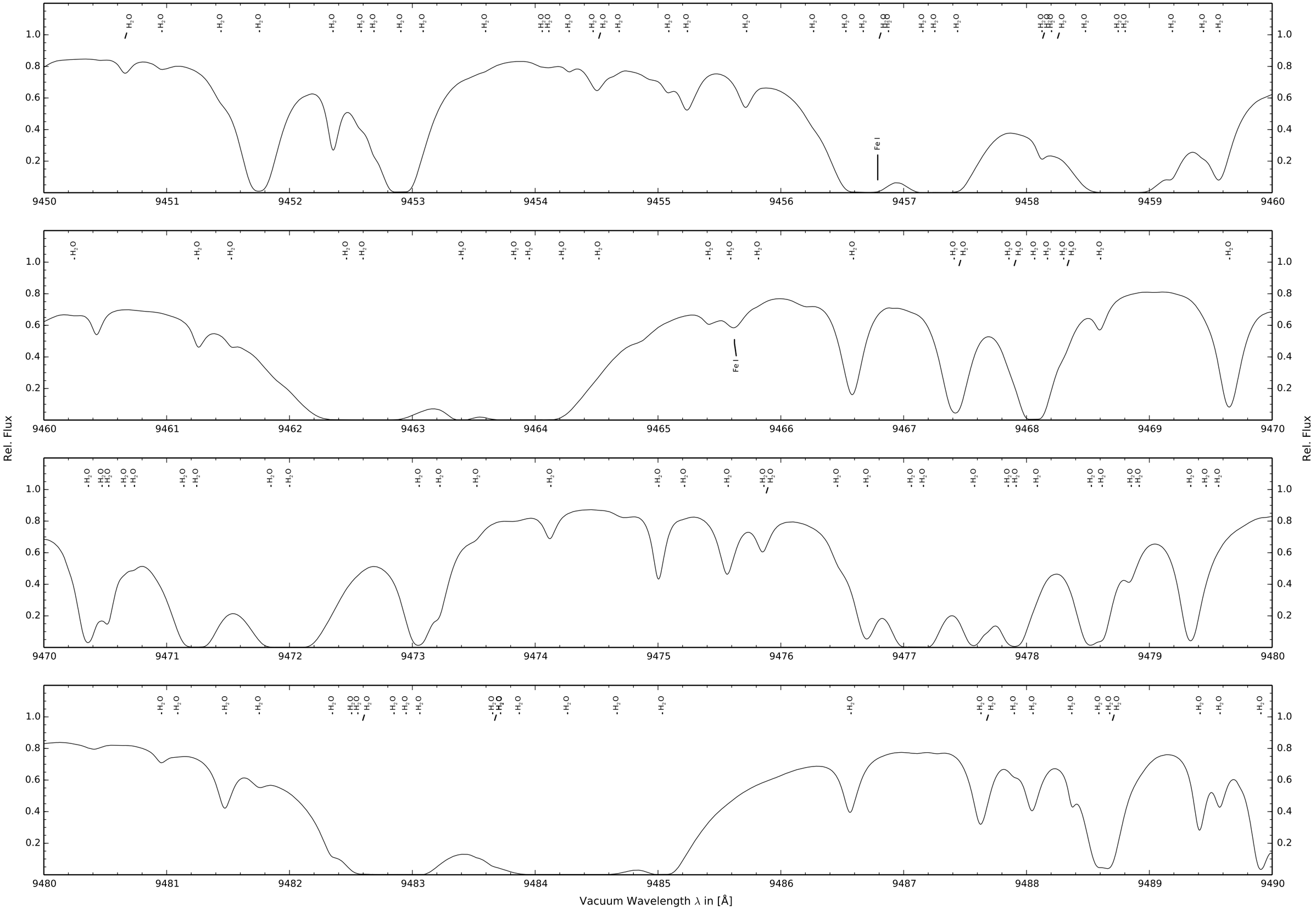
Fe I

Fe I

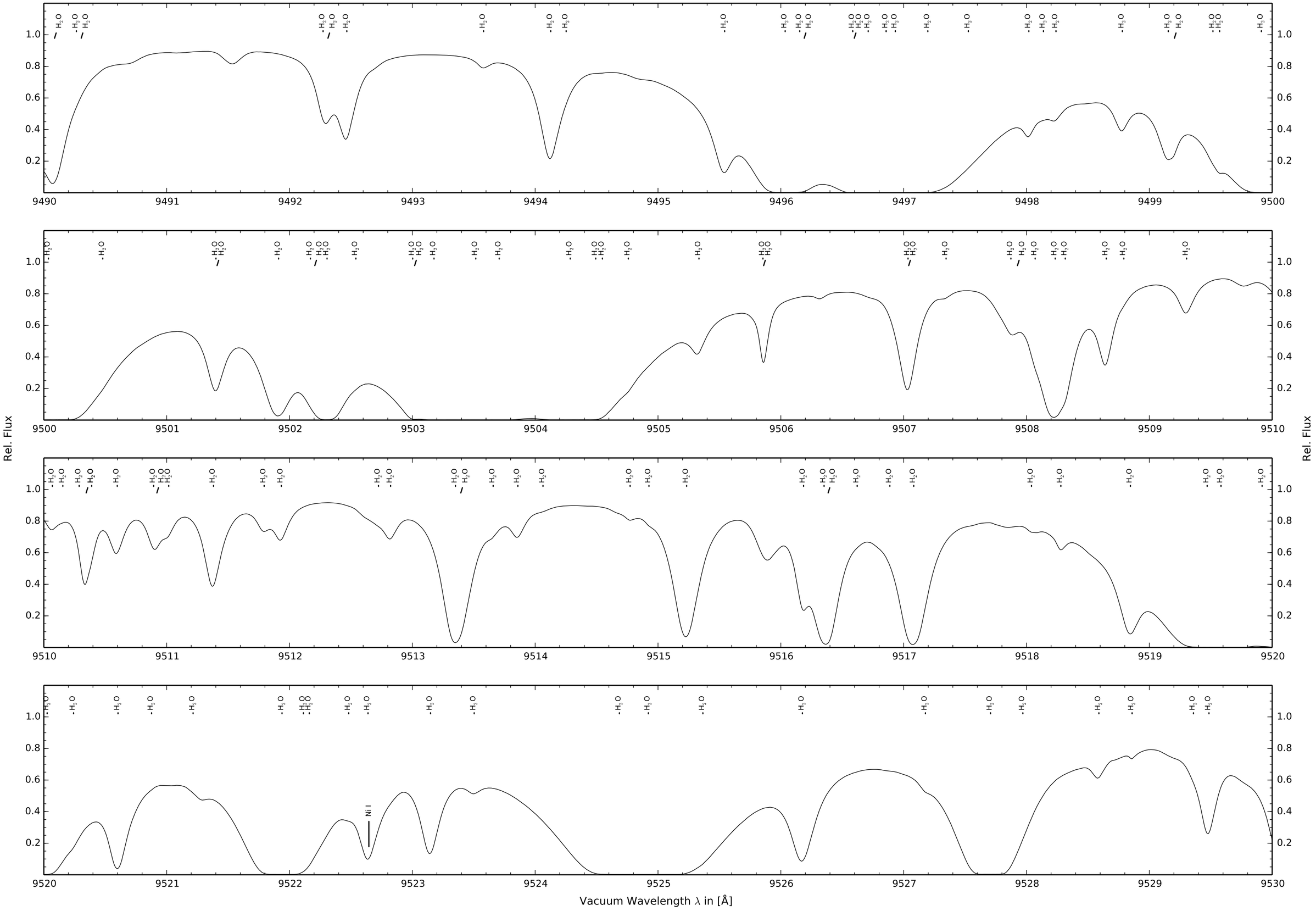
C I

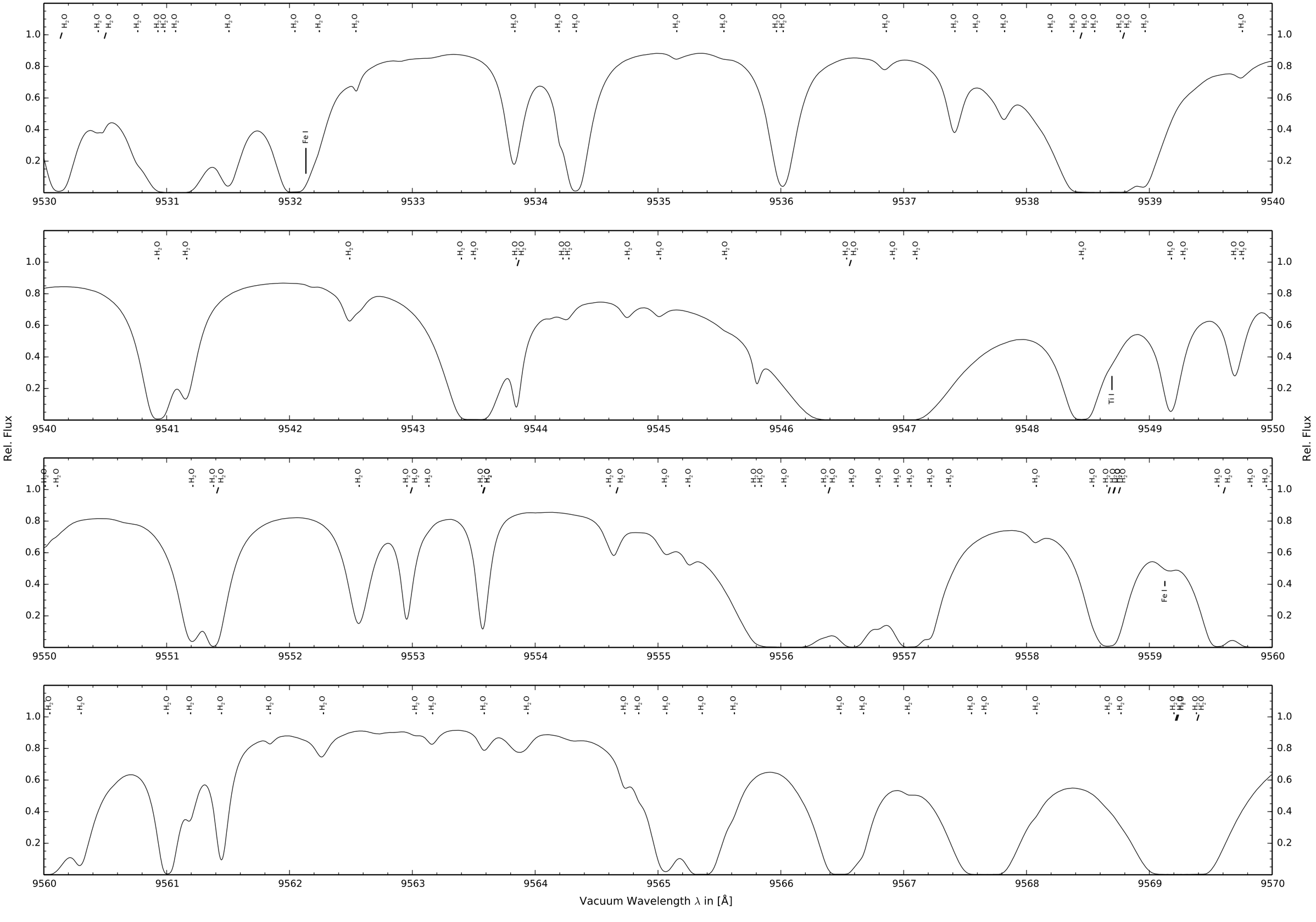
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Fe I
Mg I
Mg I
Mg I
Fe I
Mg I
Fe I



Rel. Flux
Fe I
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Ni I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Ti I
Fe I

Rel. Flux

Fe I

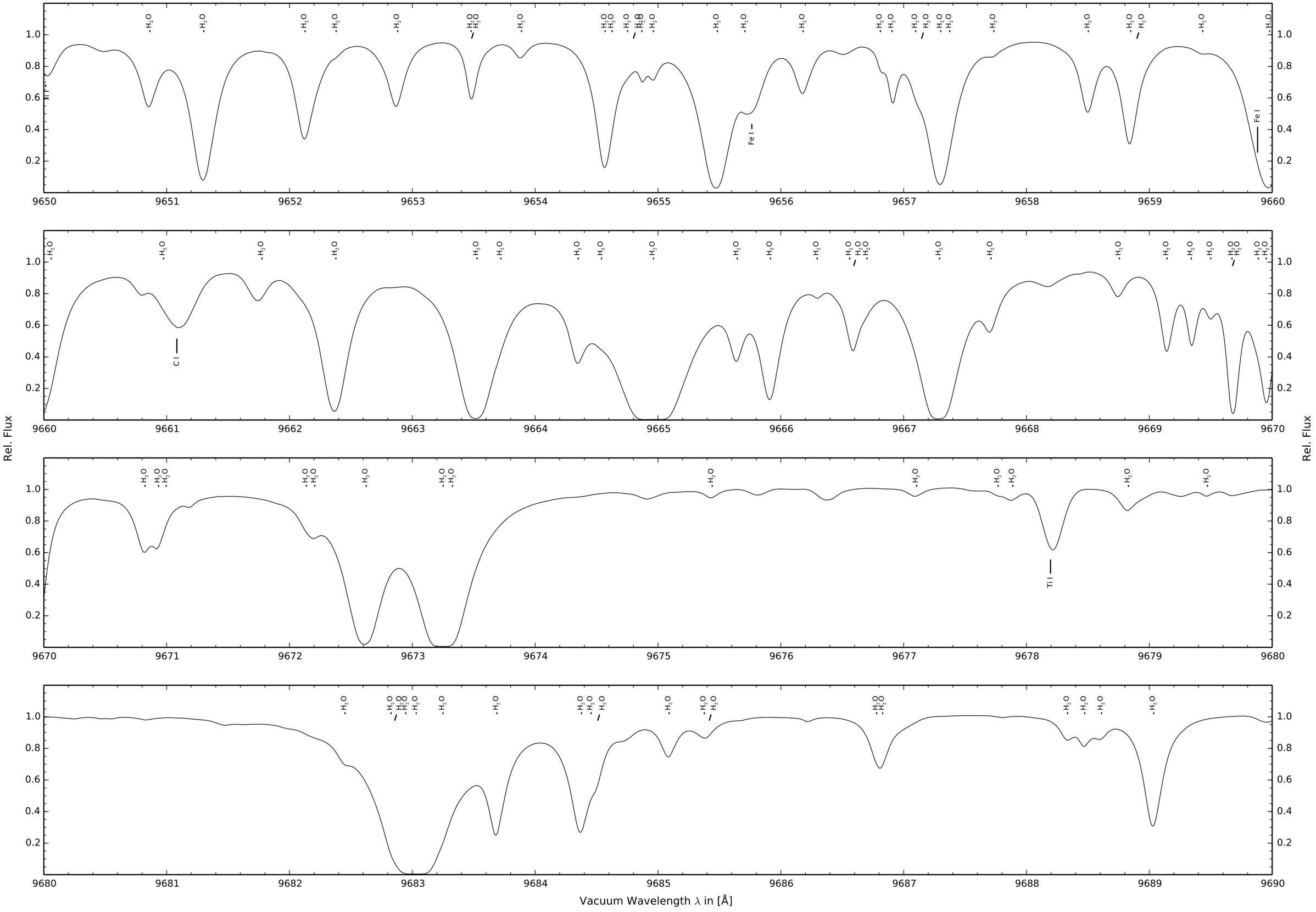
Cr I

Ti I

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
C I
Ti I

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

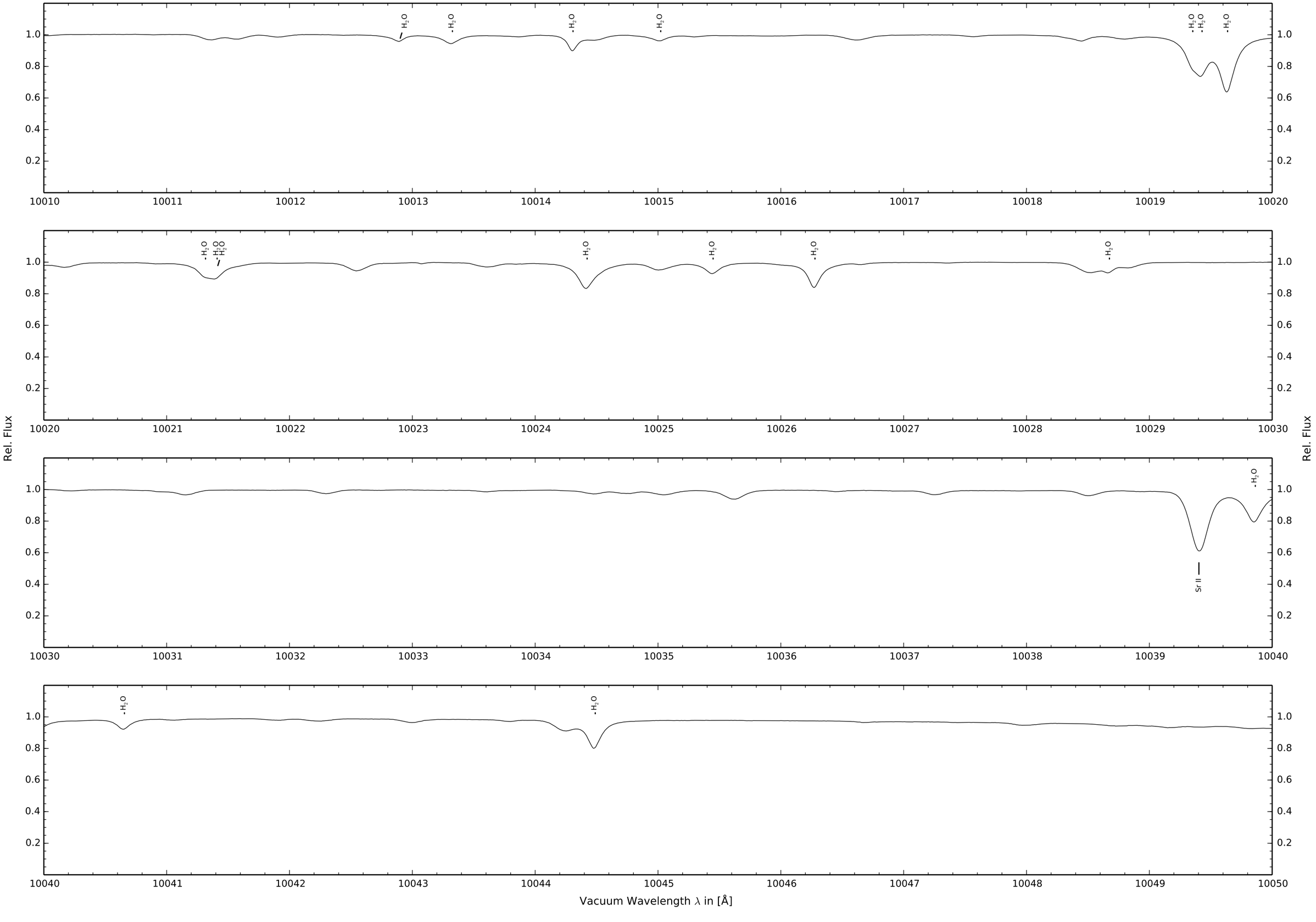
Vacuum Wavelength λ in [Å]

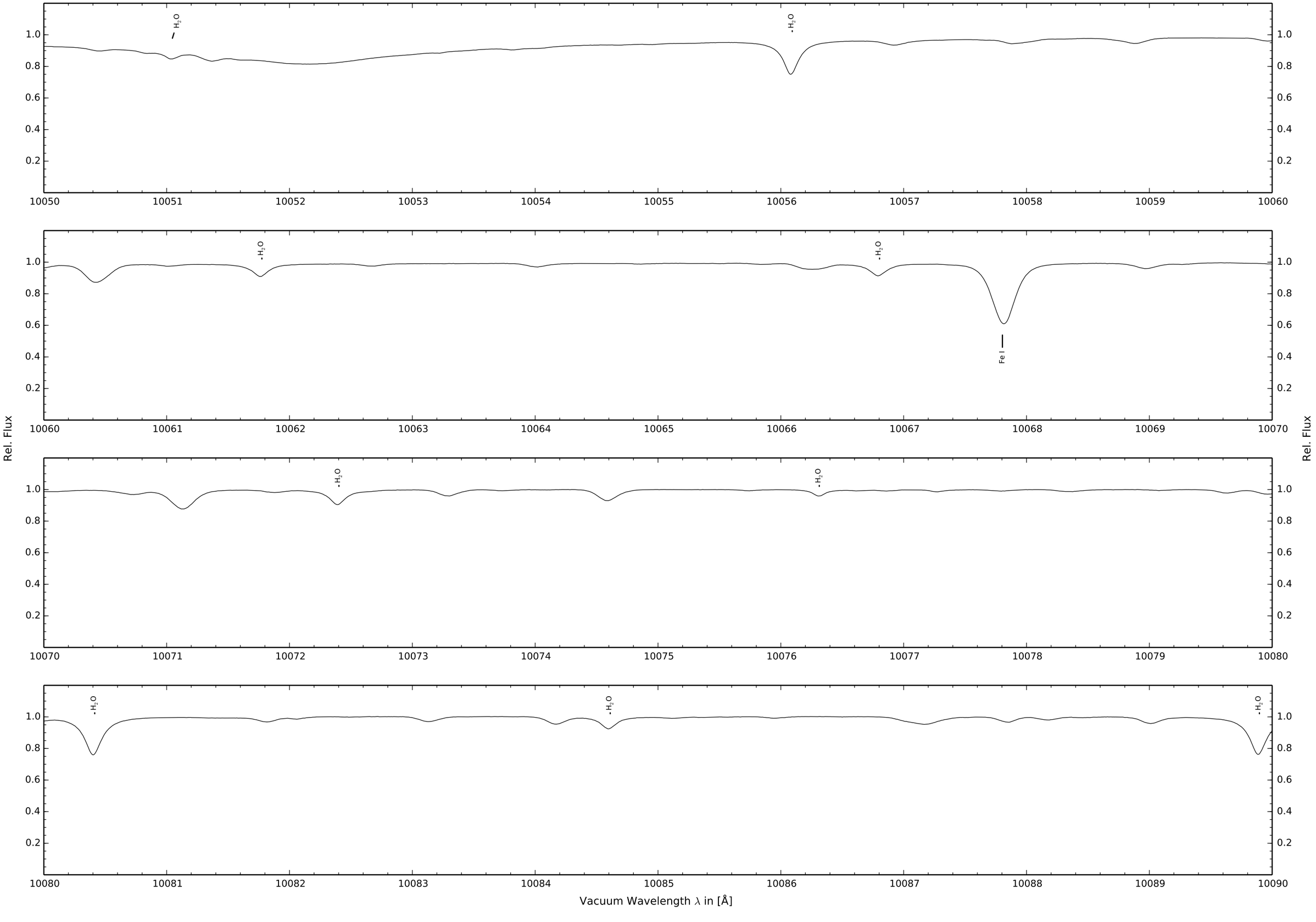
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

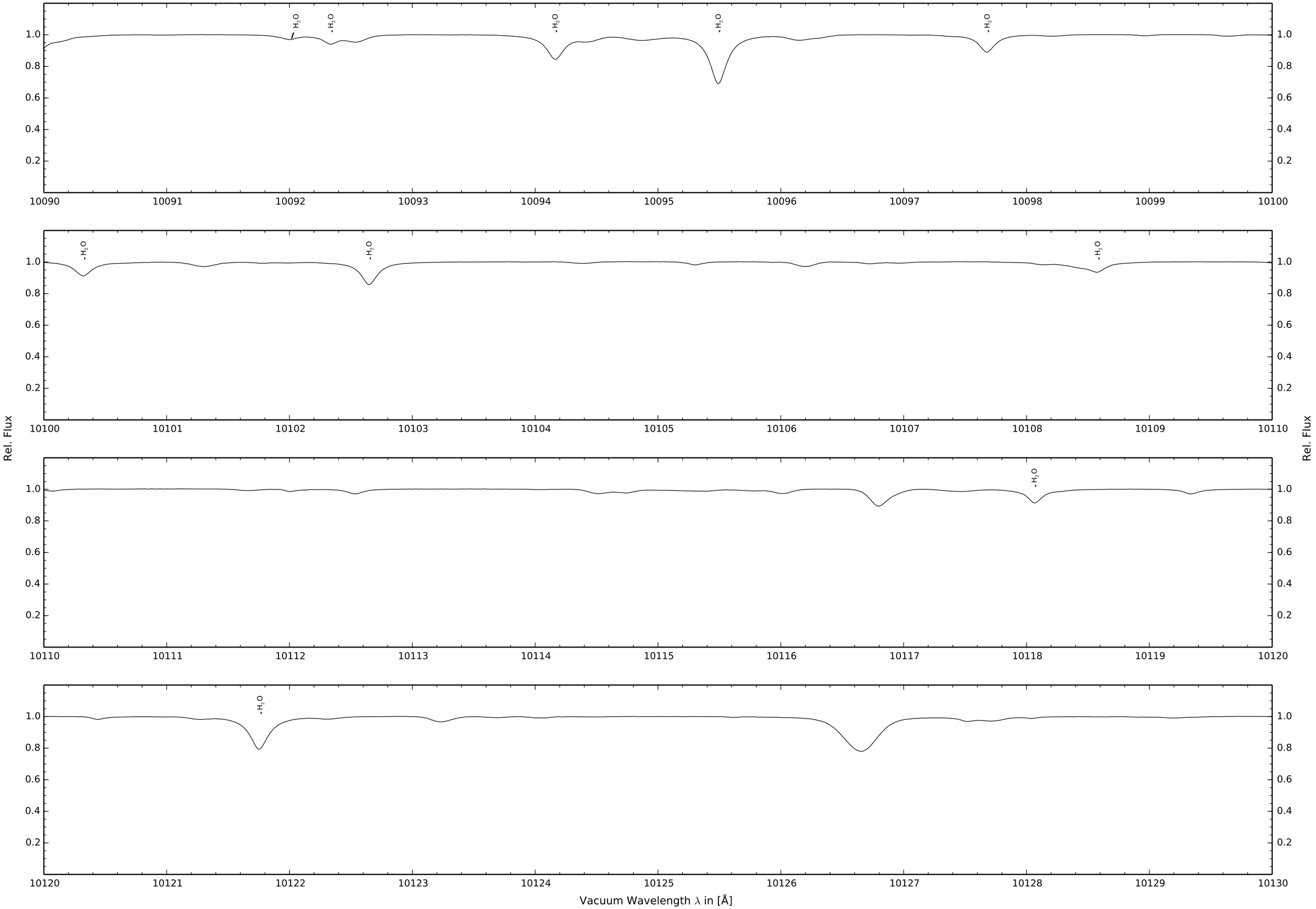
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]
- H2O

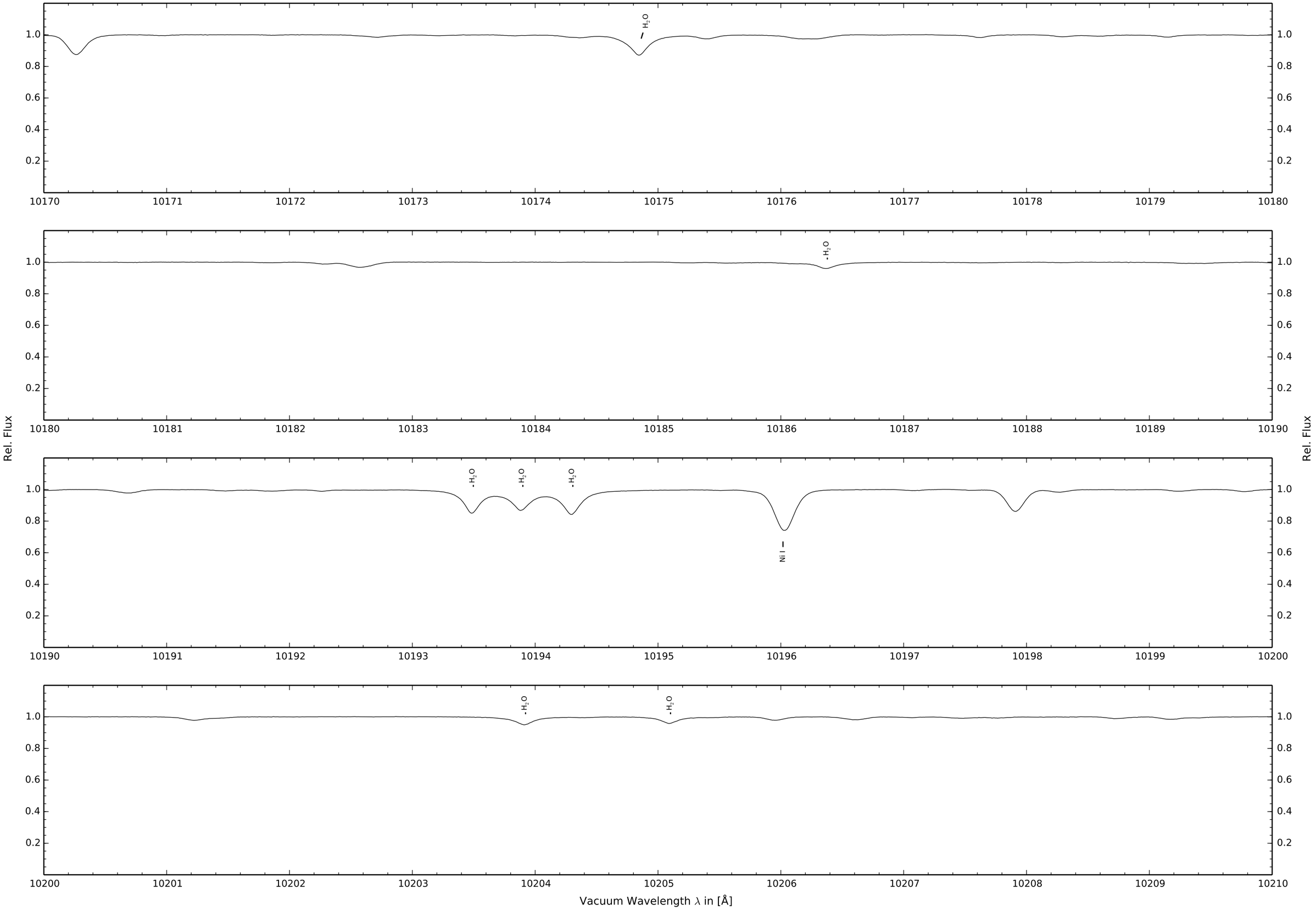
Rel. Flux
Vacuum Wavelength λ in [Å]
- H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Sr II


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

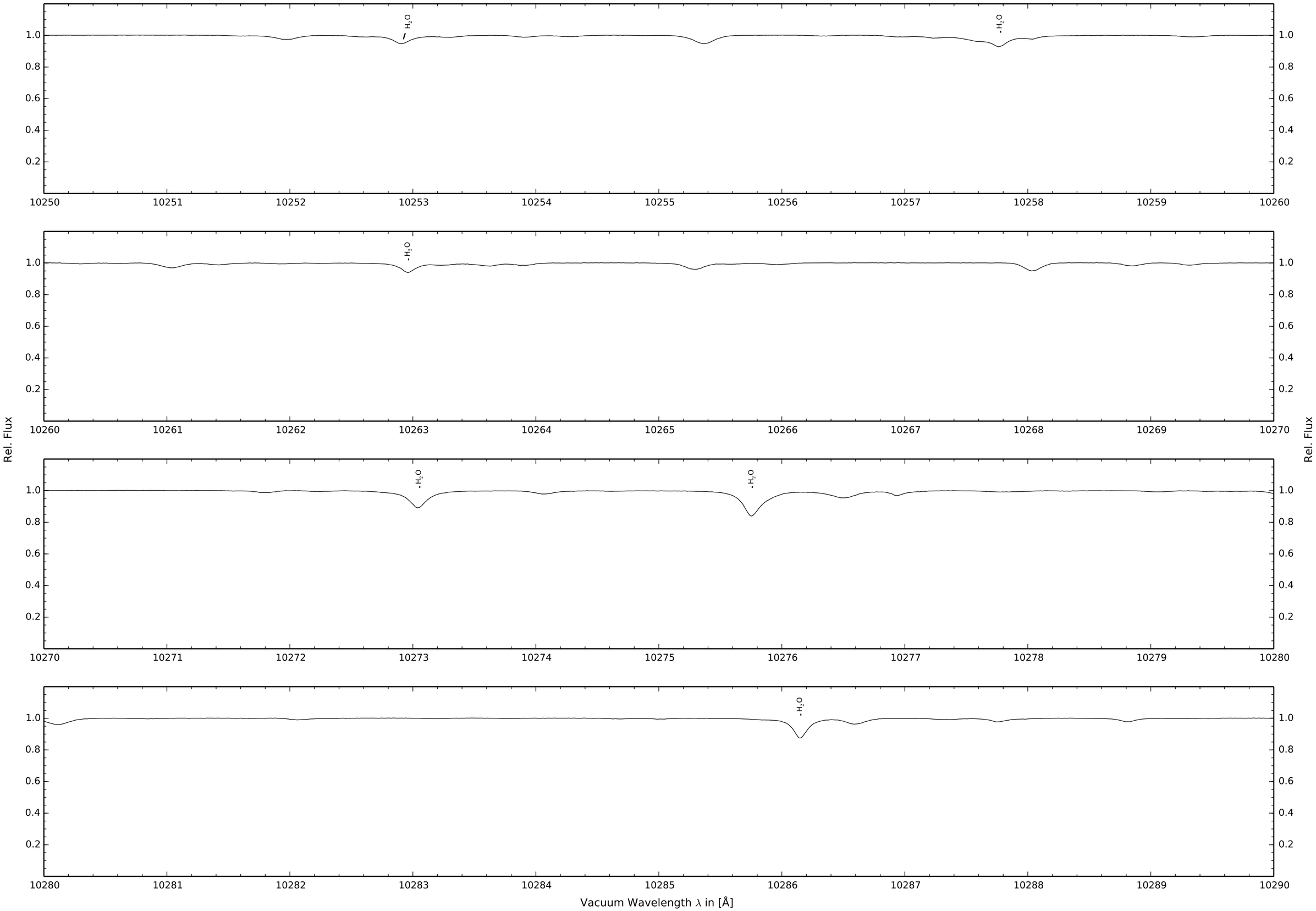

Rel. Flux
Vacuum Wavelength λ in [Å]
- H2O

H2O
Fe I
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
- H2O
Ni I

Rel. Flux

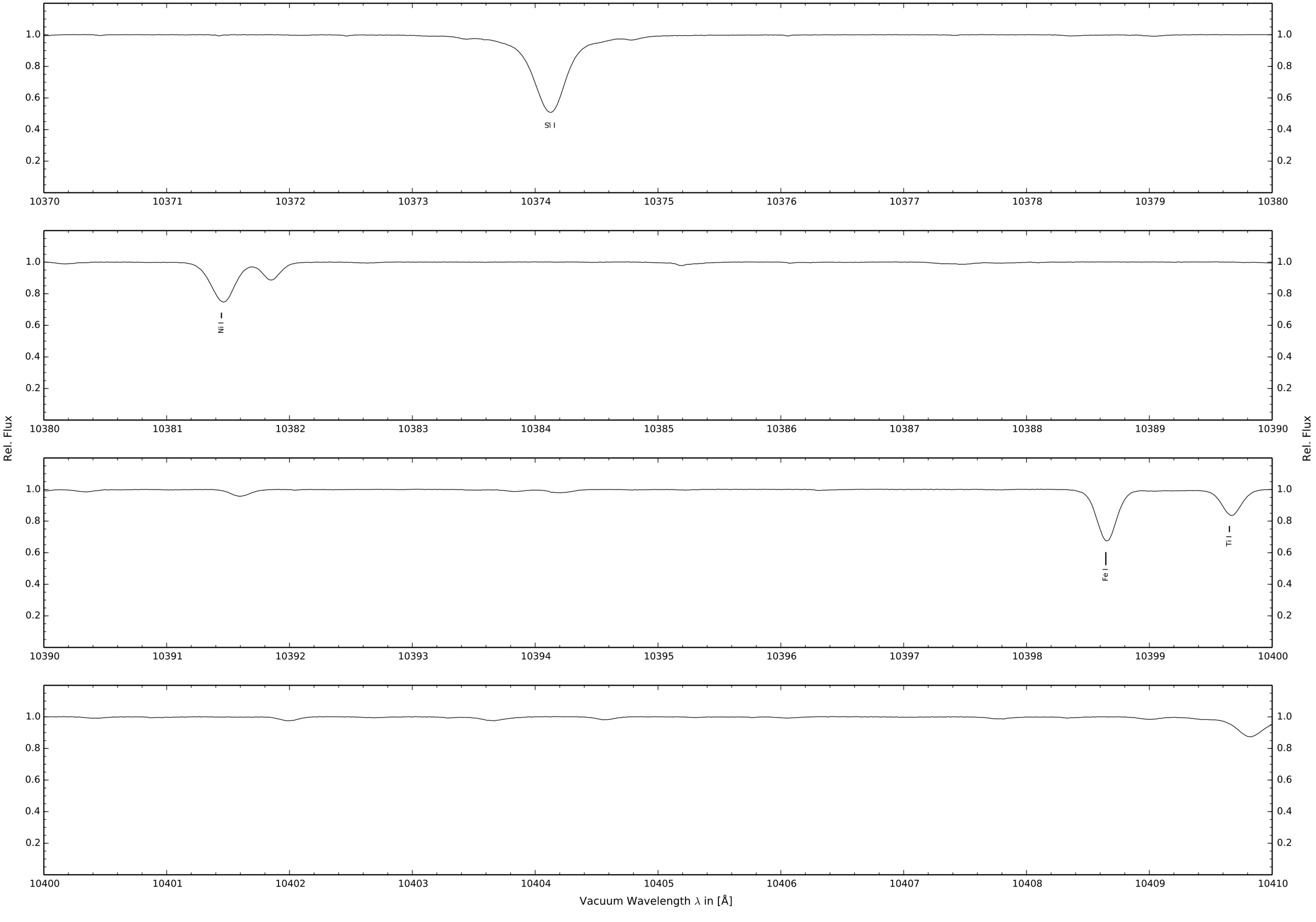
Vacuum Wavelength λ in [Å]

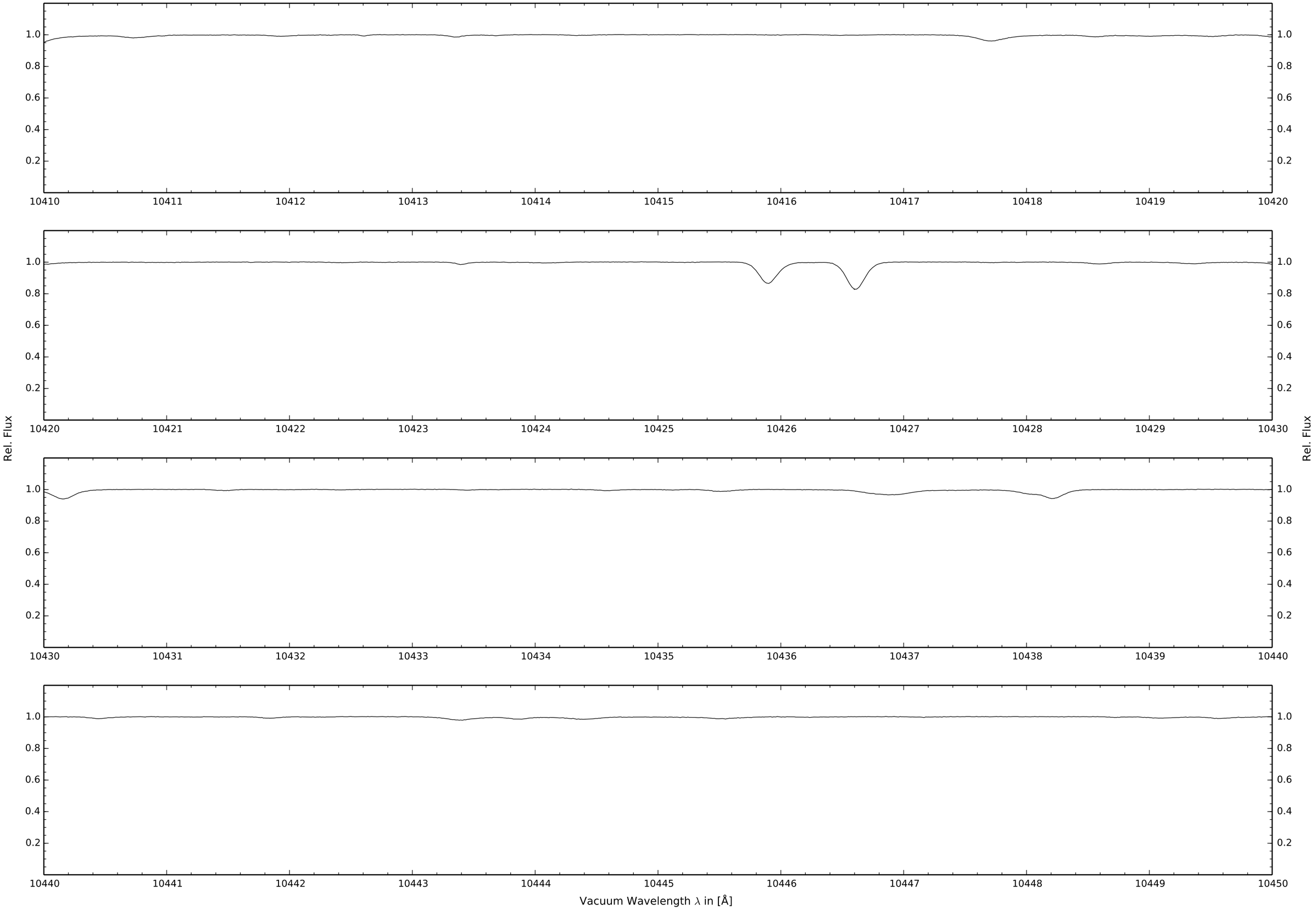


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O

Rel. Flux
Si I
- H_2O
- H_2O
- H_2O
- H_2O
Vacuum Wavelength λ in [Å]

Sr II
Ni I
H2O
Fe I
Ca I
Fe I
Rel. Flux
Vacuum Wavelength λ in [Å]


Si I
Ni I
Fe I
Ti I
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
1.0
0.8
0.6
0.4
0.2
10410
10411
10412
10413
10414
10415
10416
10417
10418
10419
10420
10421
10422
10423
10424
10425
10426
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10428
10429
10430
10431
10432
10433
10434
10435
10436
10437
10438
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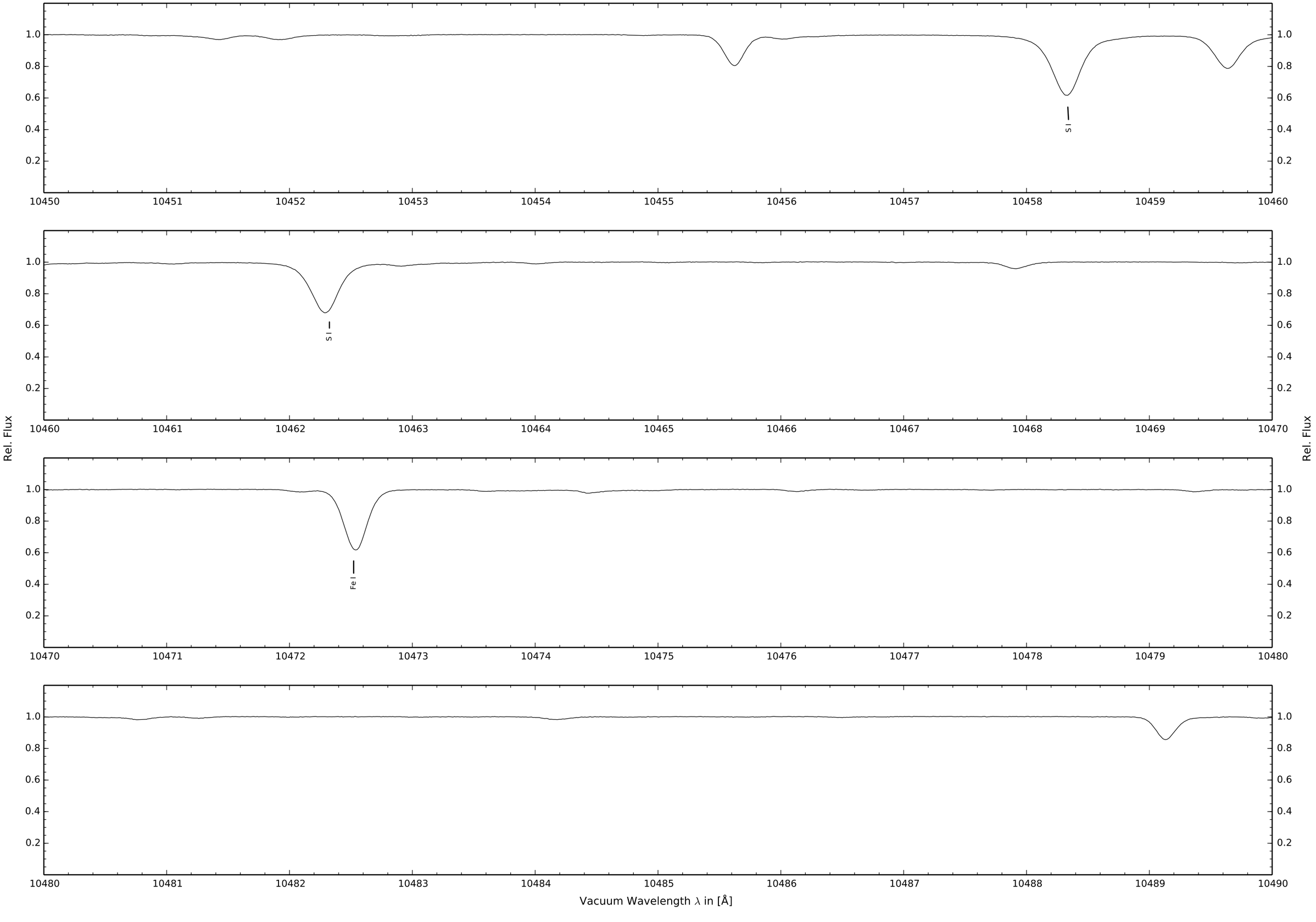
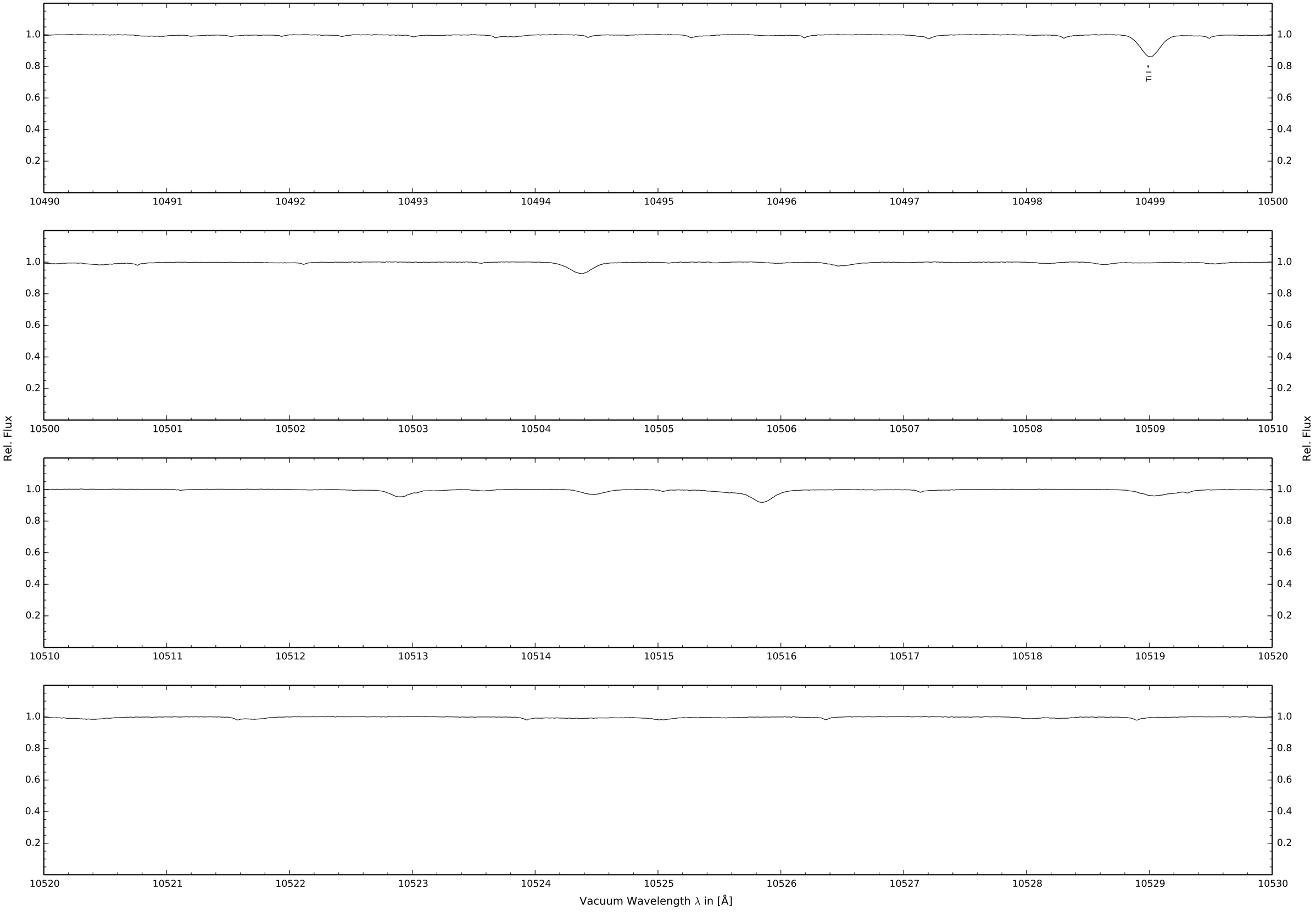
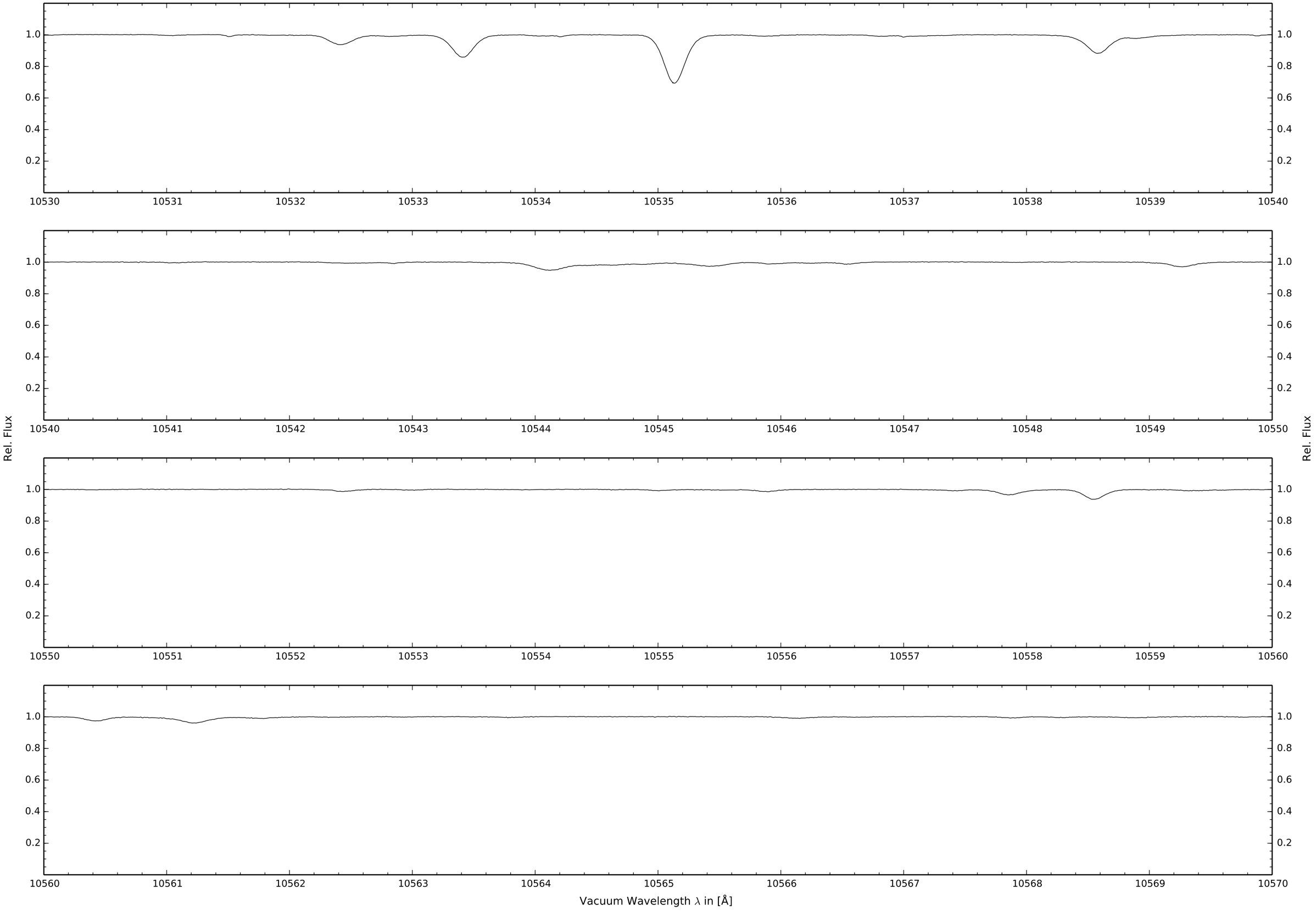
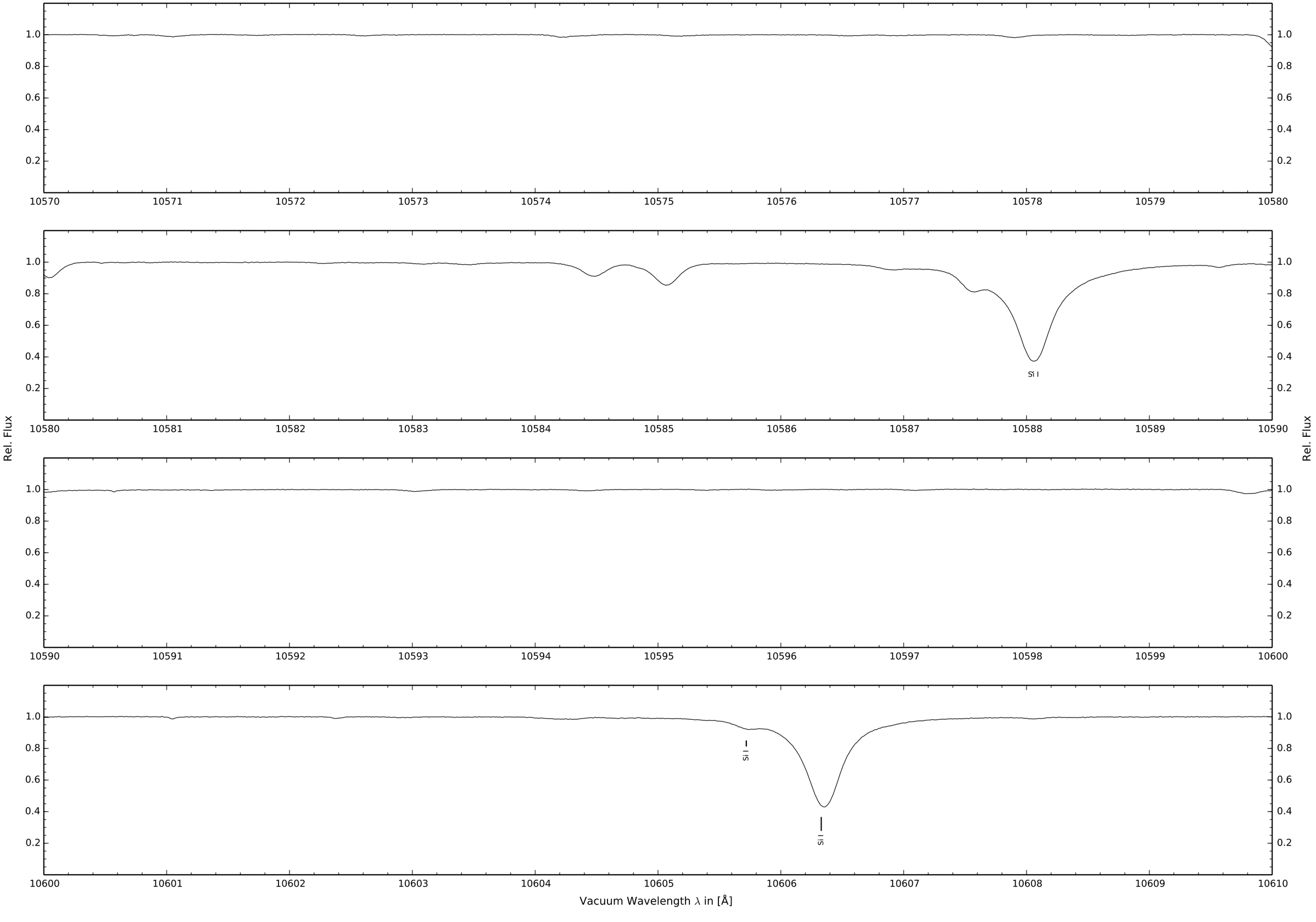
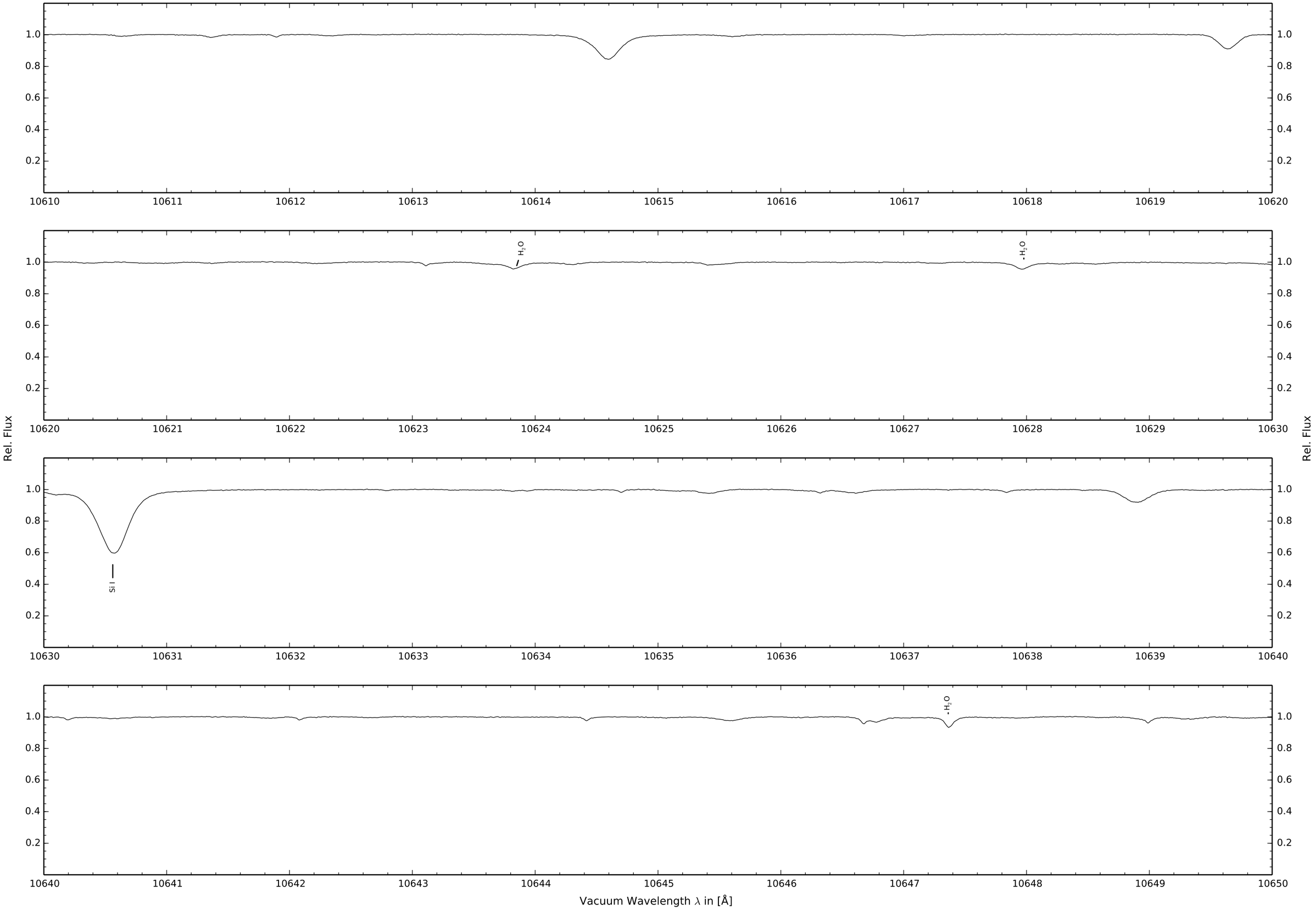
10442
10443
10444
10445
10446
10447
10448
10449
10450
Vacuum Wavelength λ in [Å]

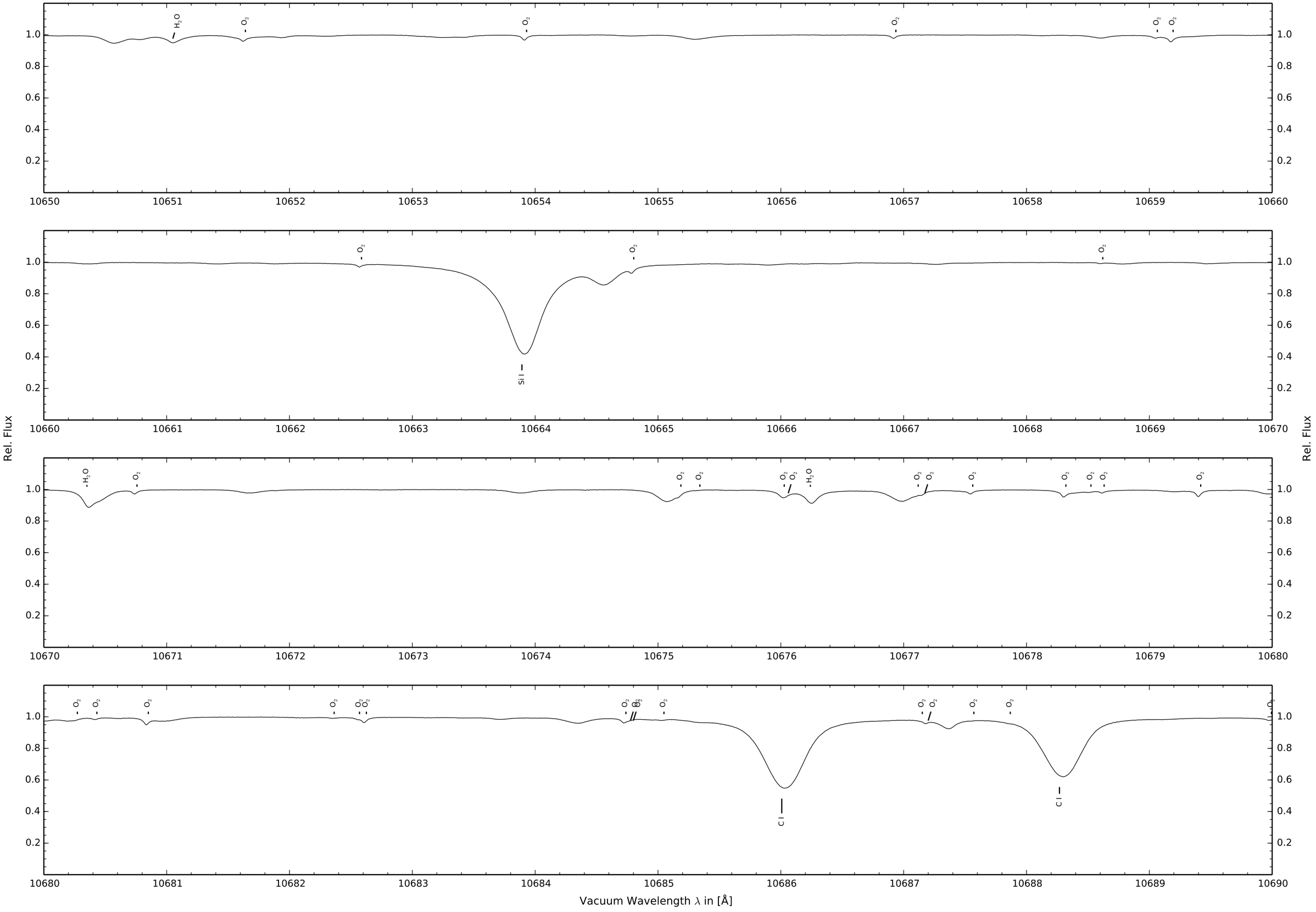

Rel. Flux
Si I
Si I
Fe I
Vacuum Wavelength λ in [Å]

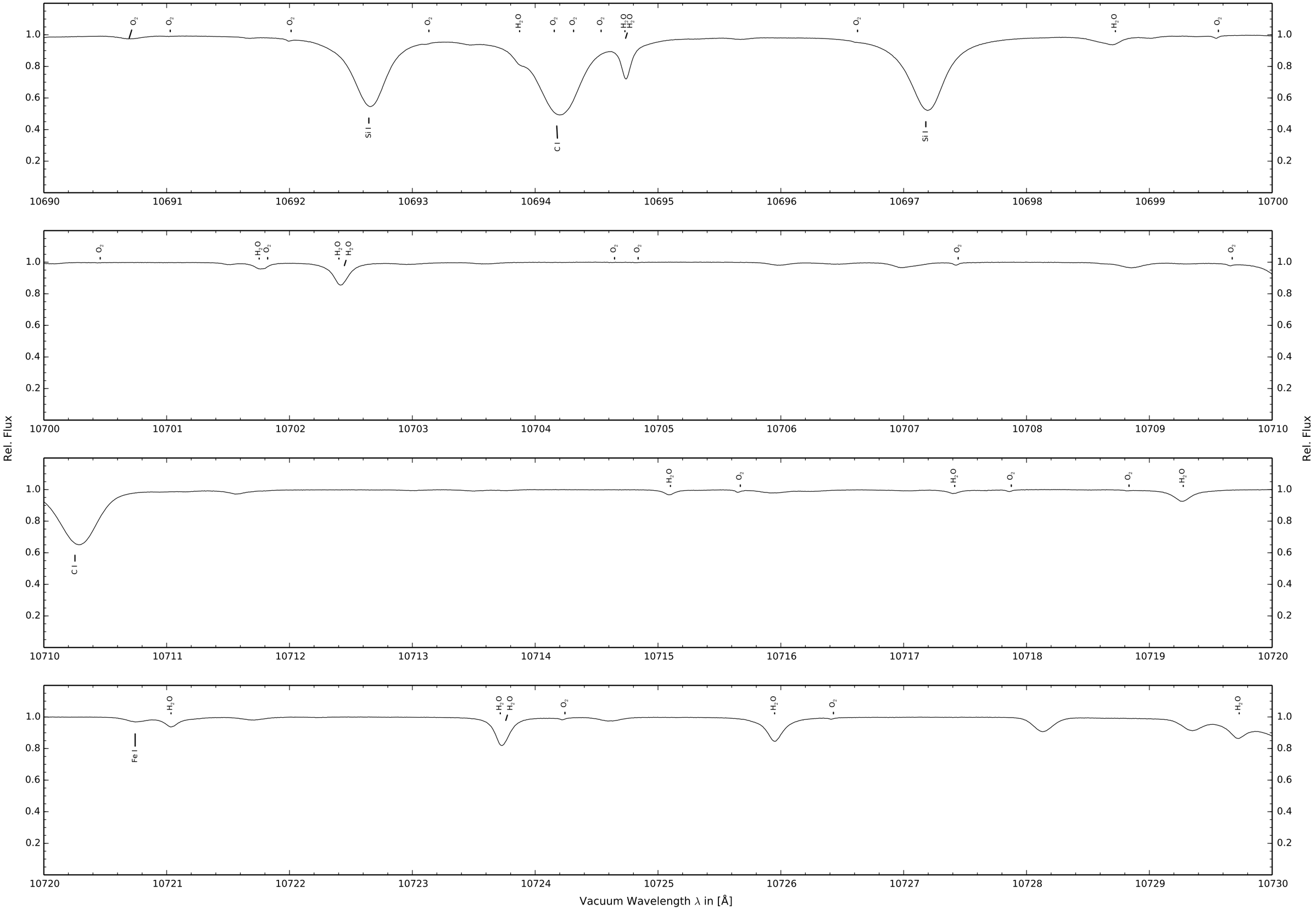

Ti I *
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Si I
Si I
Si I
Vacuum Wavelength λ in [Å]


Rel. Flux
Si I
H_2O
H_2O
H_2O
H_2O
Vacuum Wavelength λ in [Å]

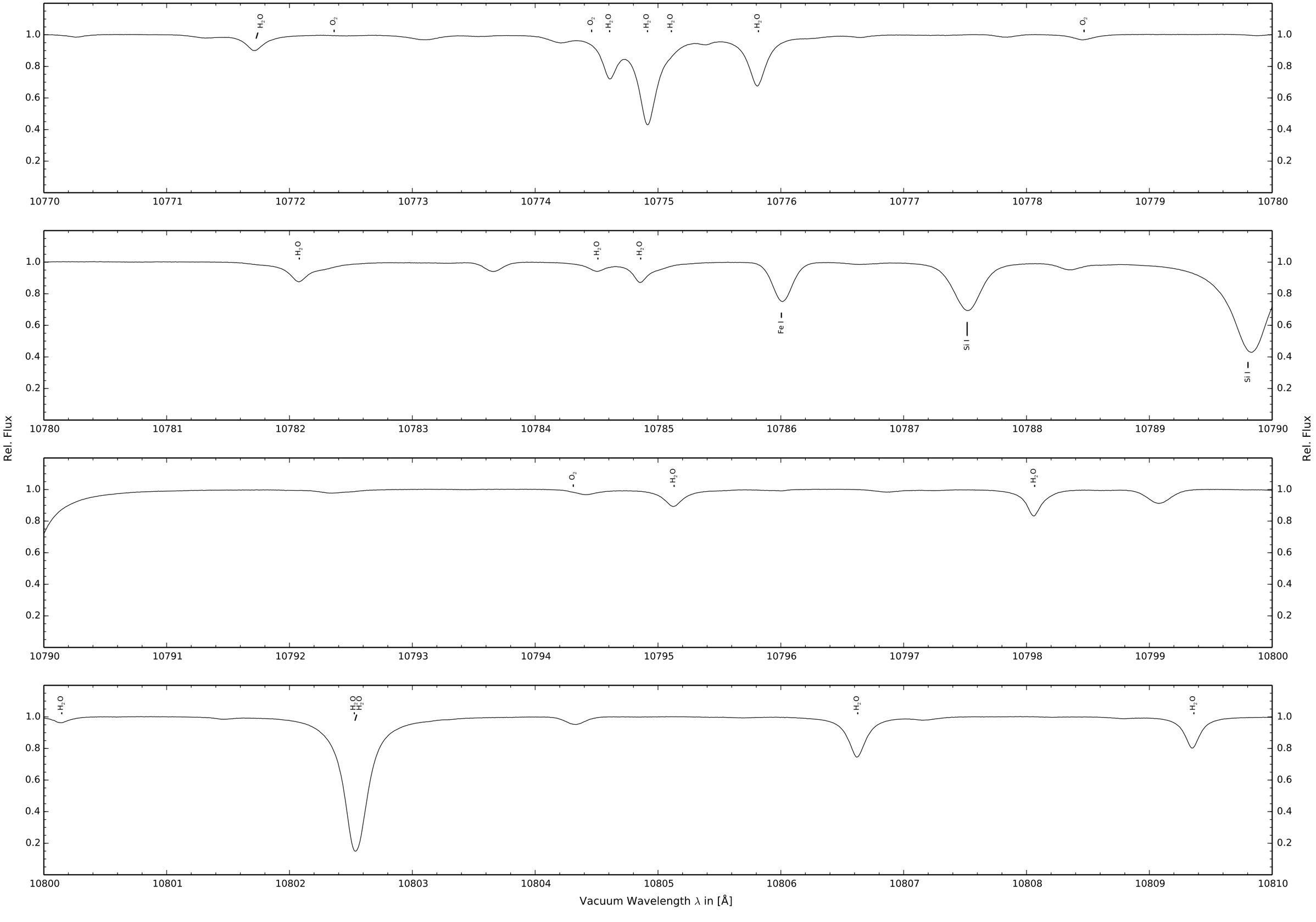

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
Si I
C I

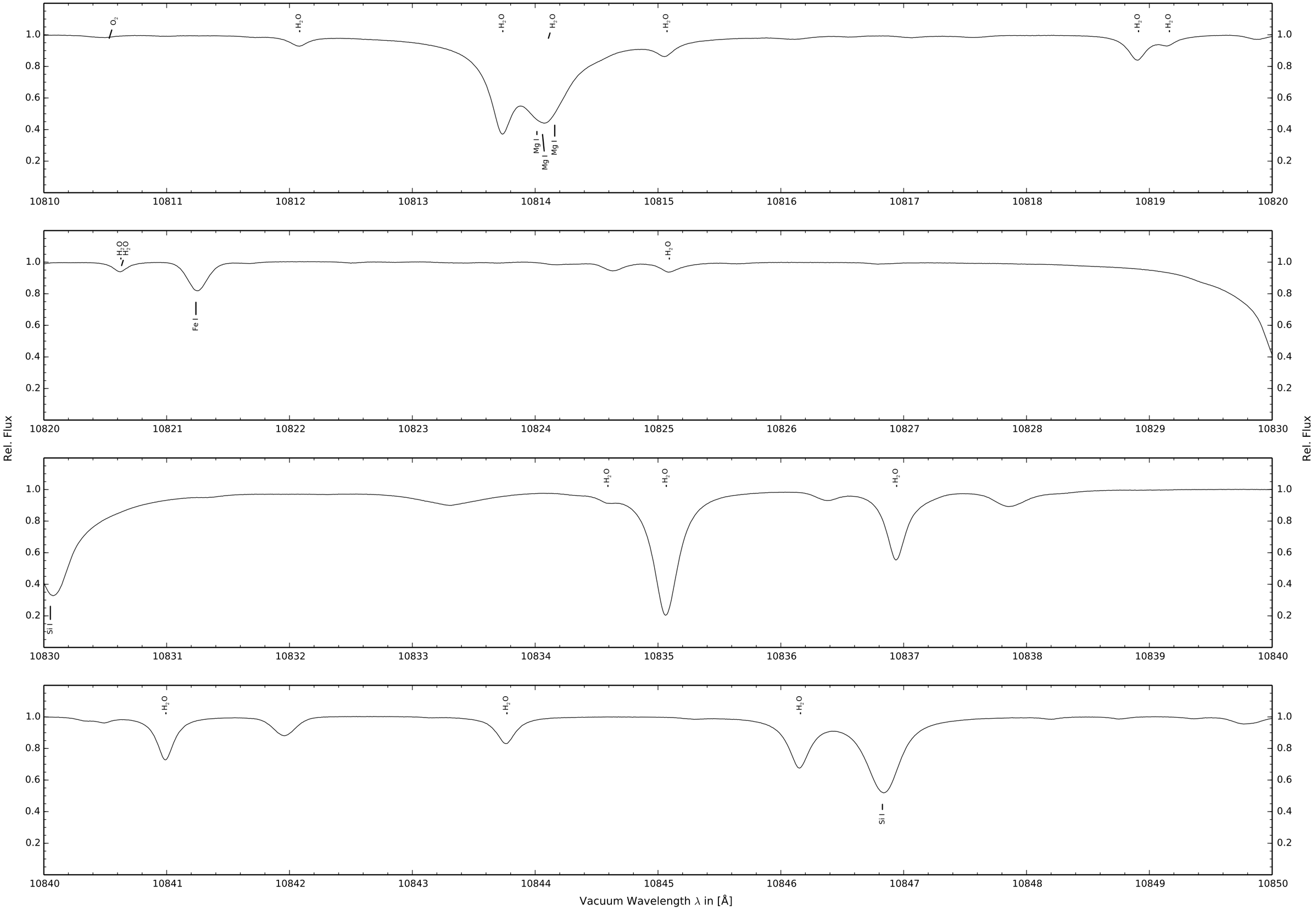

Rel. Flux
Vacuum Wavelength λ in [Å]
O2
H2O
Si I
C I
Fe I

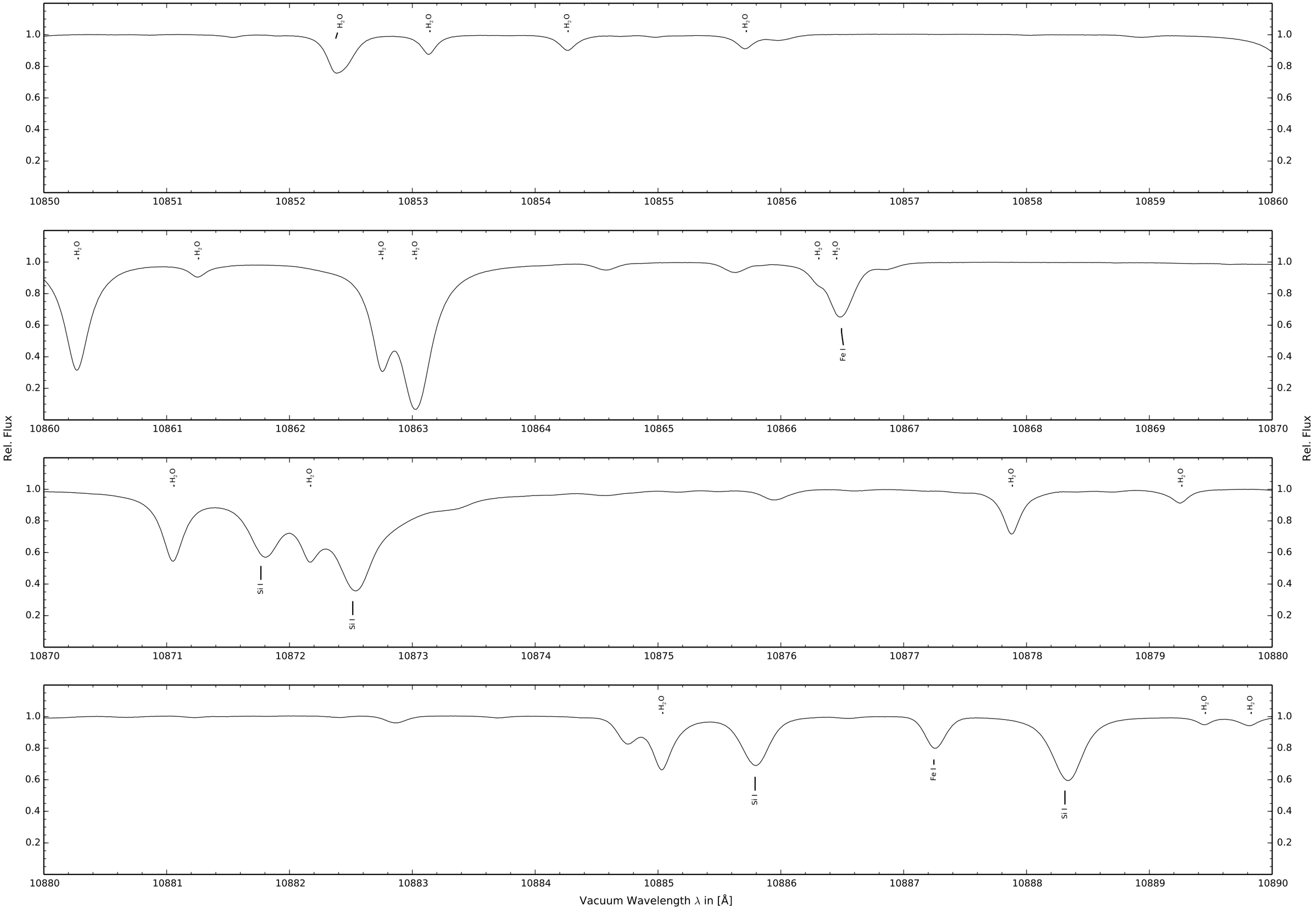
Rel. Flux

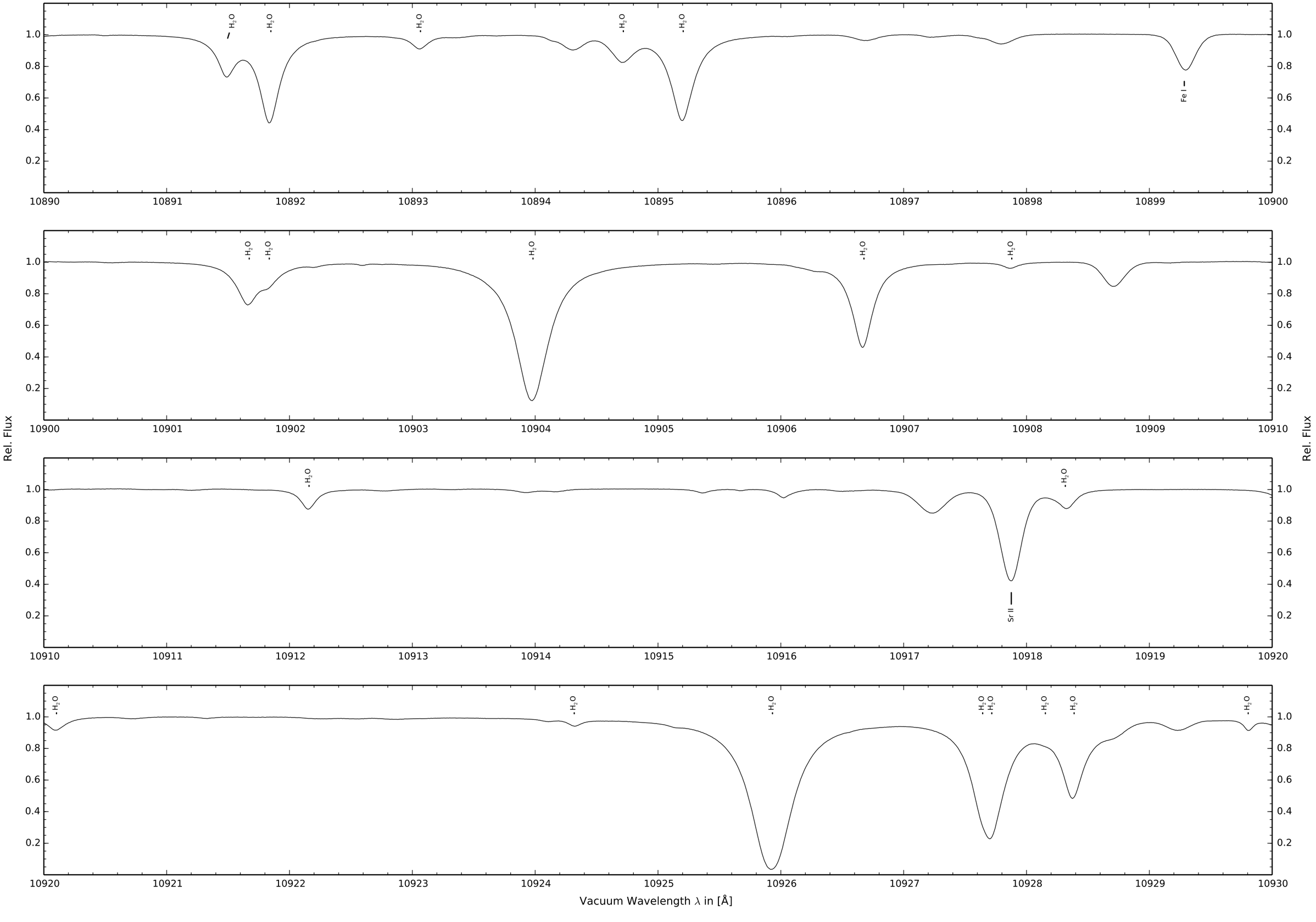
Si I
C I
O_2
O_2
O_2
O_2
O_2
H_2O
H_2O
H_2O
H_2O
O_2
H_2O
Si I
O_2
O_2
H_2O
Fe I
O_2
O_2
O_2
H_2O

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
Fe I
Si I
Si I

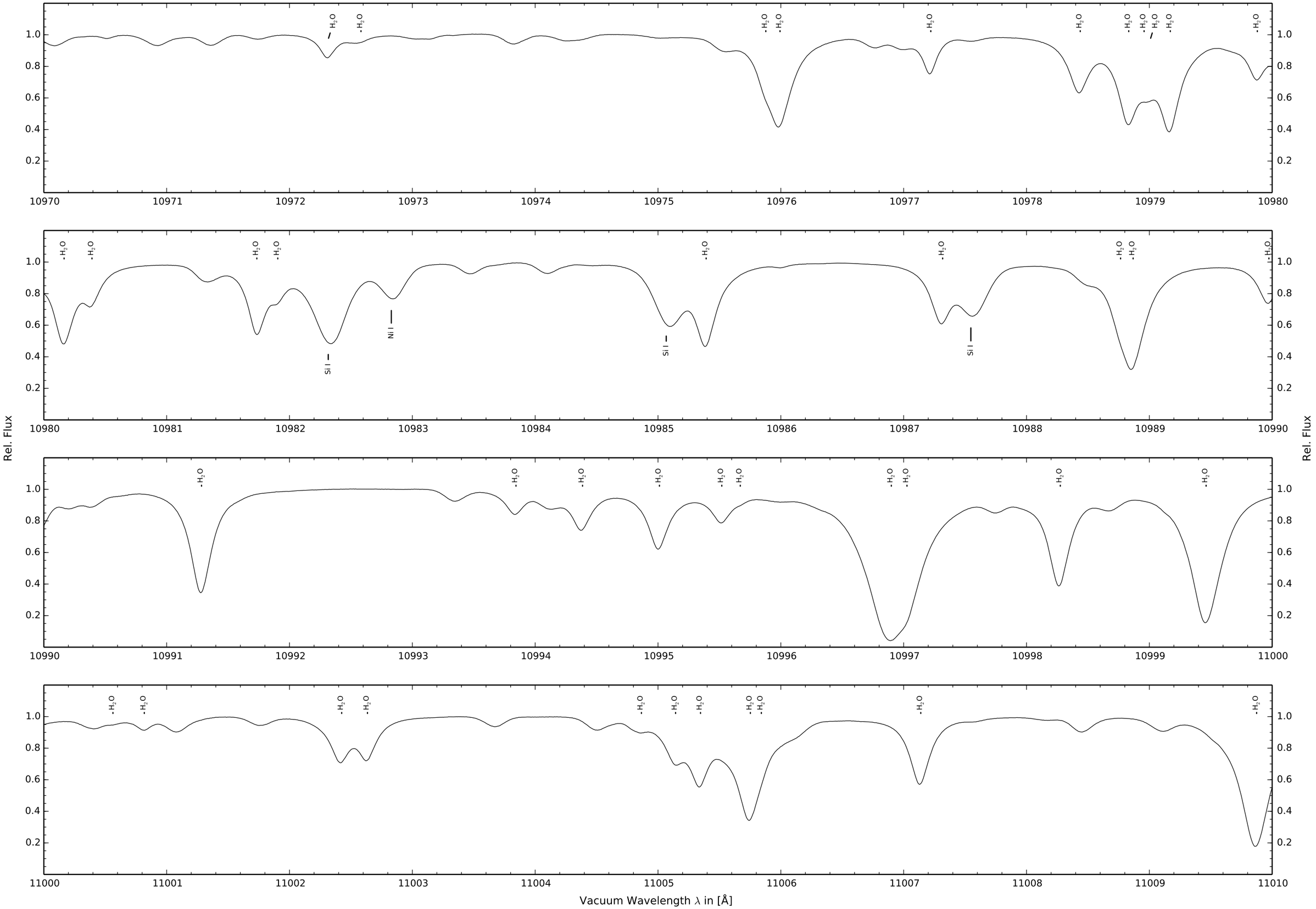

Rel. Flux
Vacuum Wavelength λ in [Å]
O2
H2O
Mg I
Fe I
Si I

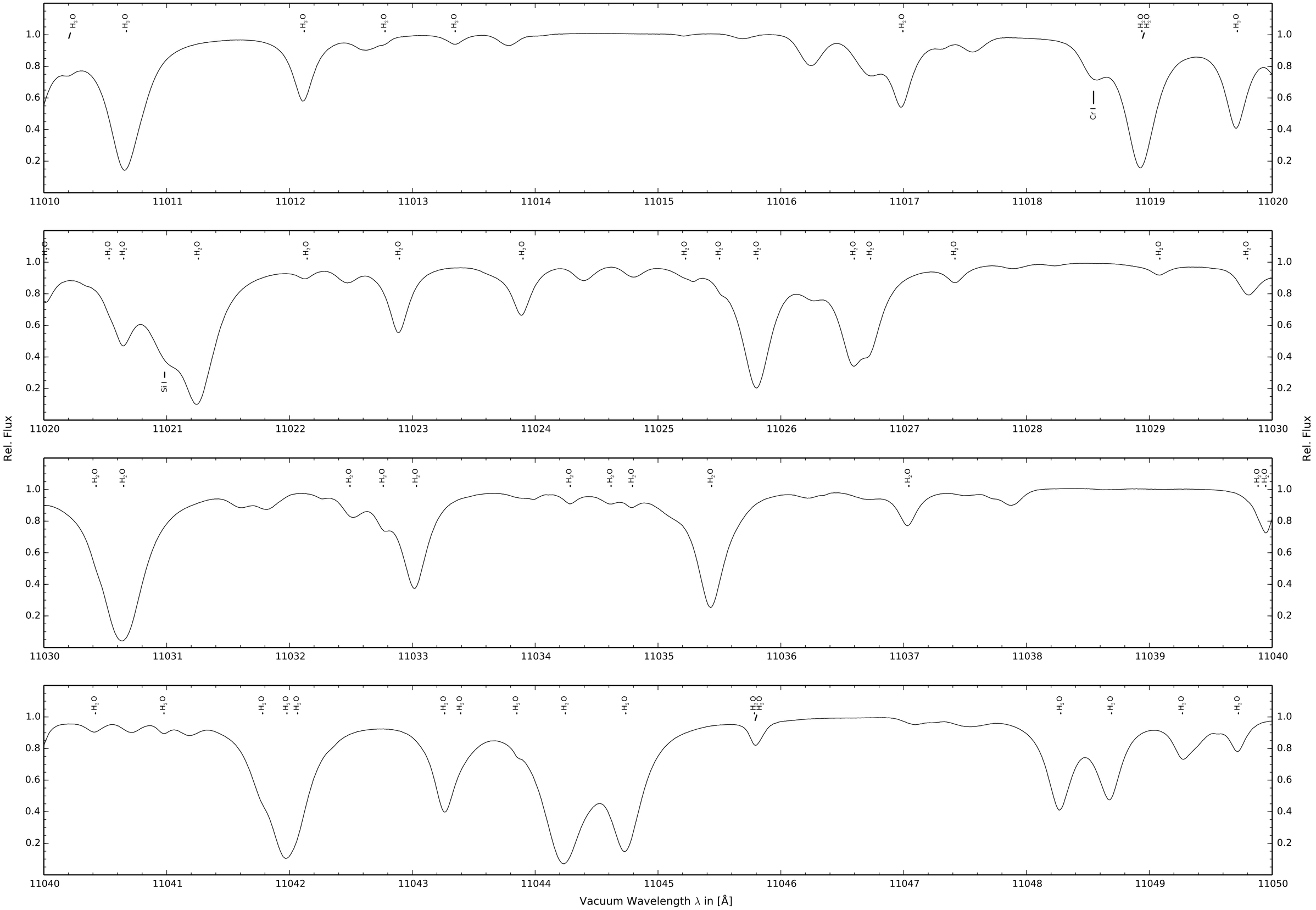

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Sr II

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Ni I


Rel. Flux
Vacuum Wavelength λ in [Å]
Cr I
Si I

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

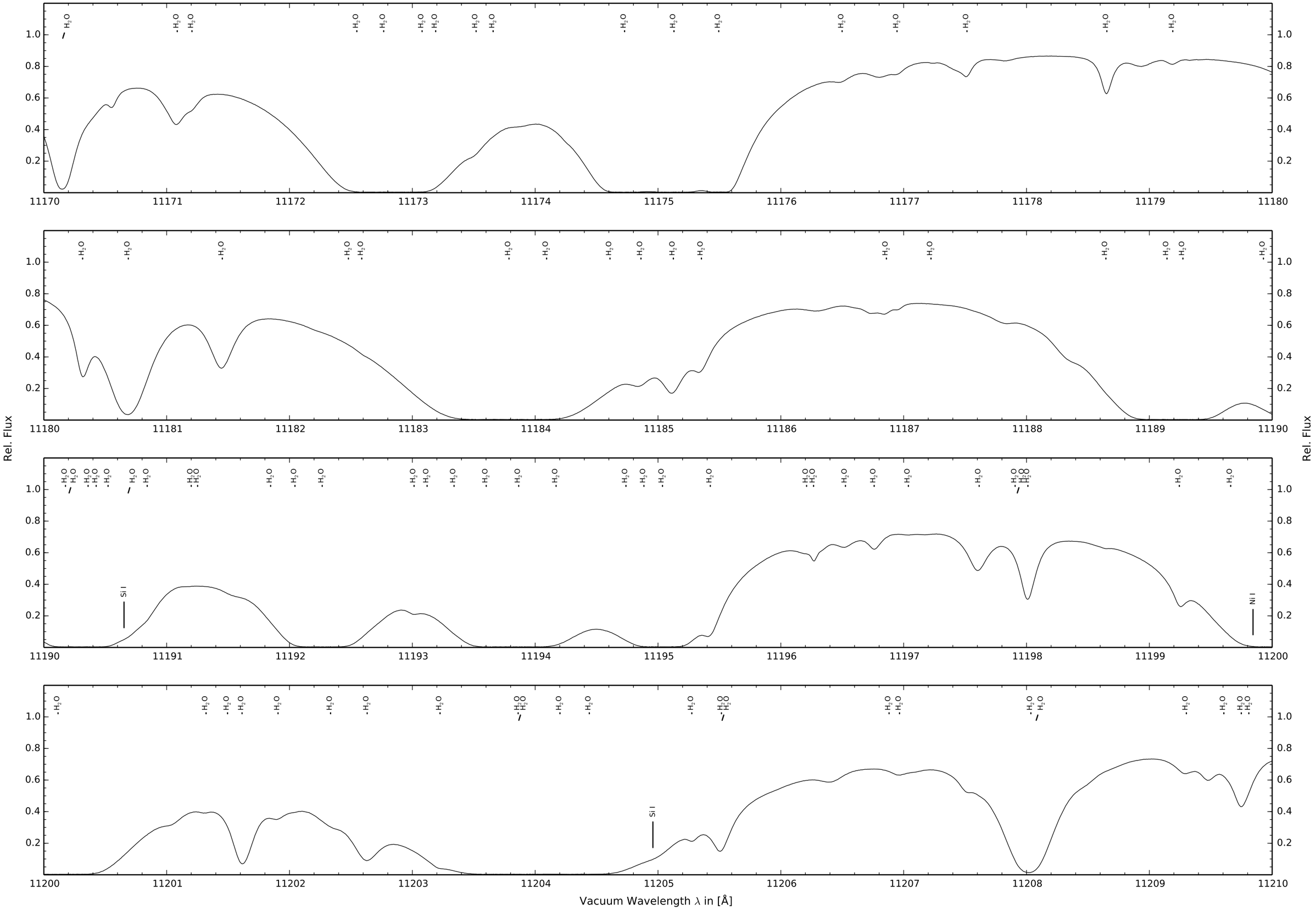
Rel. Flux

Si I

Fe I

Cr I

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Si I
Ni I

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Si I

Fe I

Si I

Vacuum Wavelength λ in [Å]

Rel. Flux

Cr I

Fe I

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

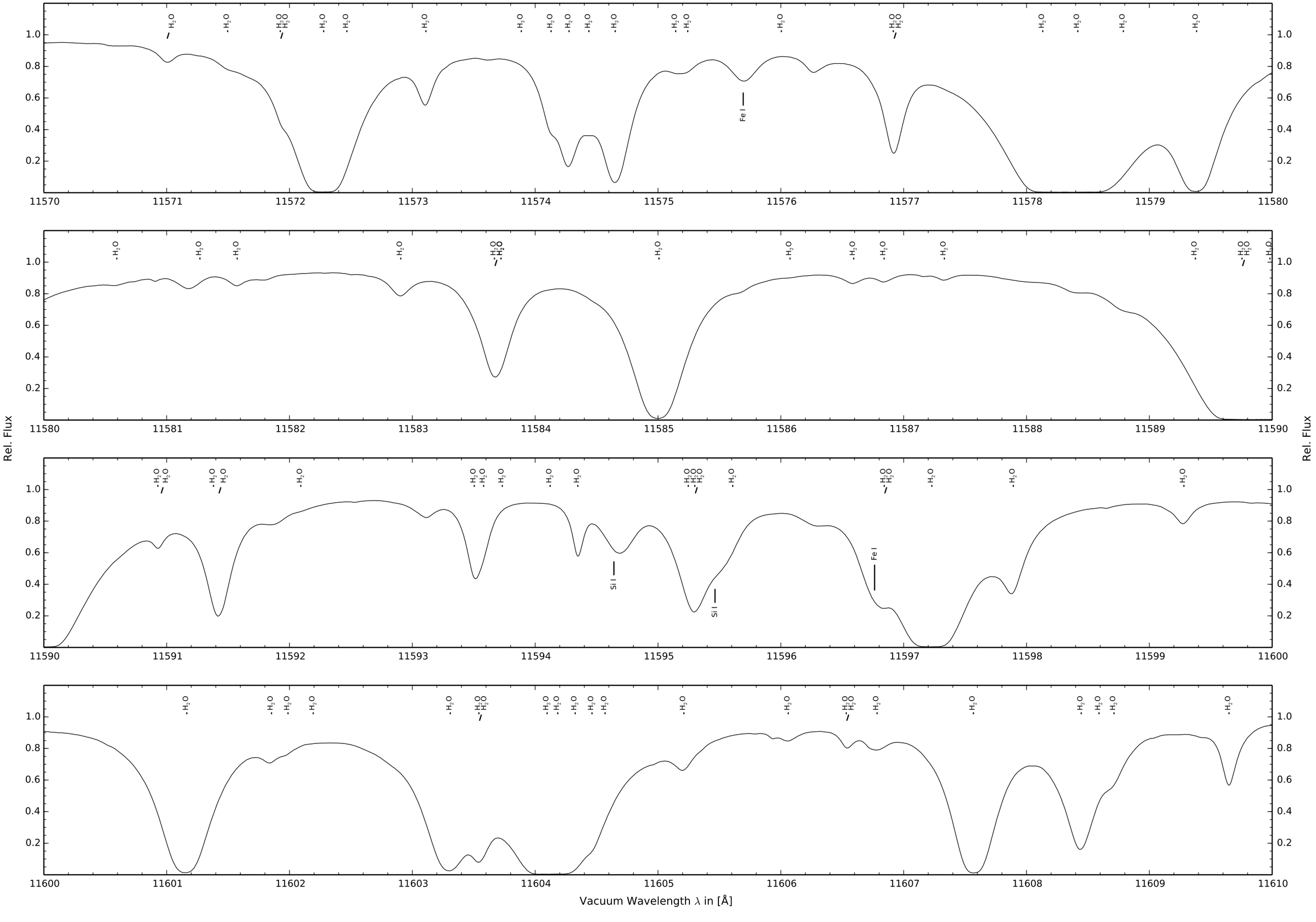
Fe I

Si I

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Si I
Si I
Fe I

Rel. Flux

Fe I
Cr I
Si I
$-H_2O$

Vacuum Wavelength λ in [Å]

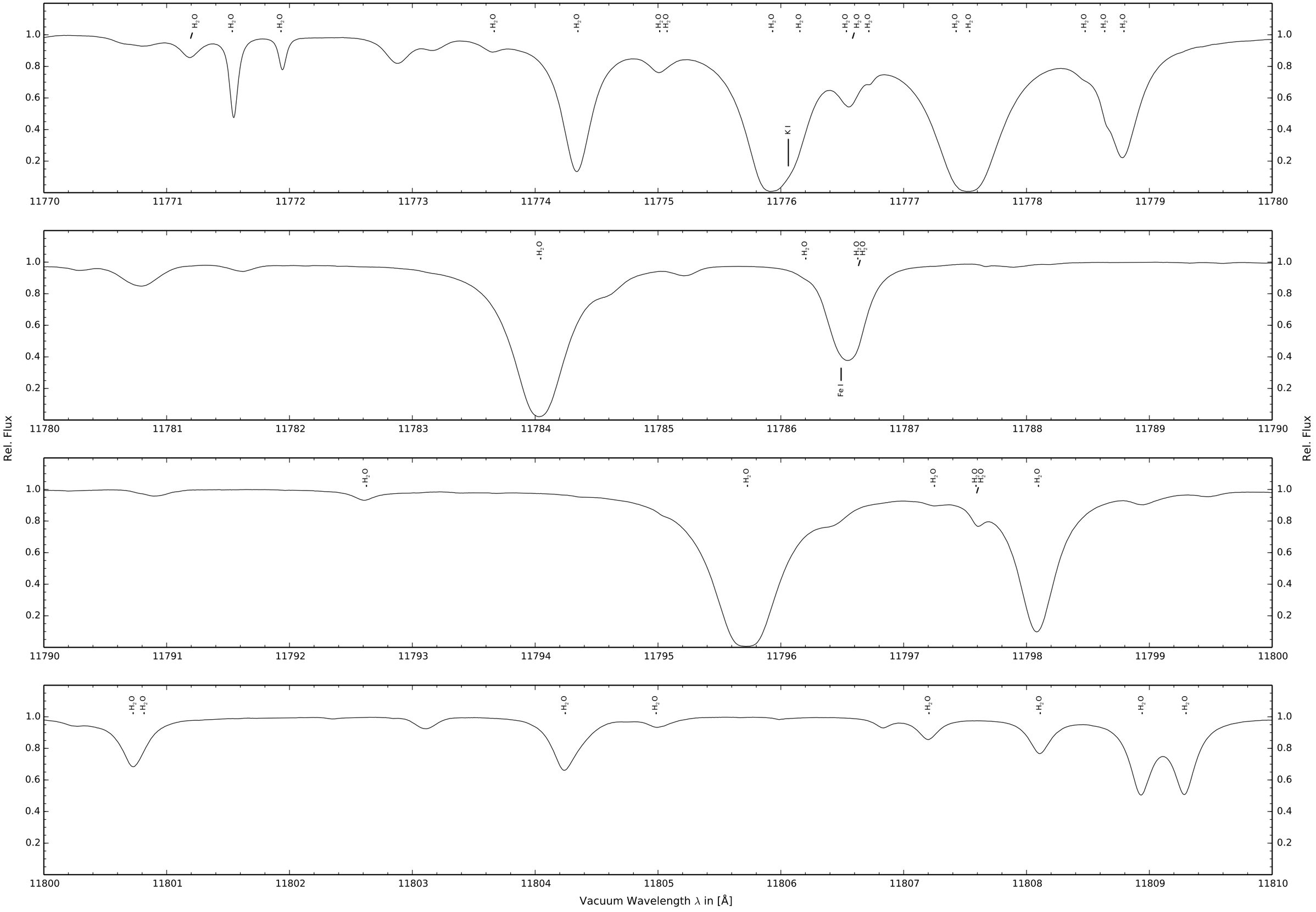
Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
C I

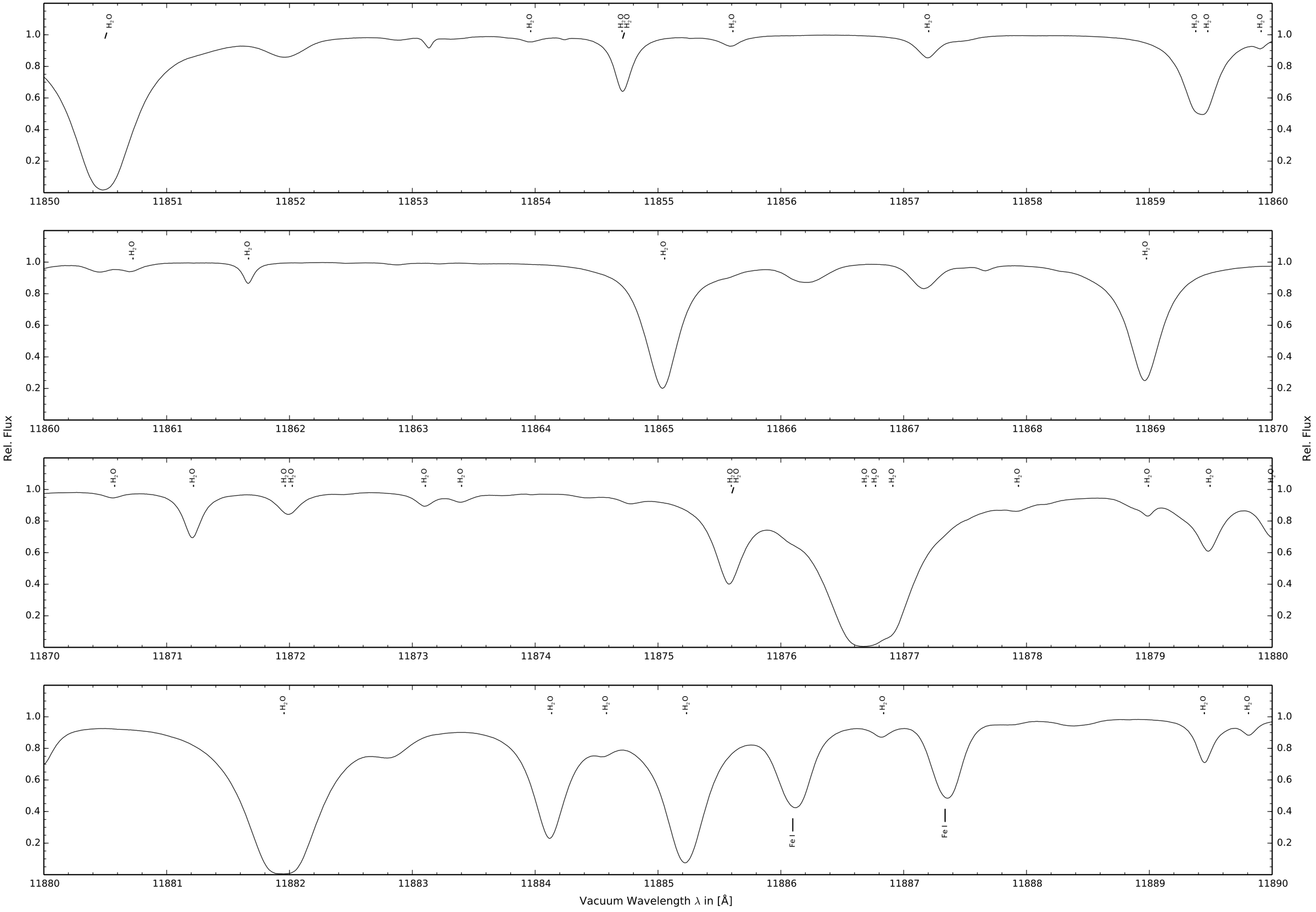

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
K I
Fe I

Rel. Flux

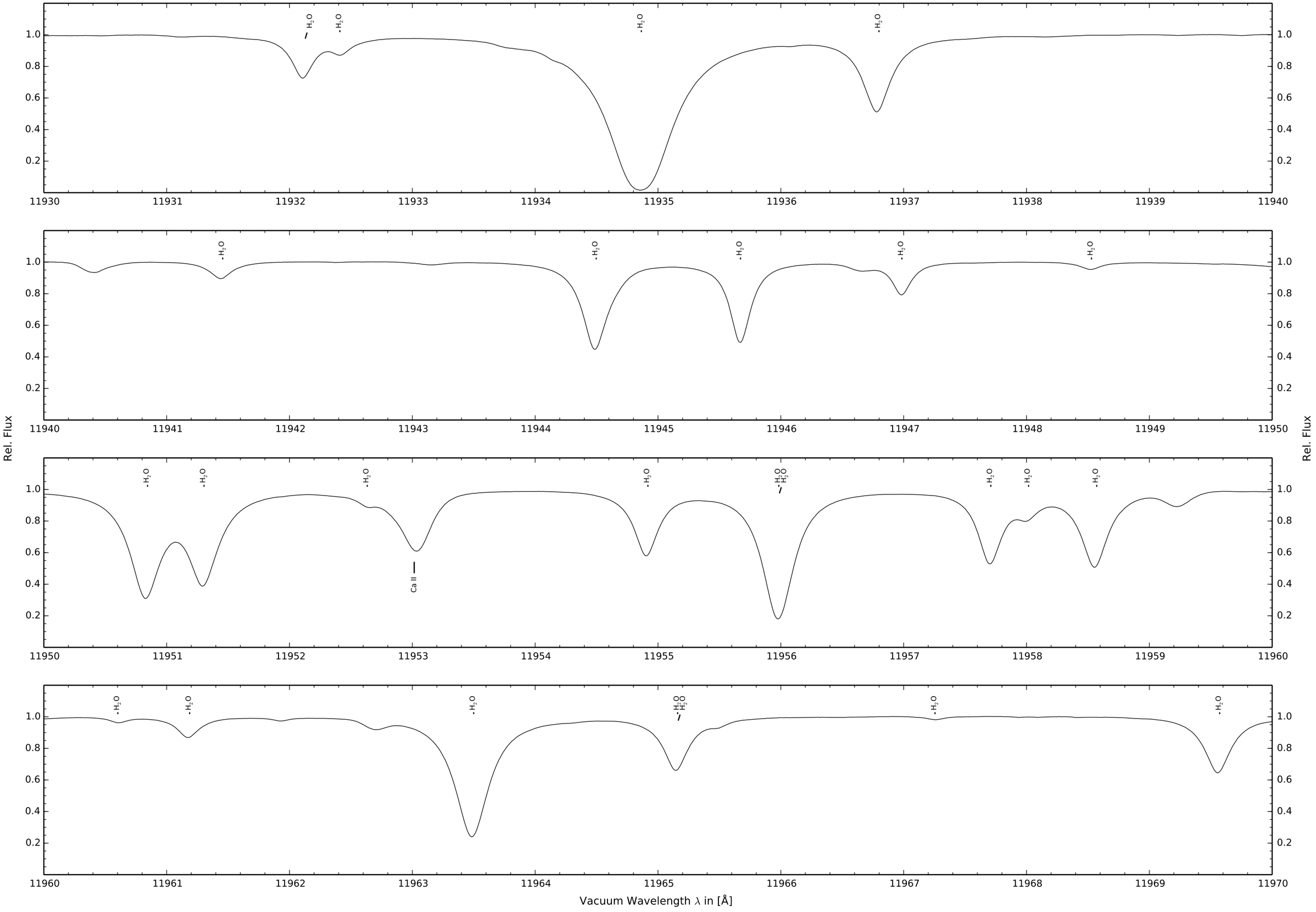
Mg I

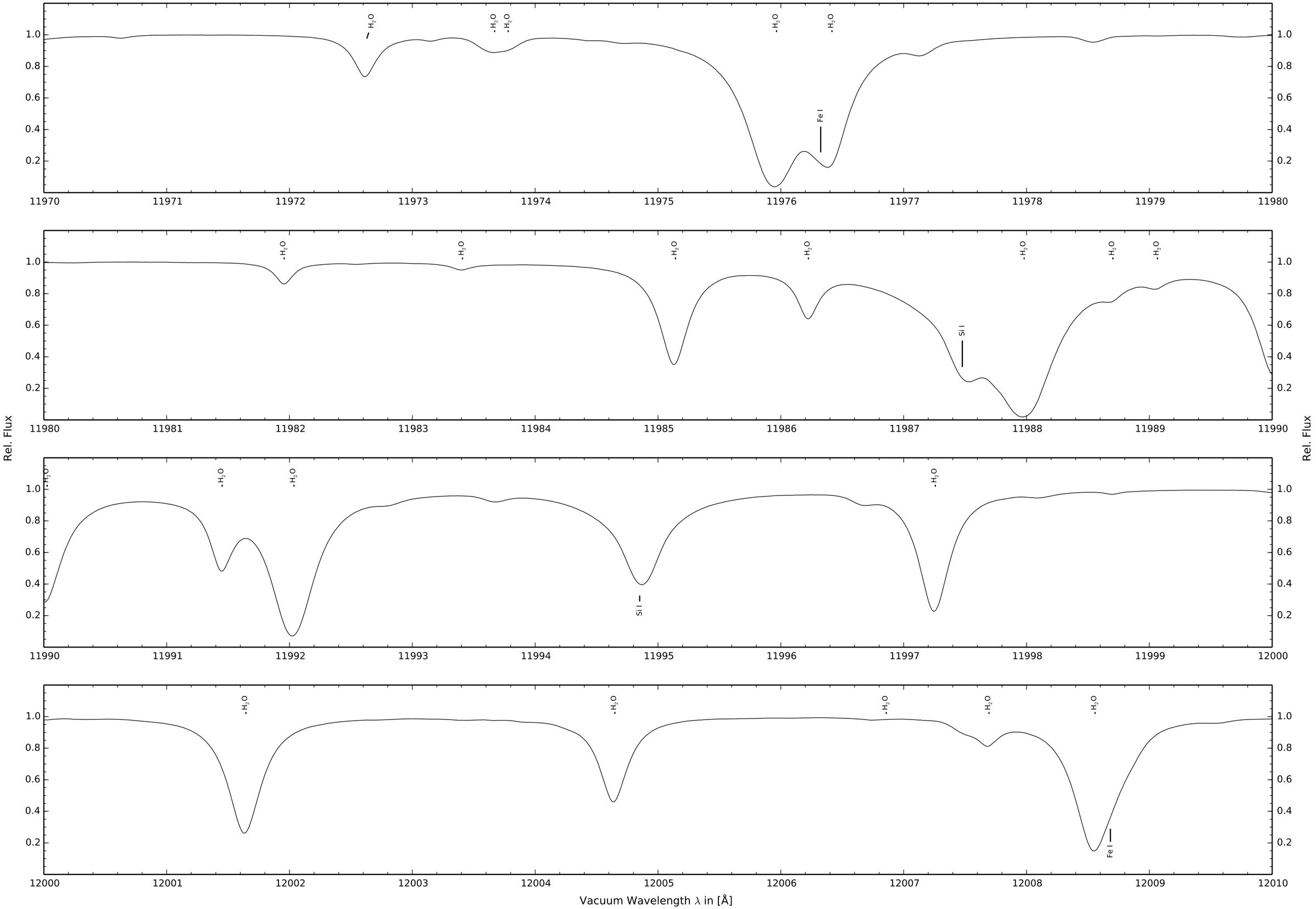
Ca II

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

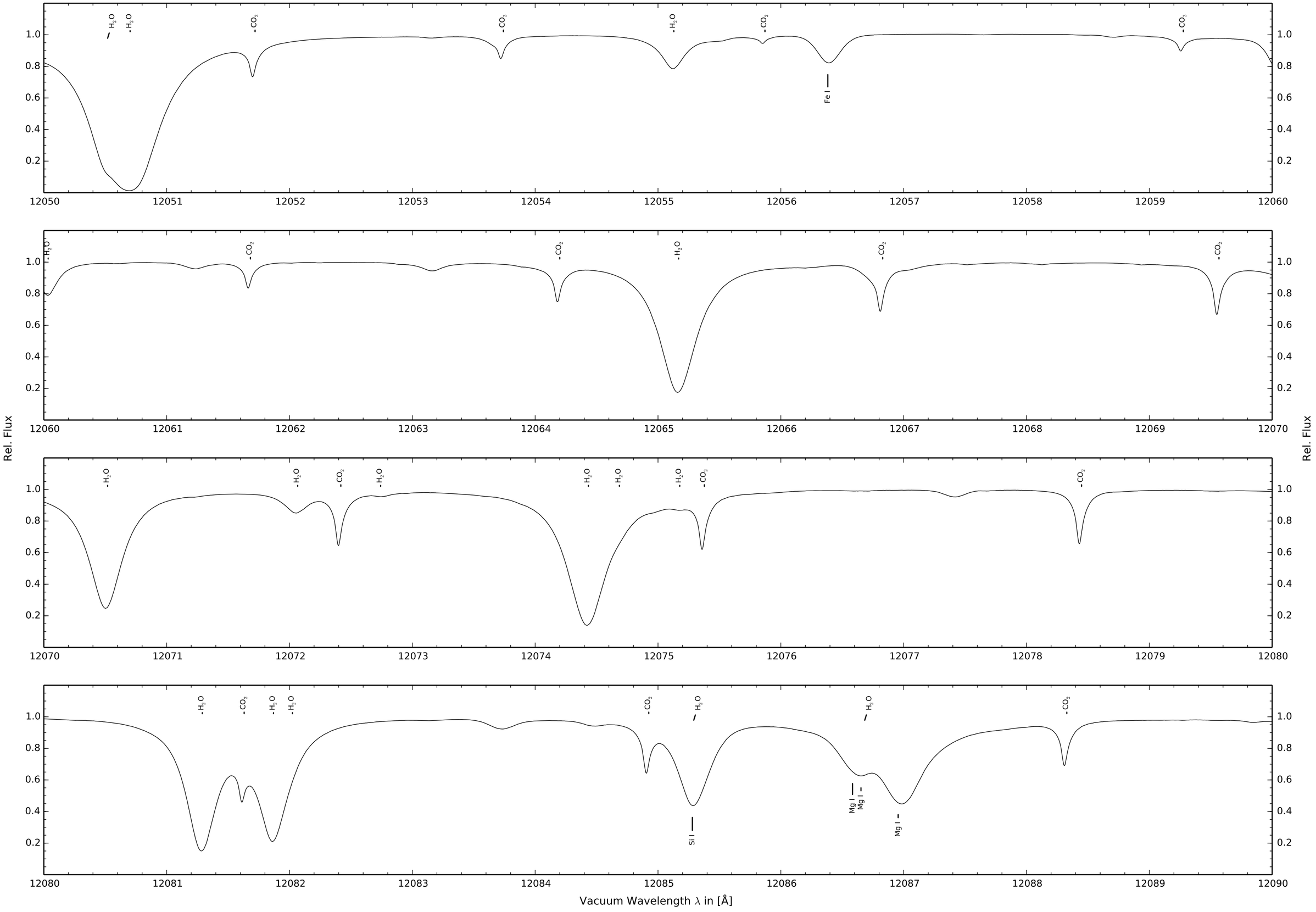
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

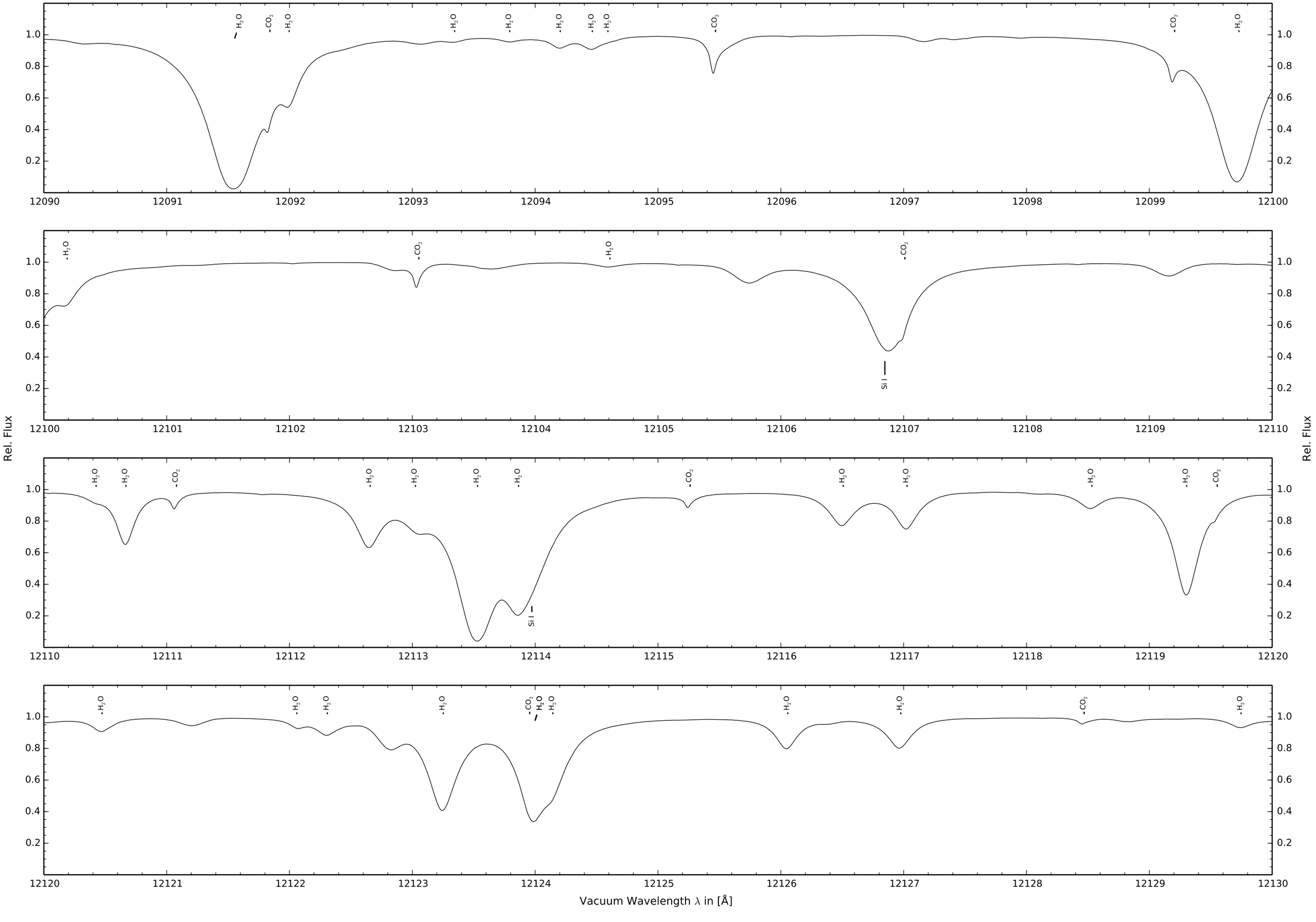

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ca II

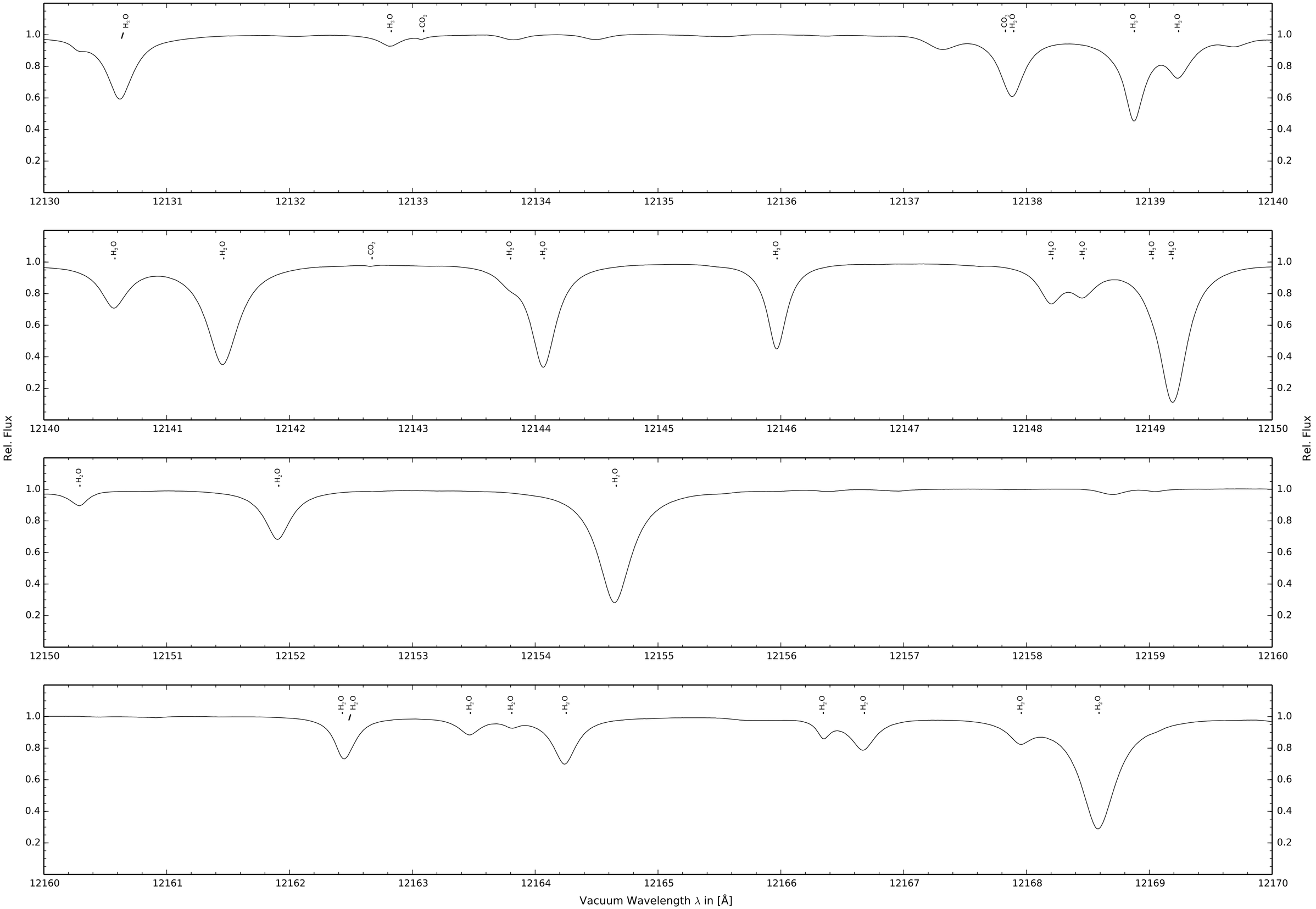

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Si I

Rel. Flux

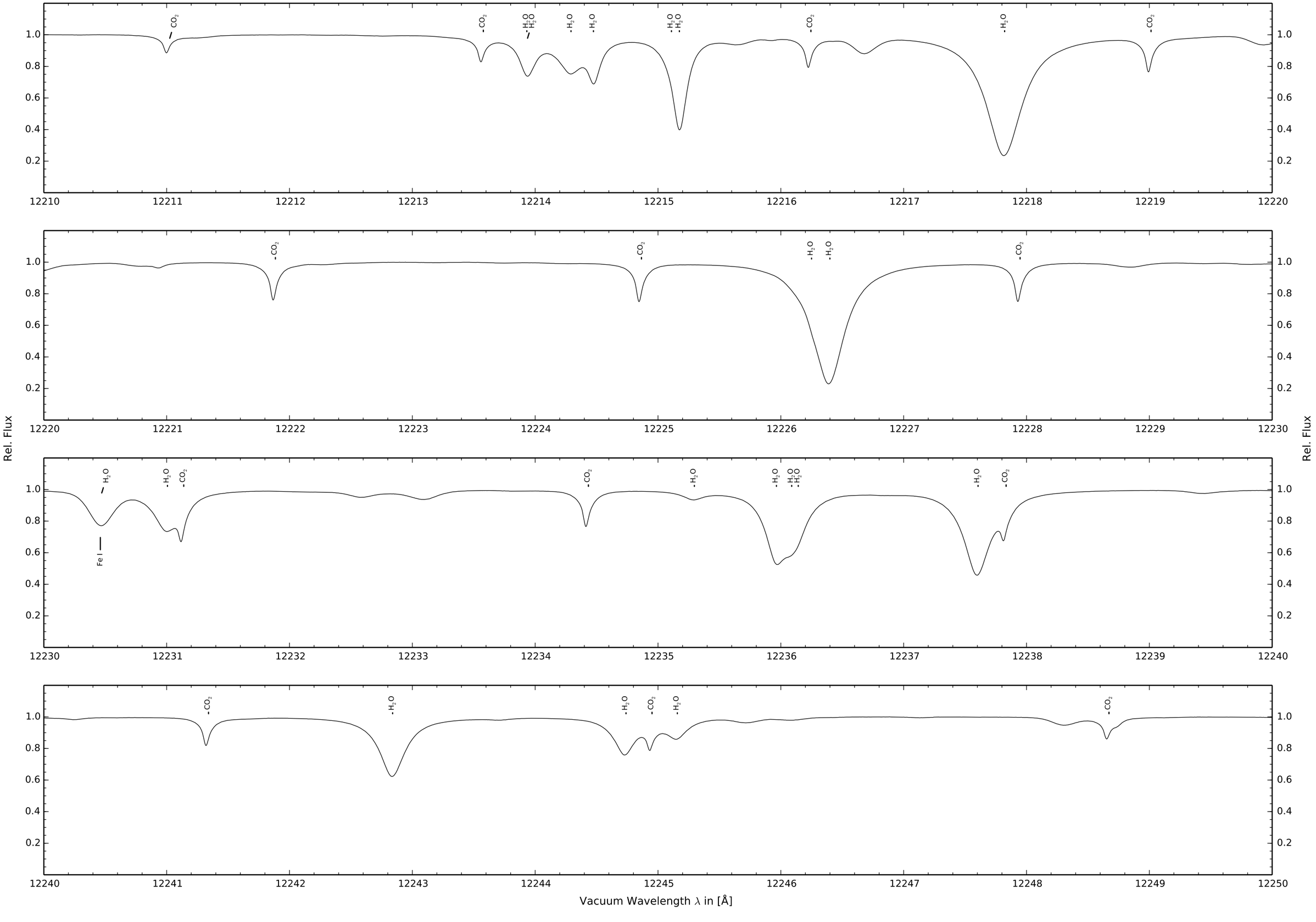
Vacuum Wavelength λ in [Å]

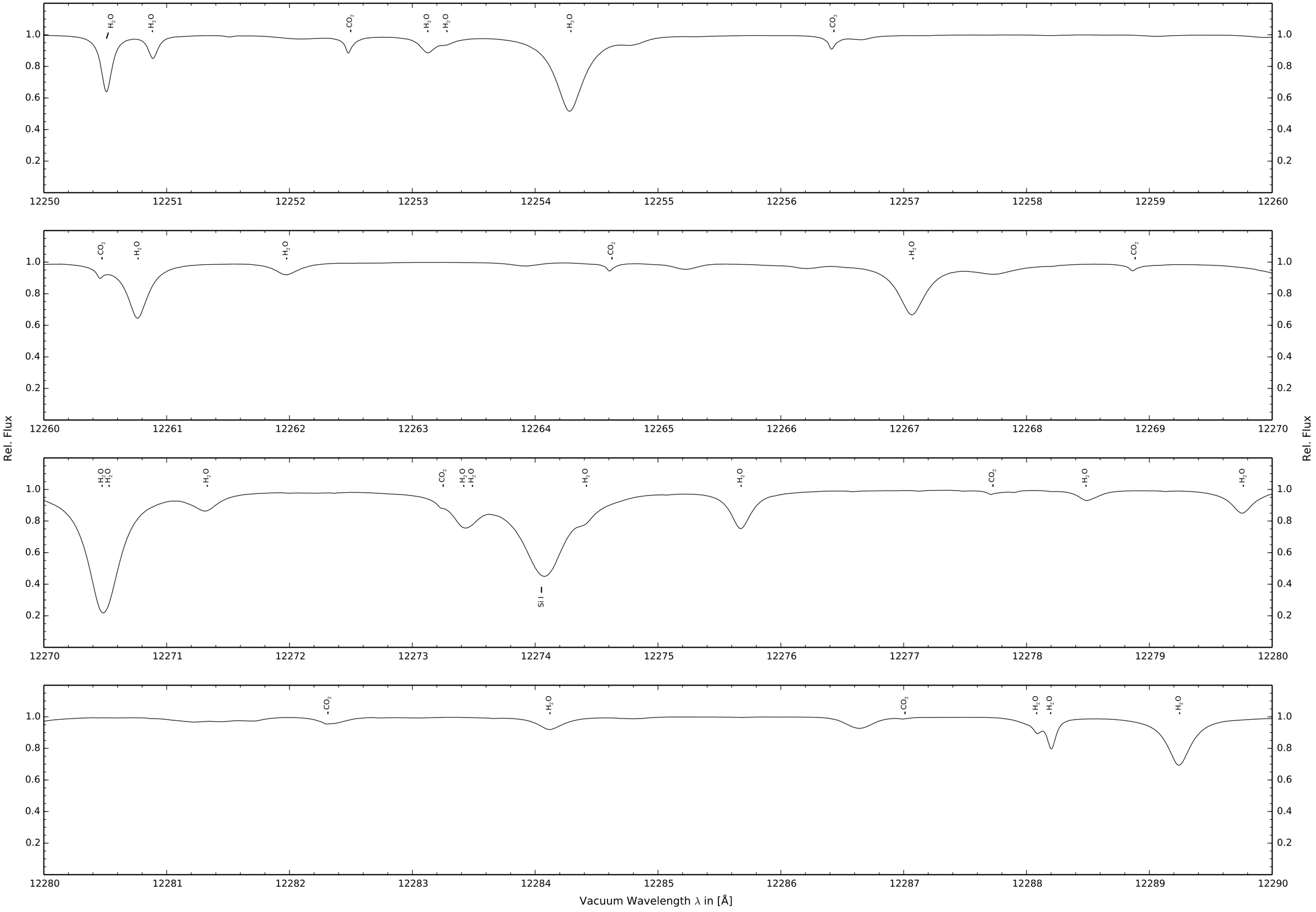

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Fe I
Si I
Mg I
Mg I
Mg I

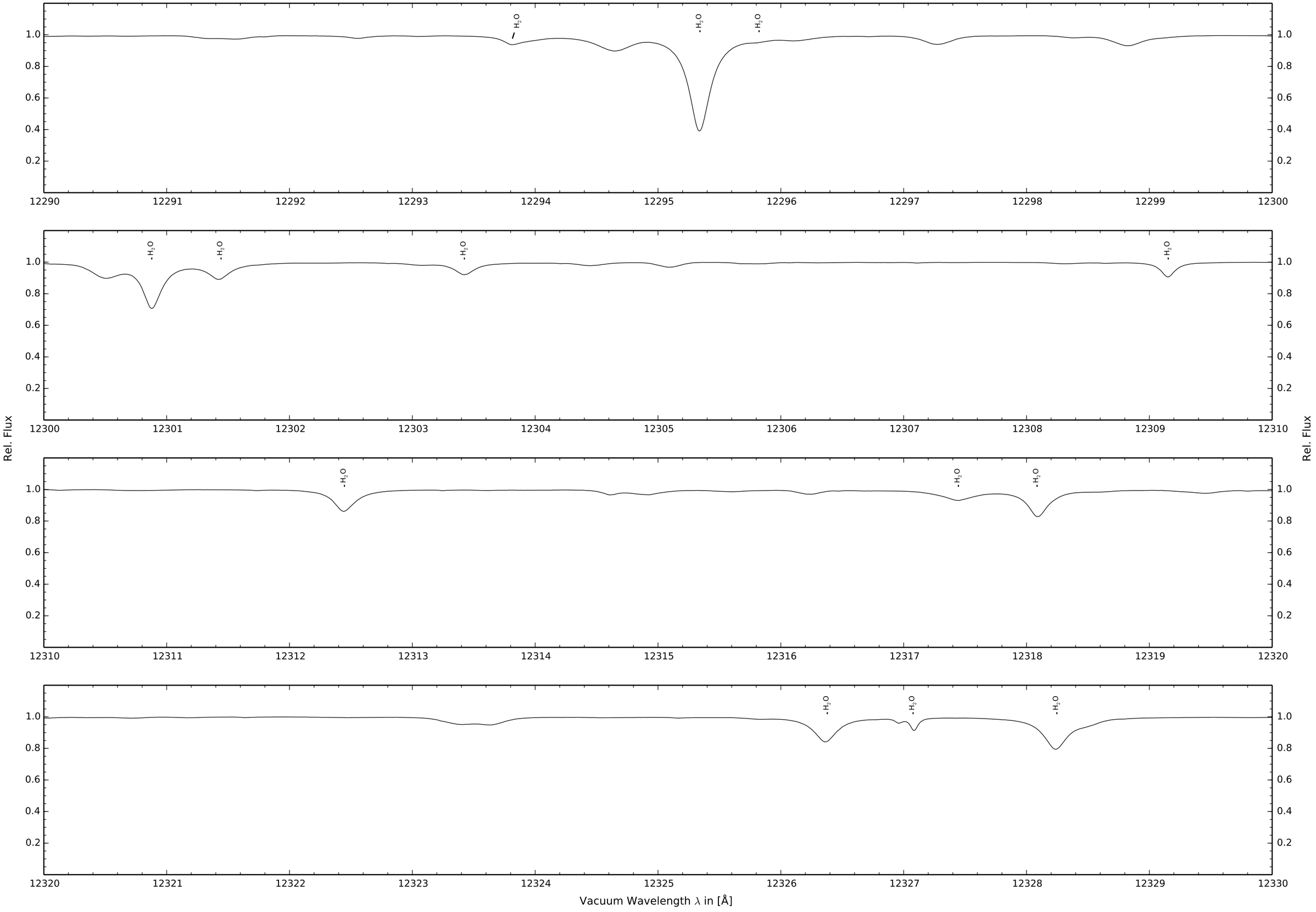

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Si I

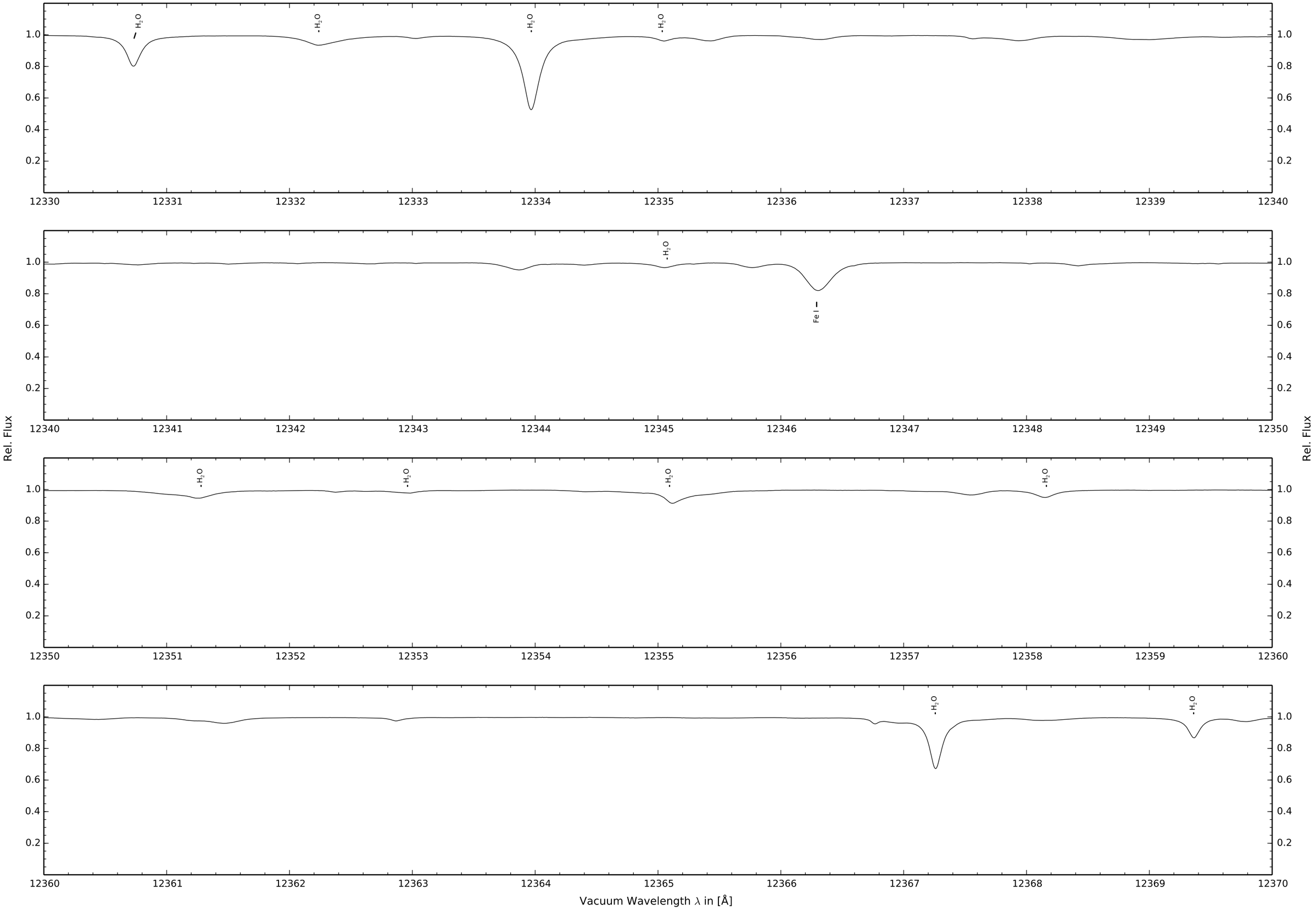

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2

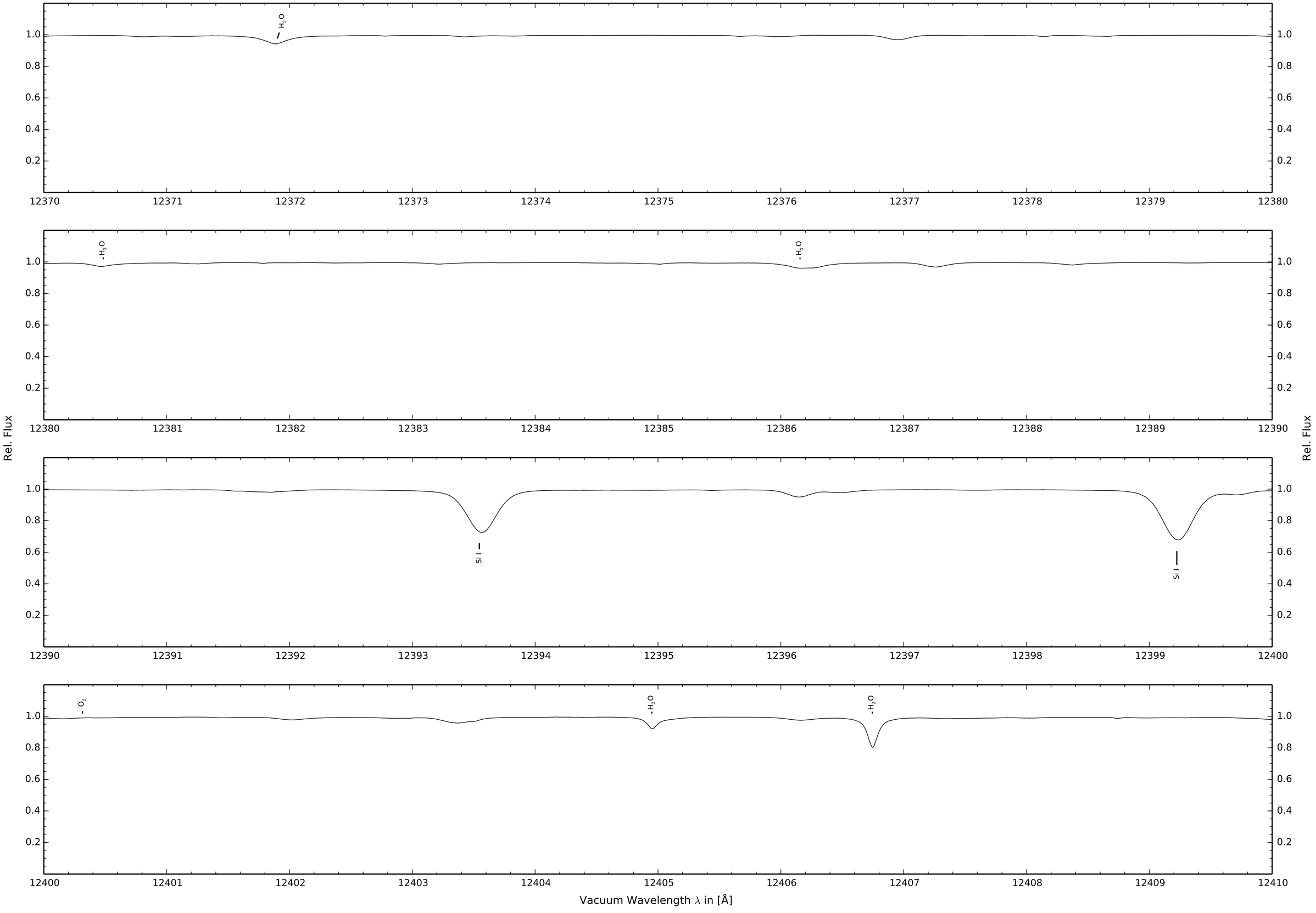
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I

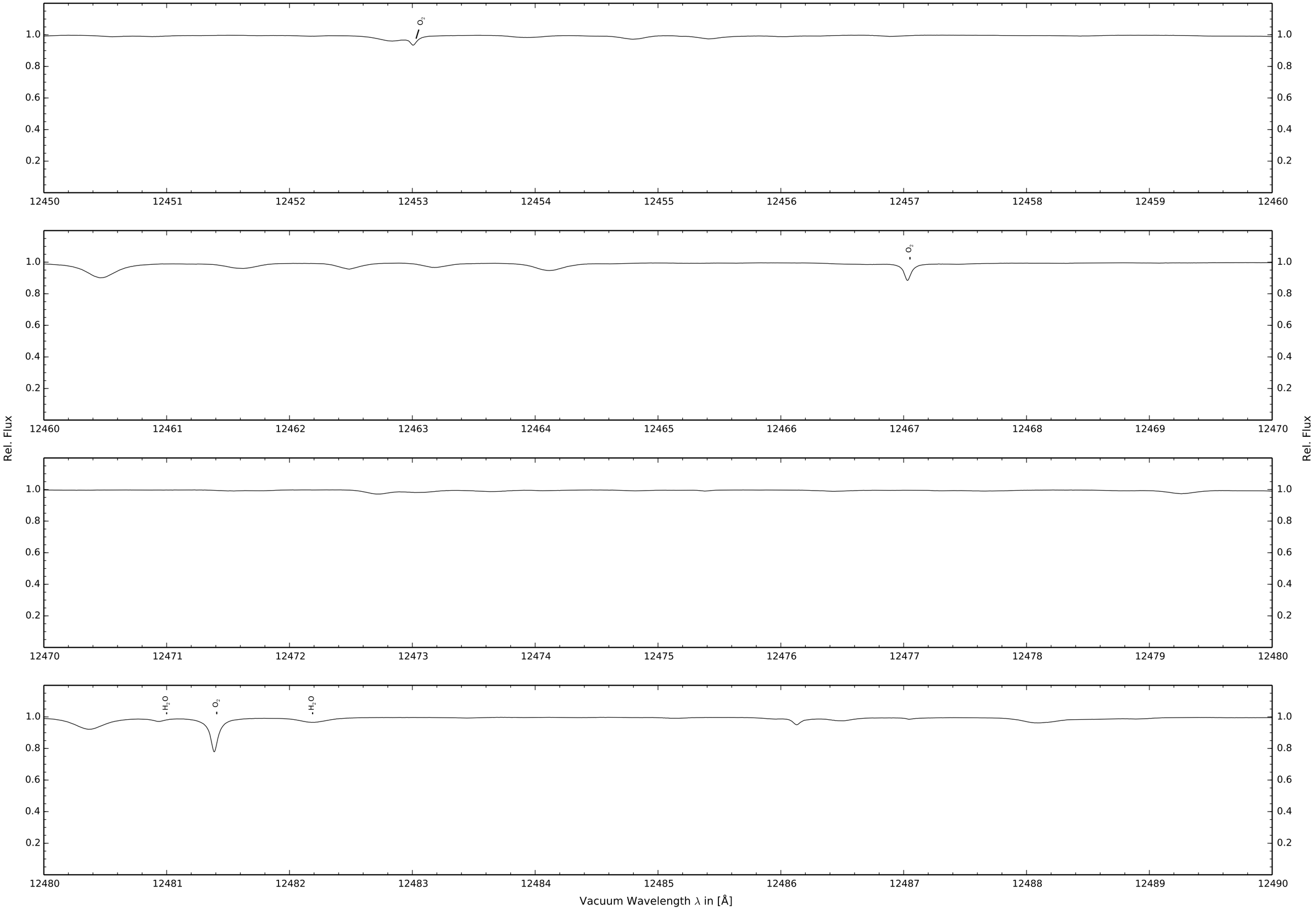

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Si I

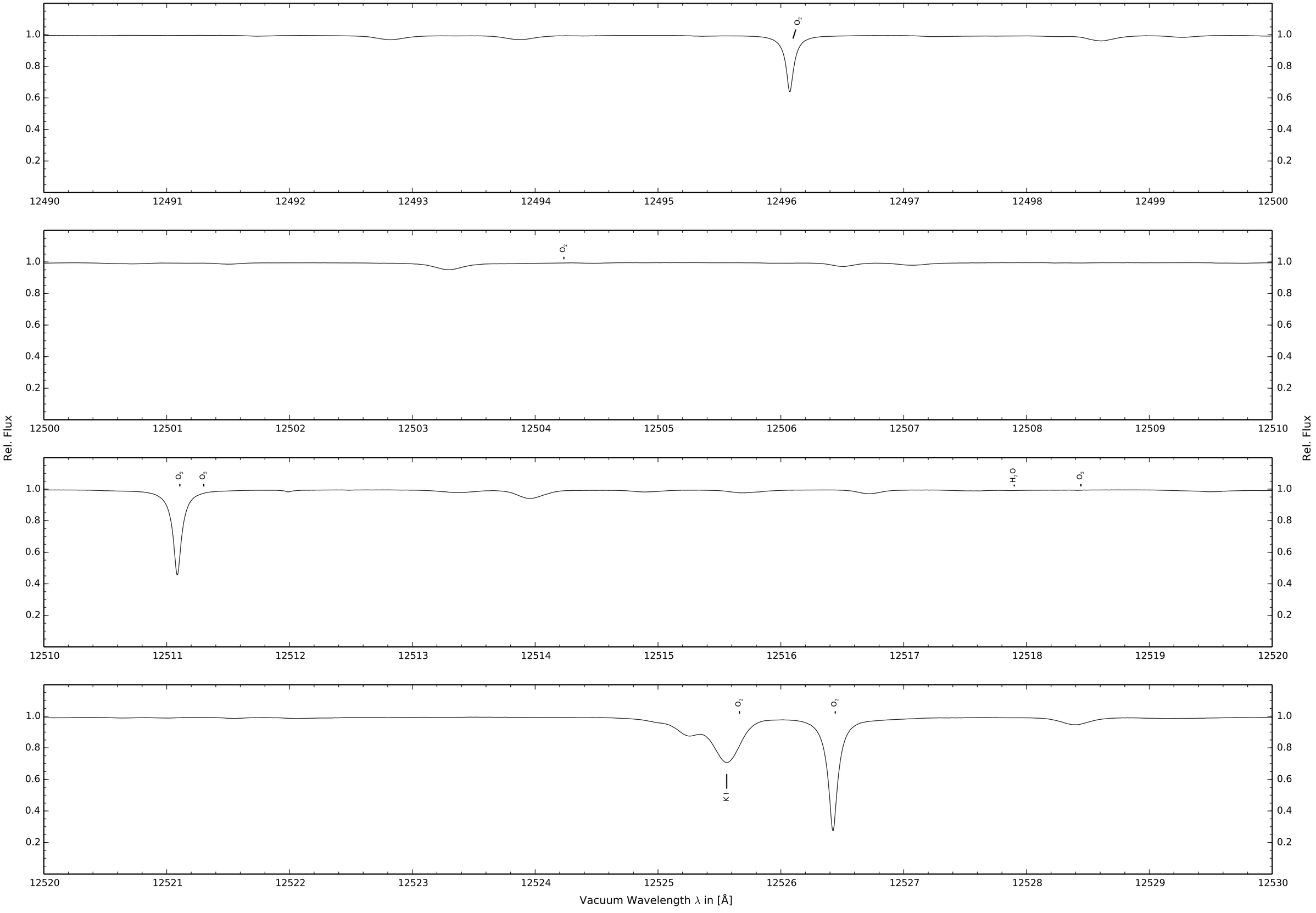

- H2O
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

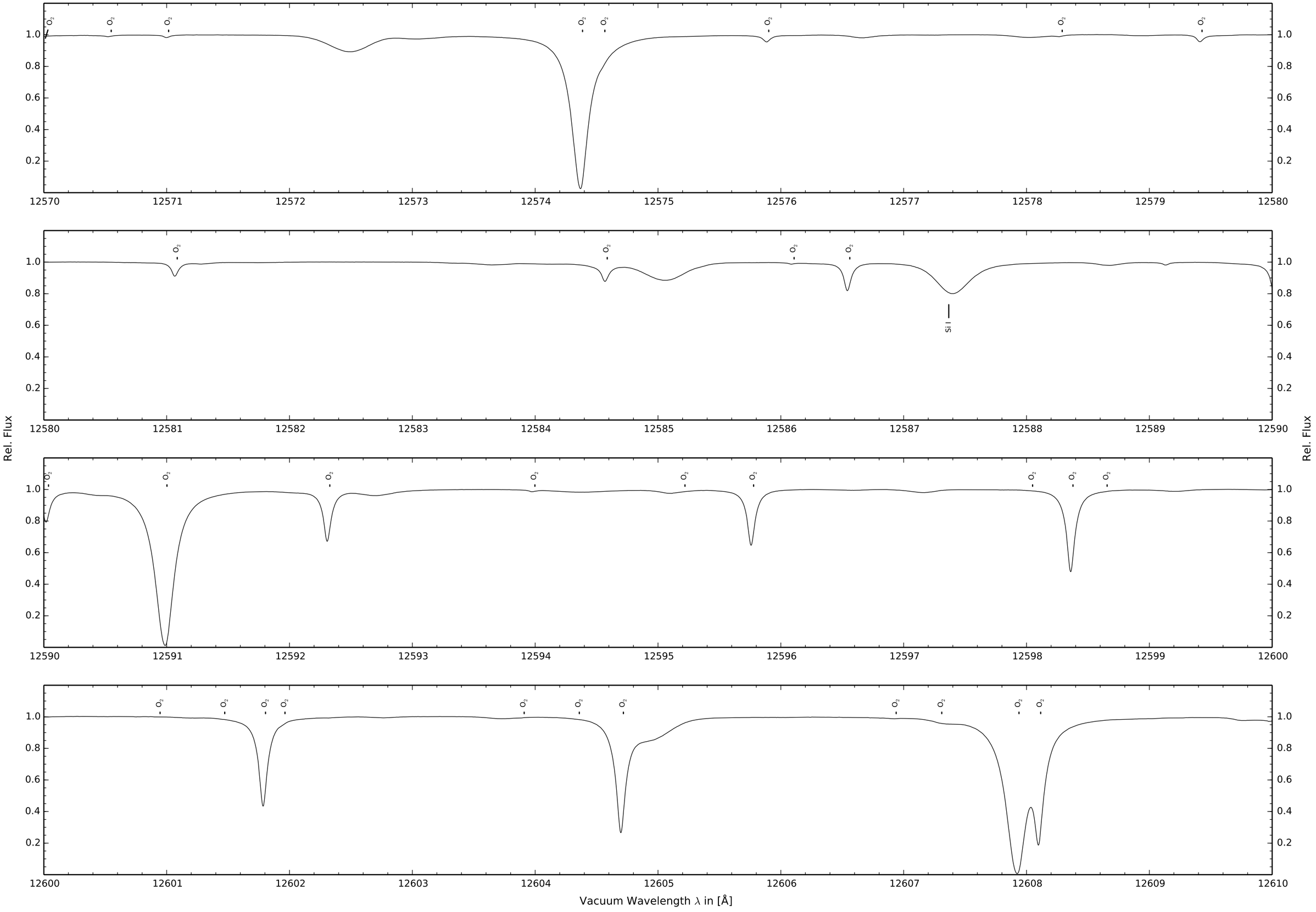

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
H2O
H2O
Si I
Si I
O2
H2O
H2O

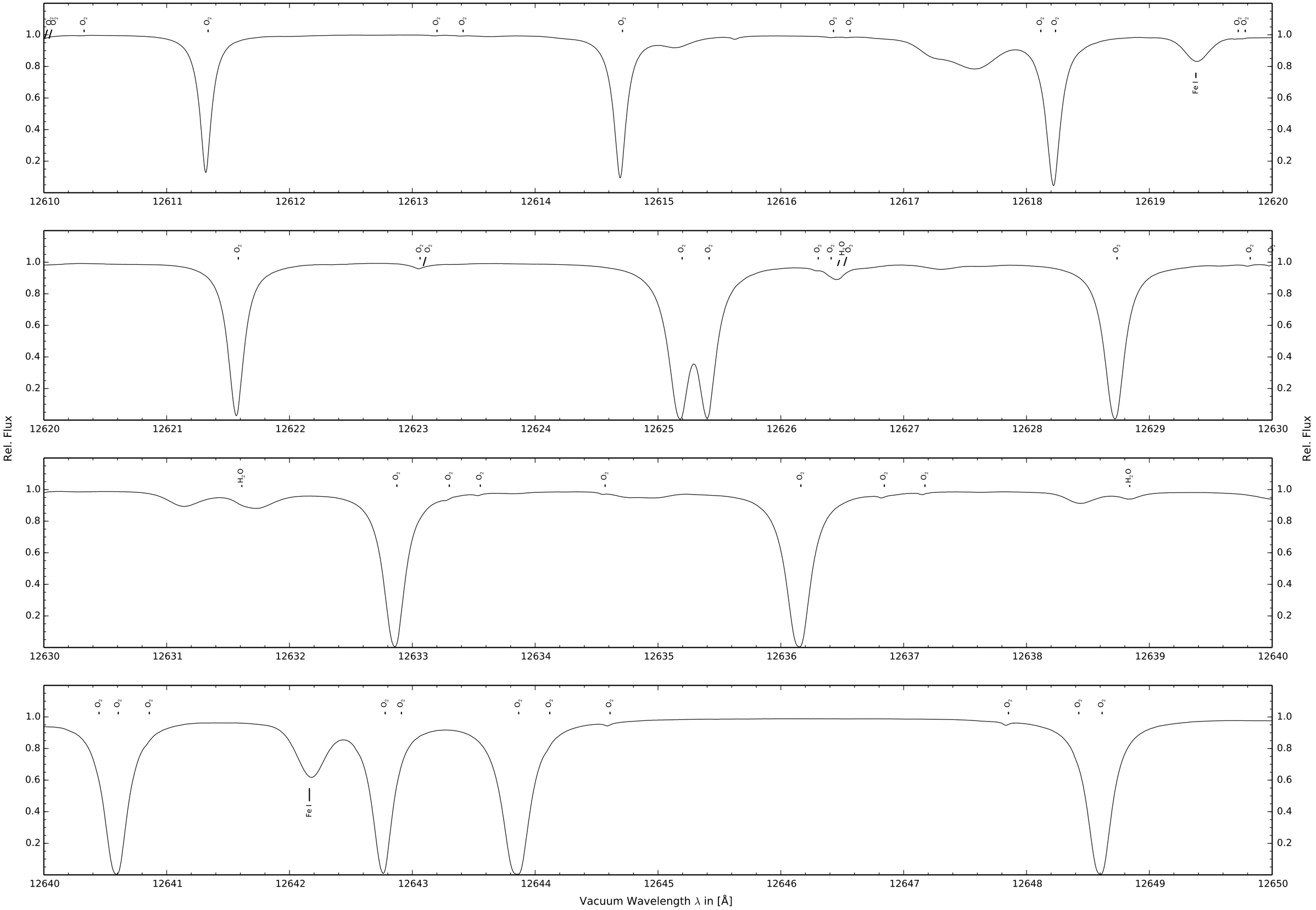
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
O2
Mg I
Mg I
O2
H2O

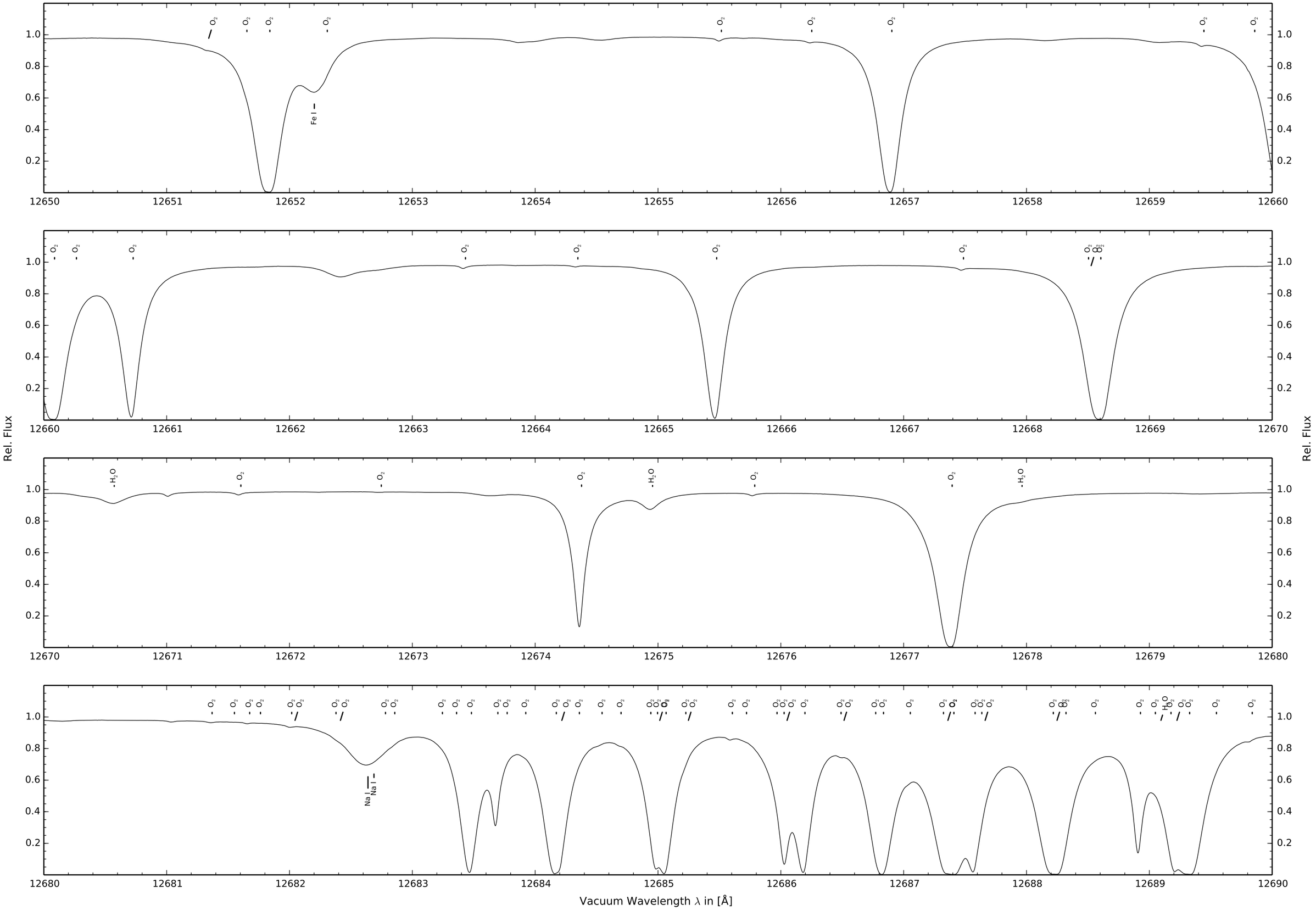

O_2
O_2
H_2O
O_2
H_2O
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
O2
O2
O2
O2
O2
H2O
O2
O2
K I

Rel. Flux
Vacuum Wavelength λ in [Å]
O2
H2O
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
O2
Si I

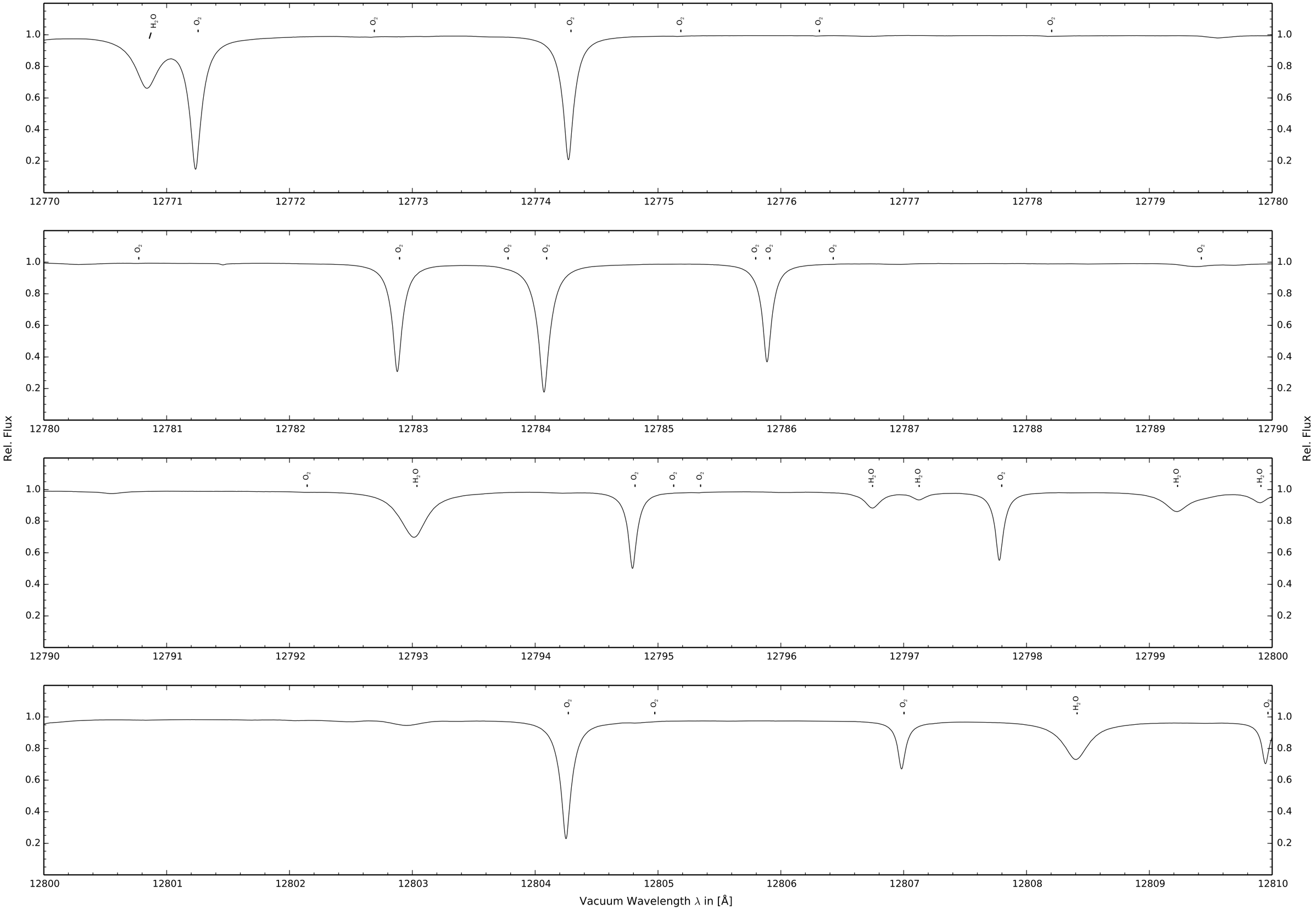

Rel. Flux
Vacuum Wavelength λ in [Å]
O2
H2O
Fe I

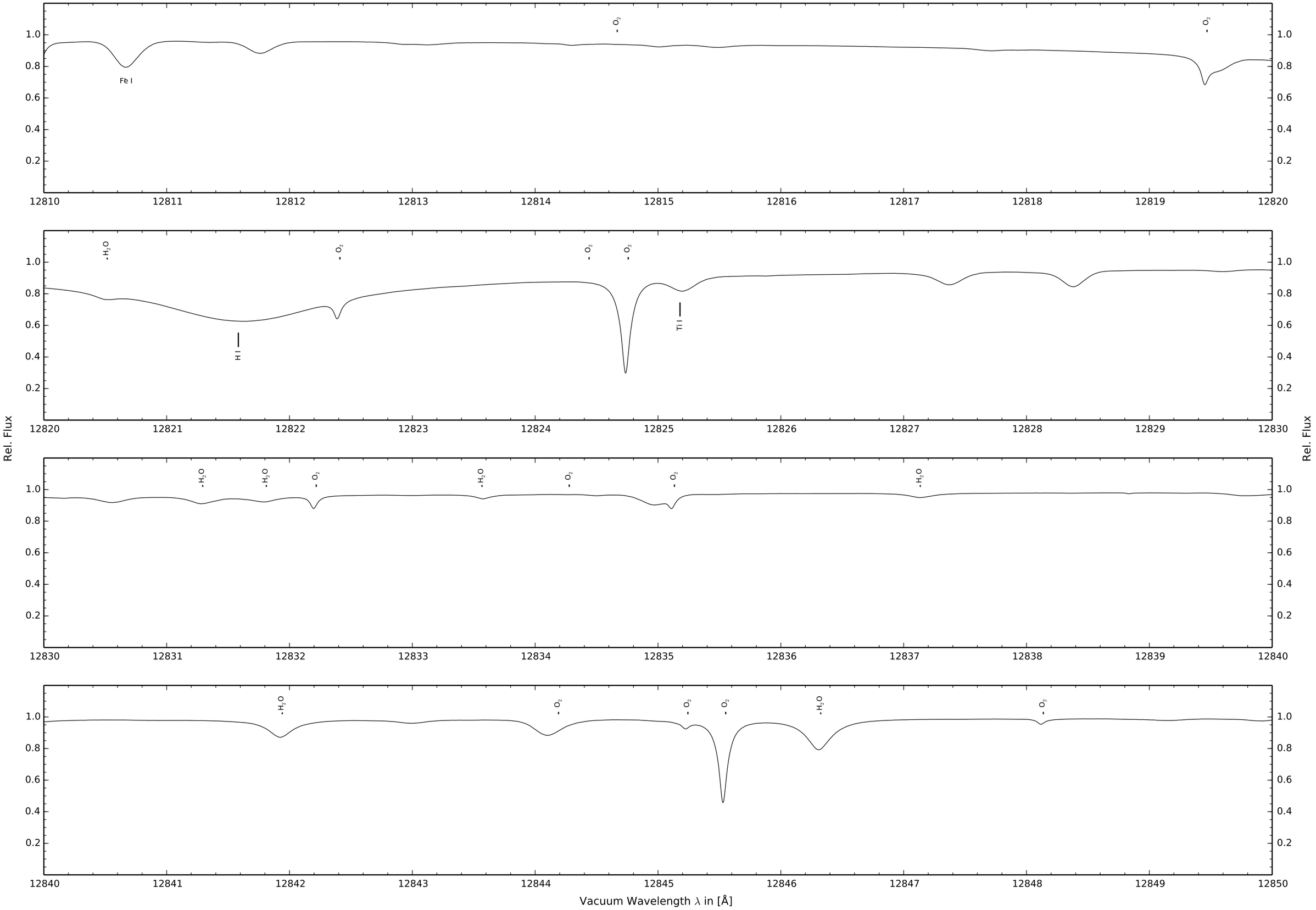

Rel. Flux
Vacuum Wavelength λ in [Å]
O2
H2O
Fe I
Na I
Ca II

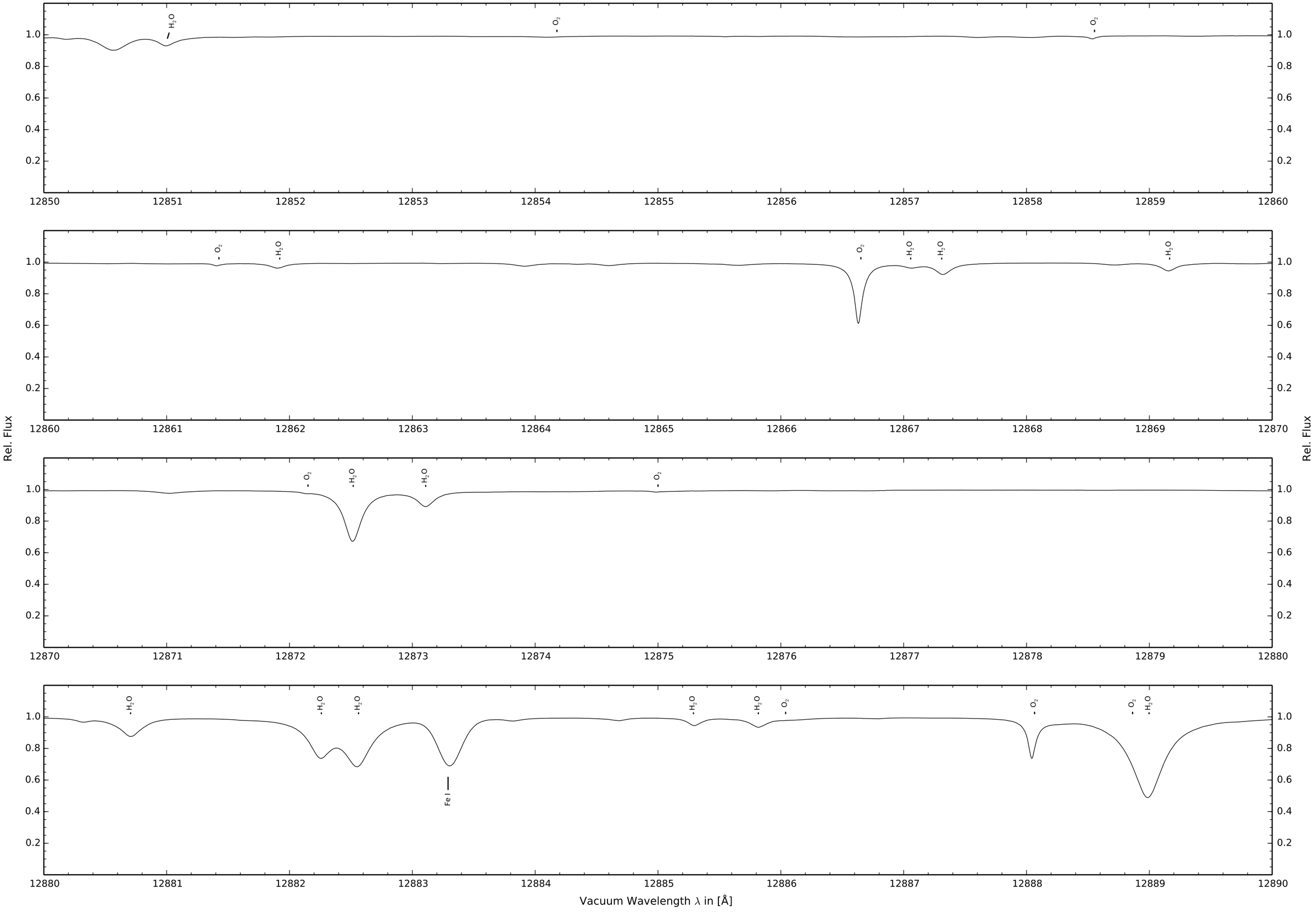
Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux
Vacuum Wavelength λ in [Å]
O2
H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2

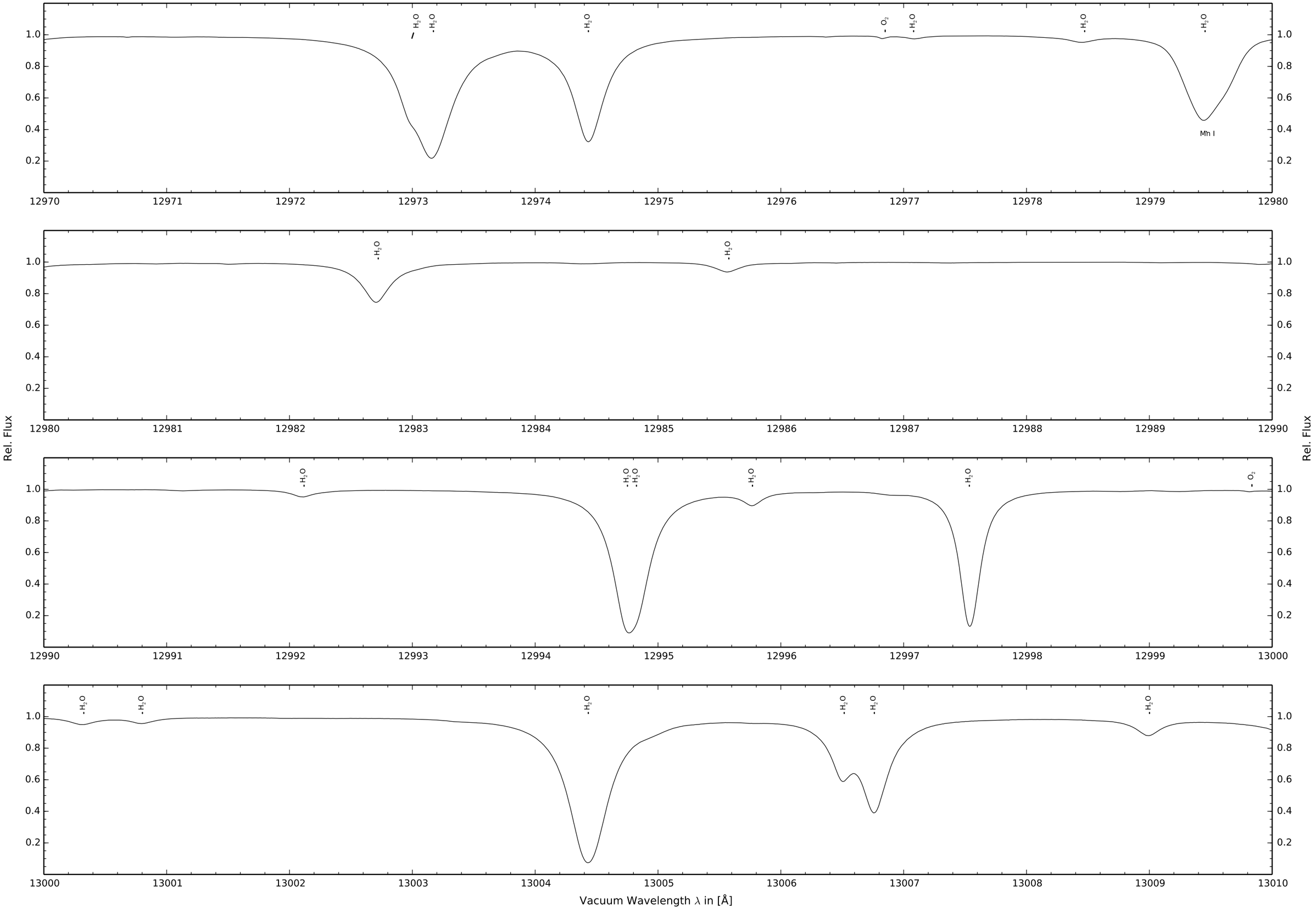

Fe I
- O_2
- O_2
- H_2O
H I
- O_2
- O_2
Ti I
- H_2O
- H_2O
- O_2
- H_2O
- O_2
- O_2
- H_2O
- H_2O
- O_2
- O_2
- O_2
- H_2O
- O_2
Rel. Flux
Vacuum Wavelength λ in [Å]

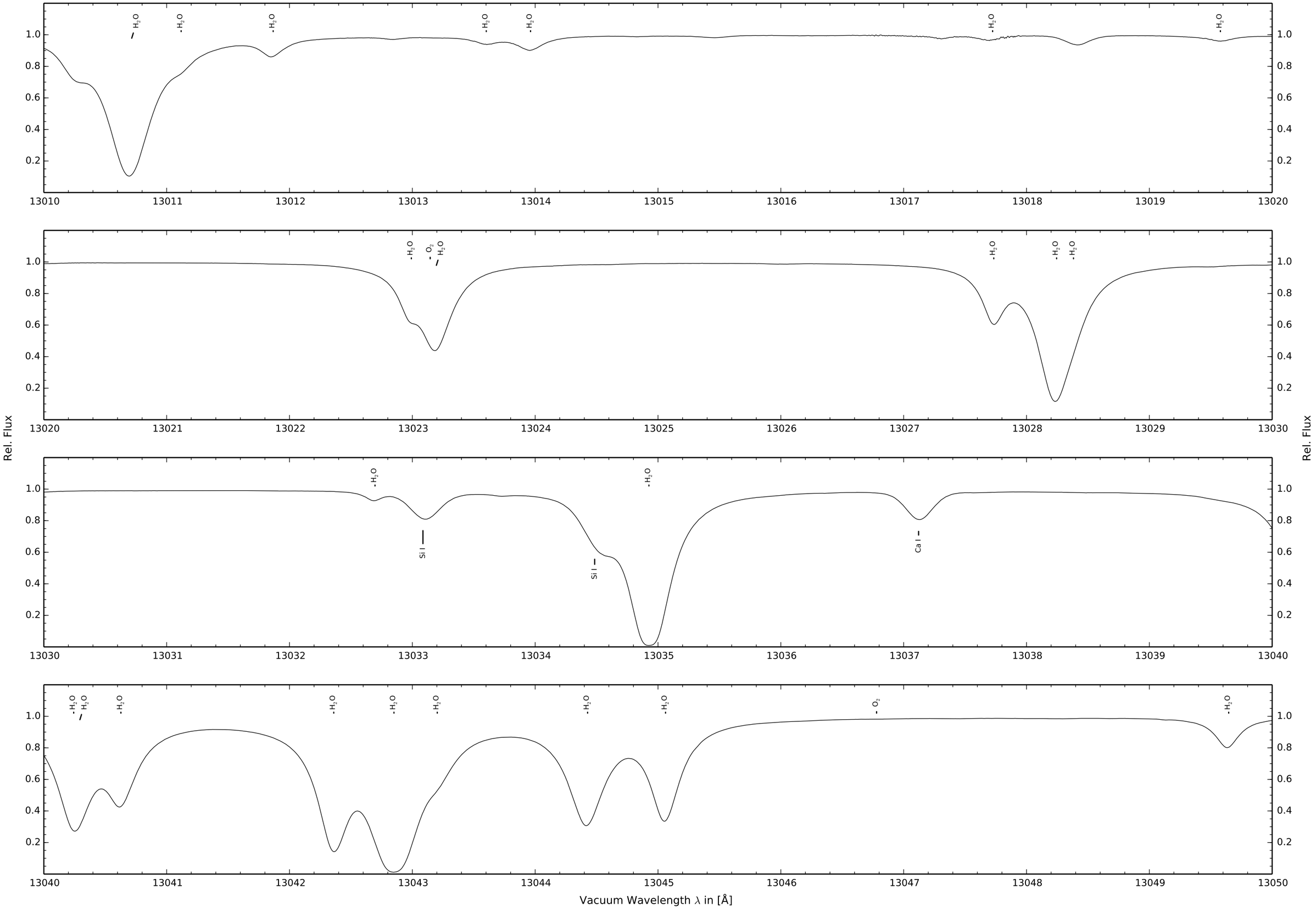

Rel. Flux
Vacuum Wavelength λ in [Å]
- H2O
- O2

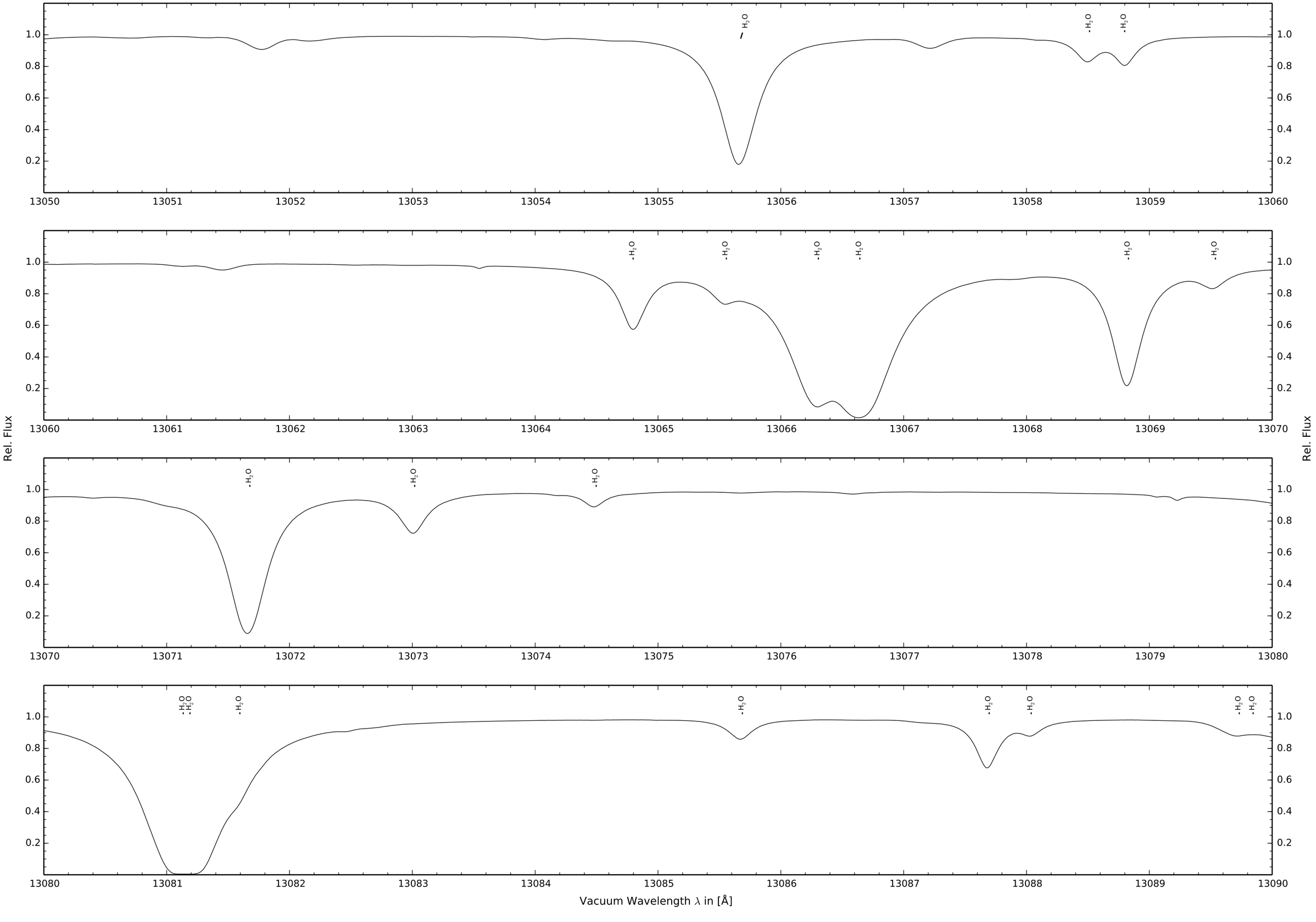
Rel. Flux
Vacuum Wavelength λ in [Å]
- H2O
- CO2
- O2
Mn I

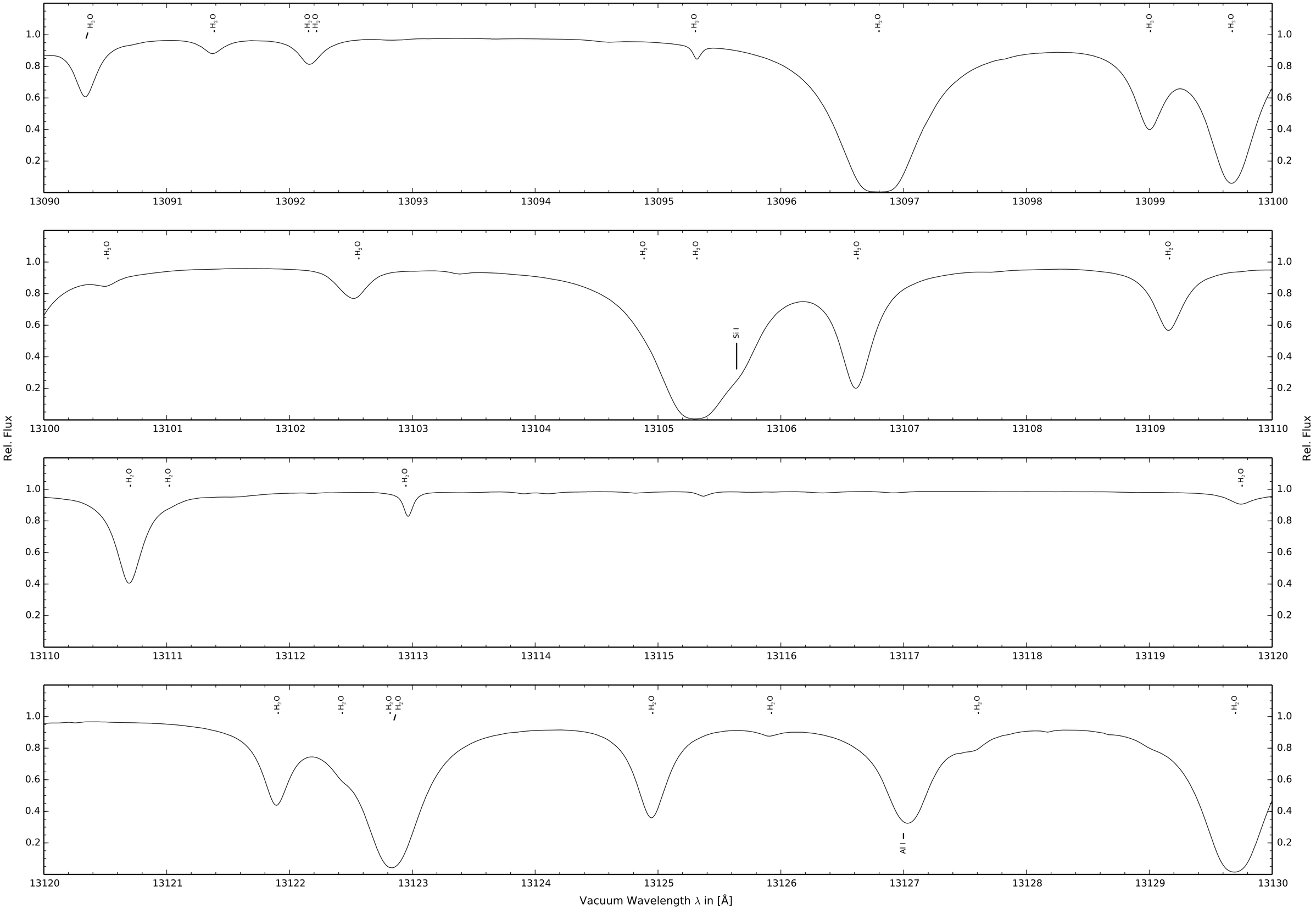
Rel. Flux

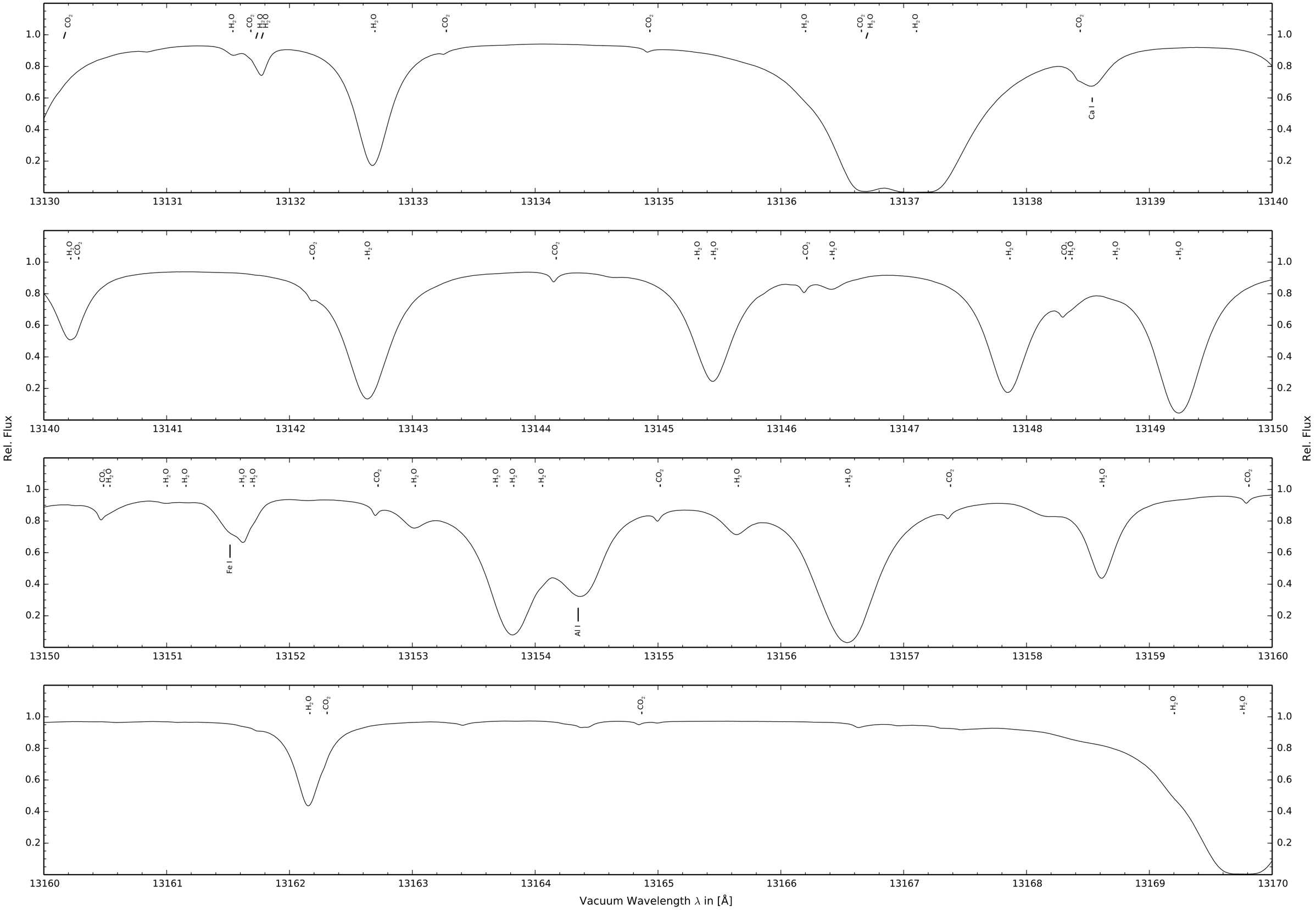
Vacuum Wavelength λ in [Å]

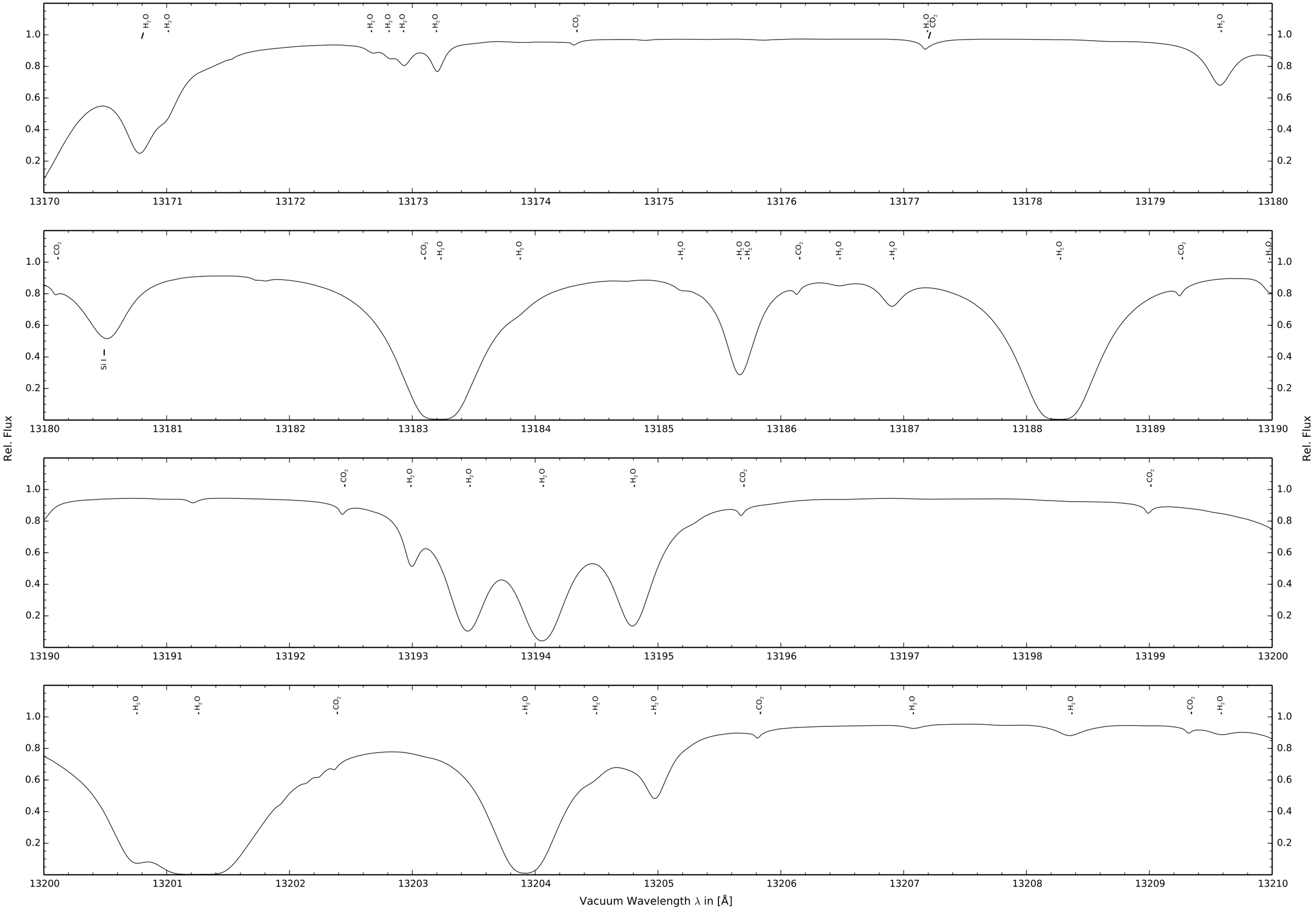

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
Mn I

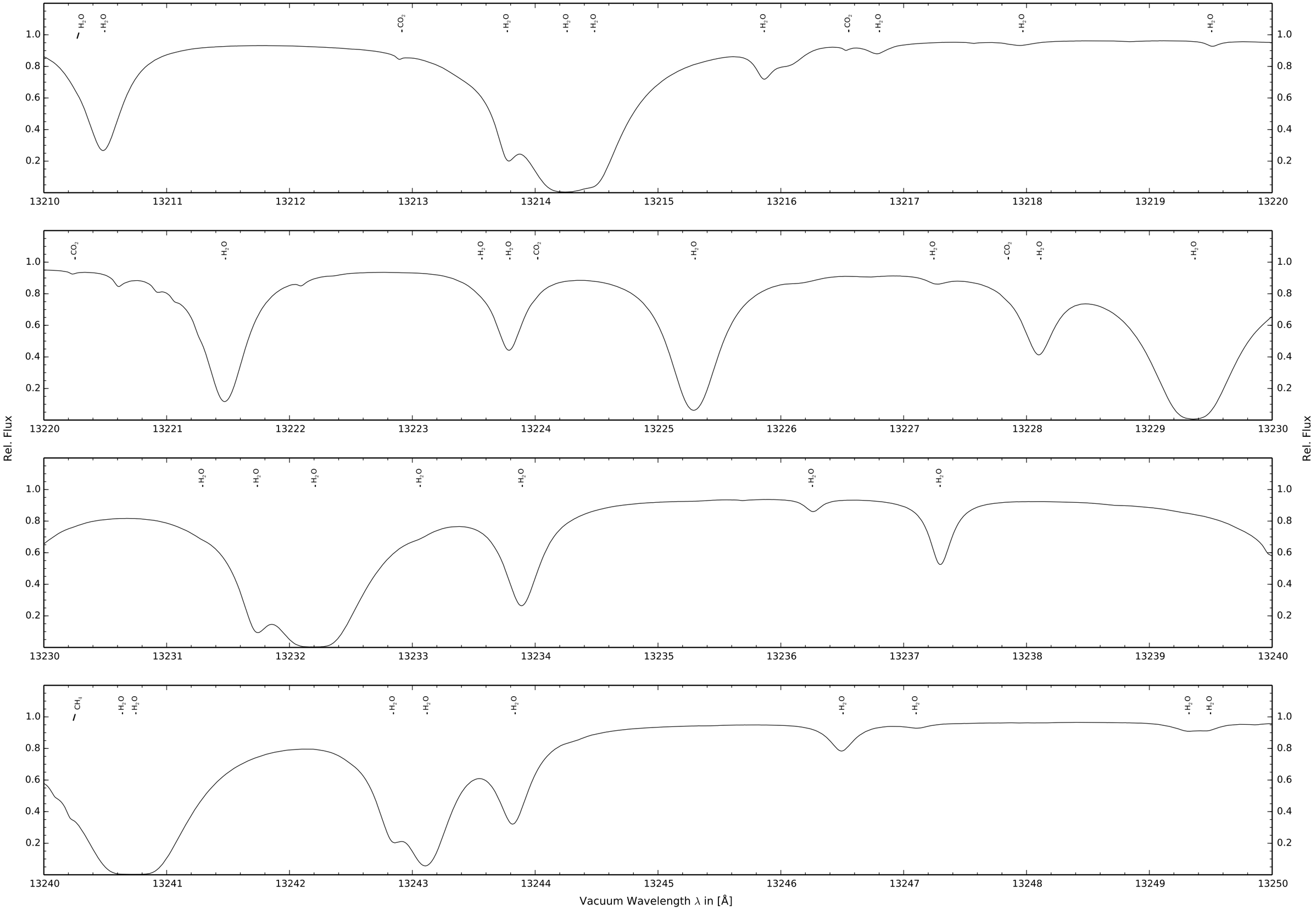

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
O2
Si I
Ca I


Rel. Flux
Vacuum Wavelength λ in [Å]
-H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Al I

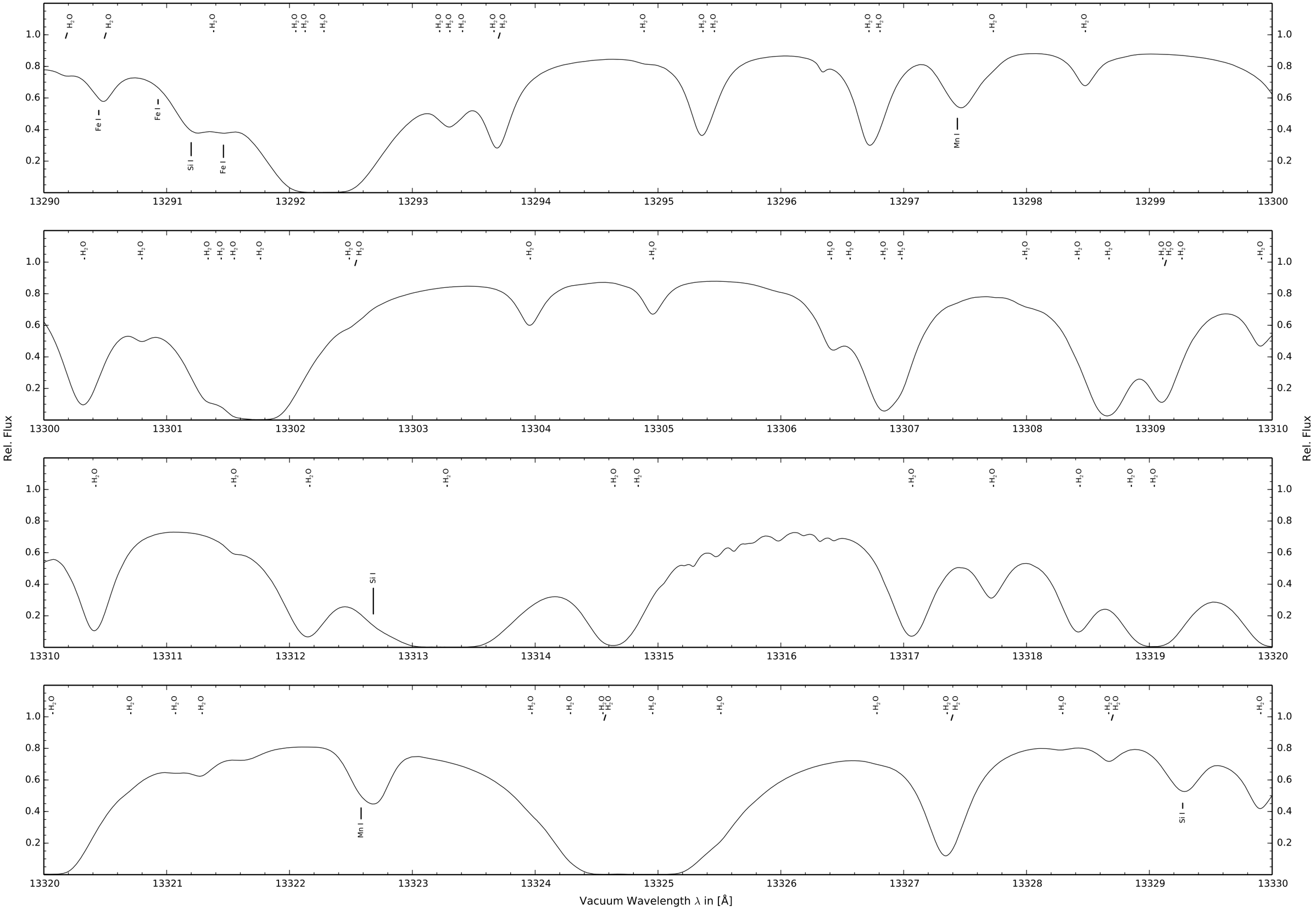

Rel. Flux
Vacuum Wavelength λ in [Å]
Ca I
Fe I
Al I

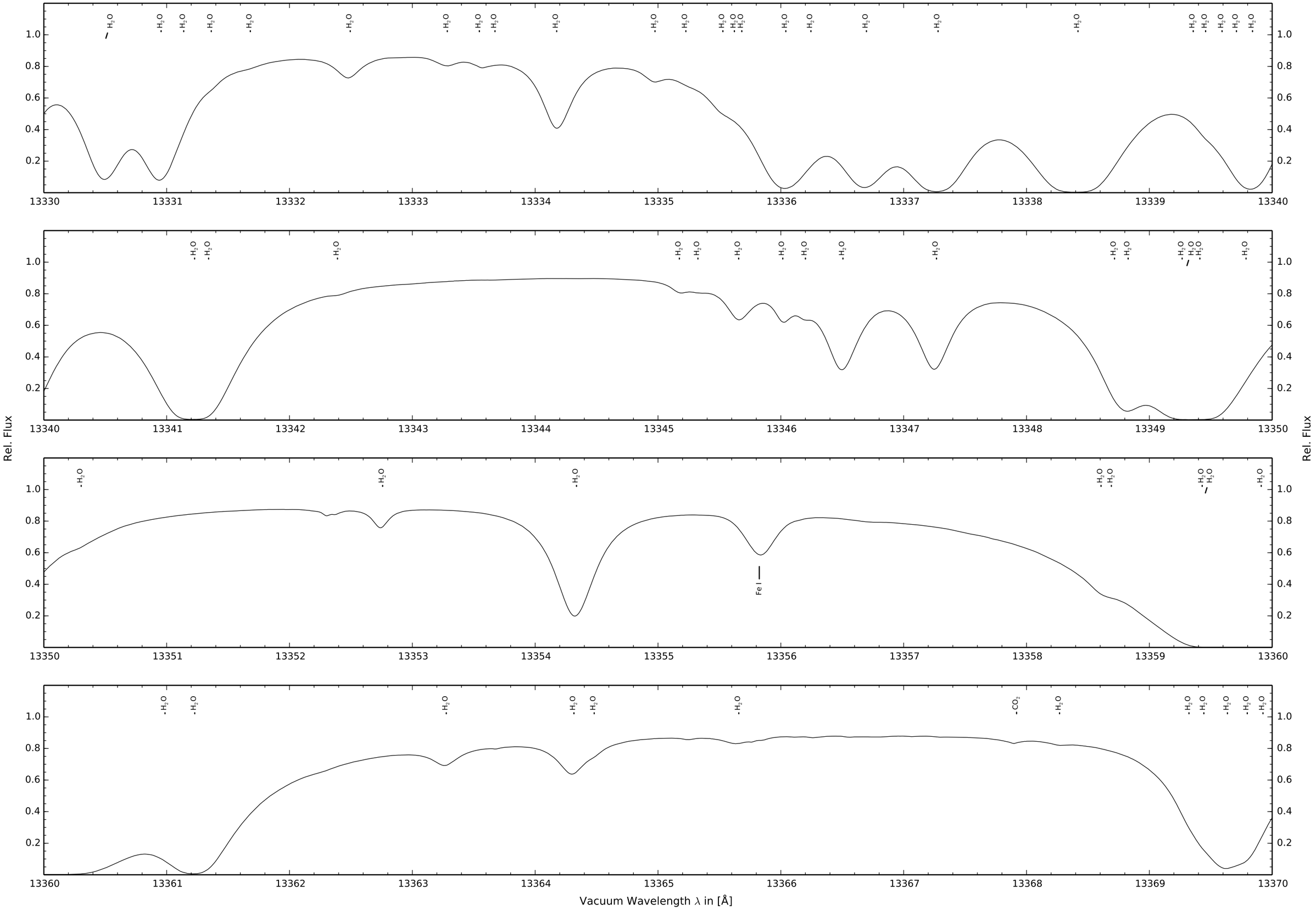

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
H2O
CO2


Rel. Flux
Vacuum Wavelength λ in [Å]
CH4
H2O
CO2

Rel. Flux

Vacuum Wavelength λ in [Å]

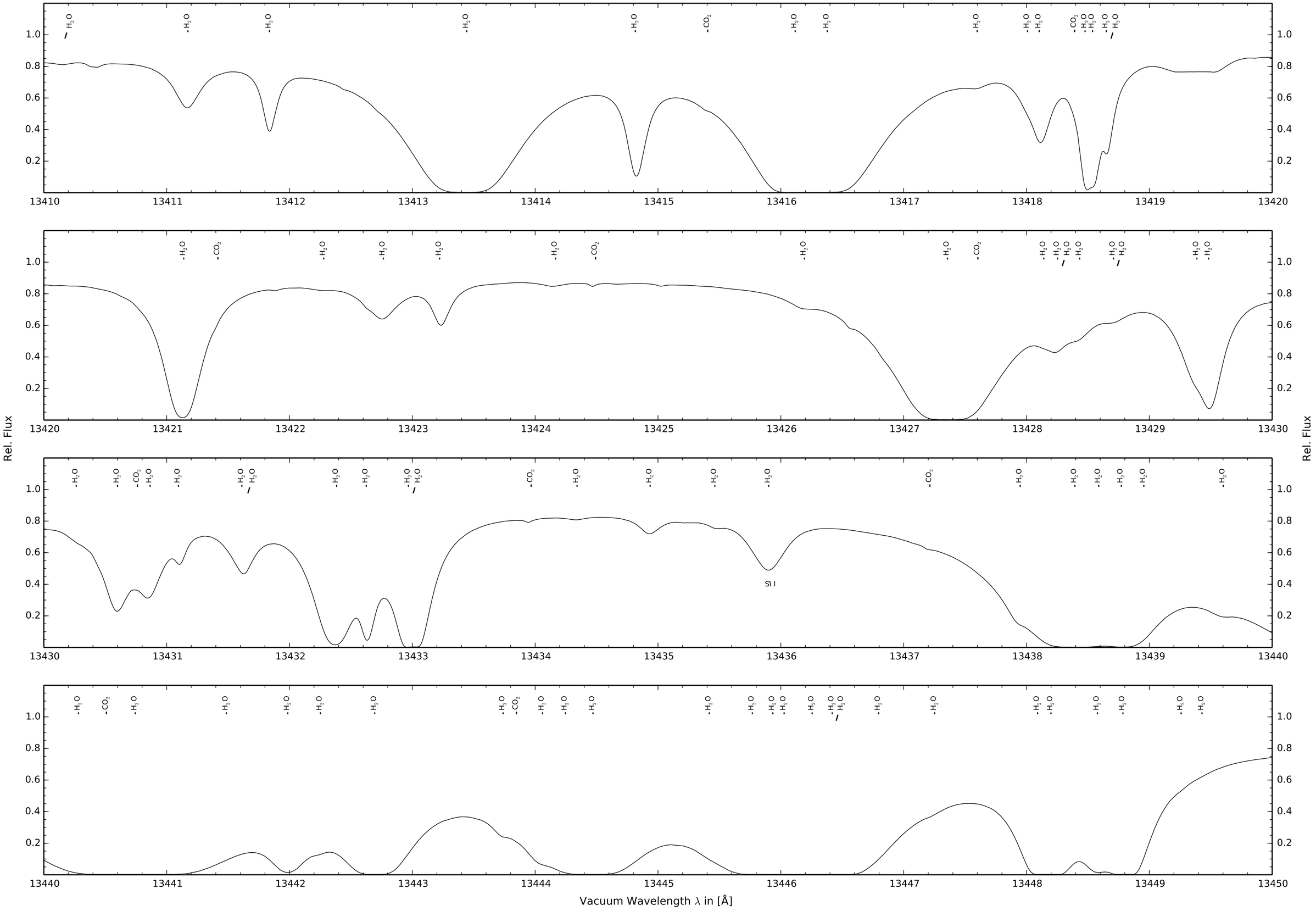

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Si I
Mn I
H2O



Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I

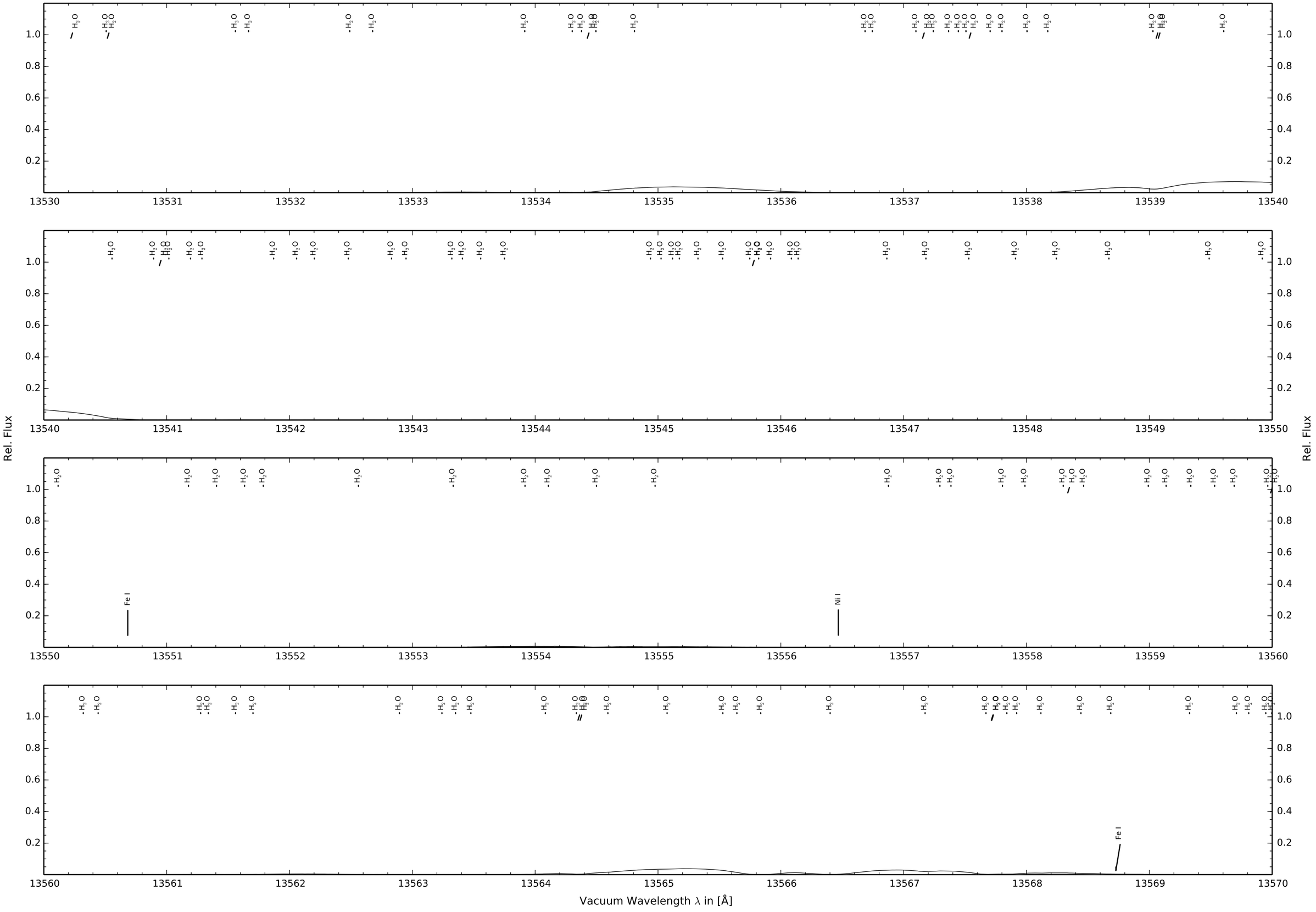
Rel. Flux

Vacuum Wavelength λ in [Å]

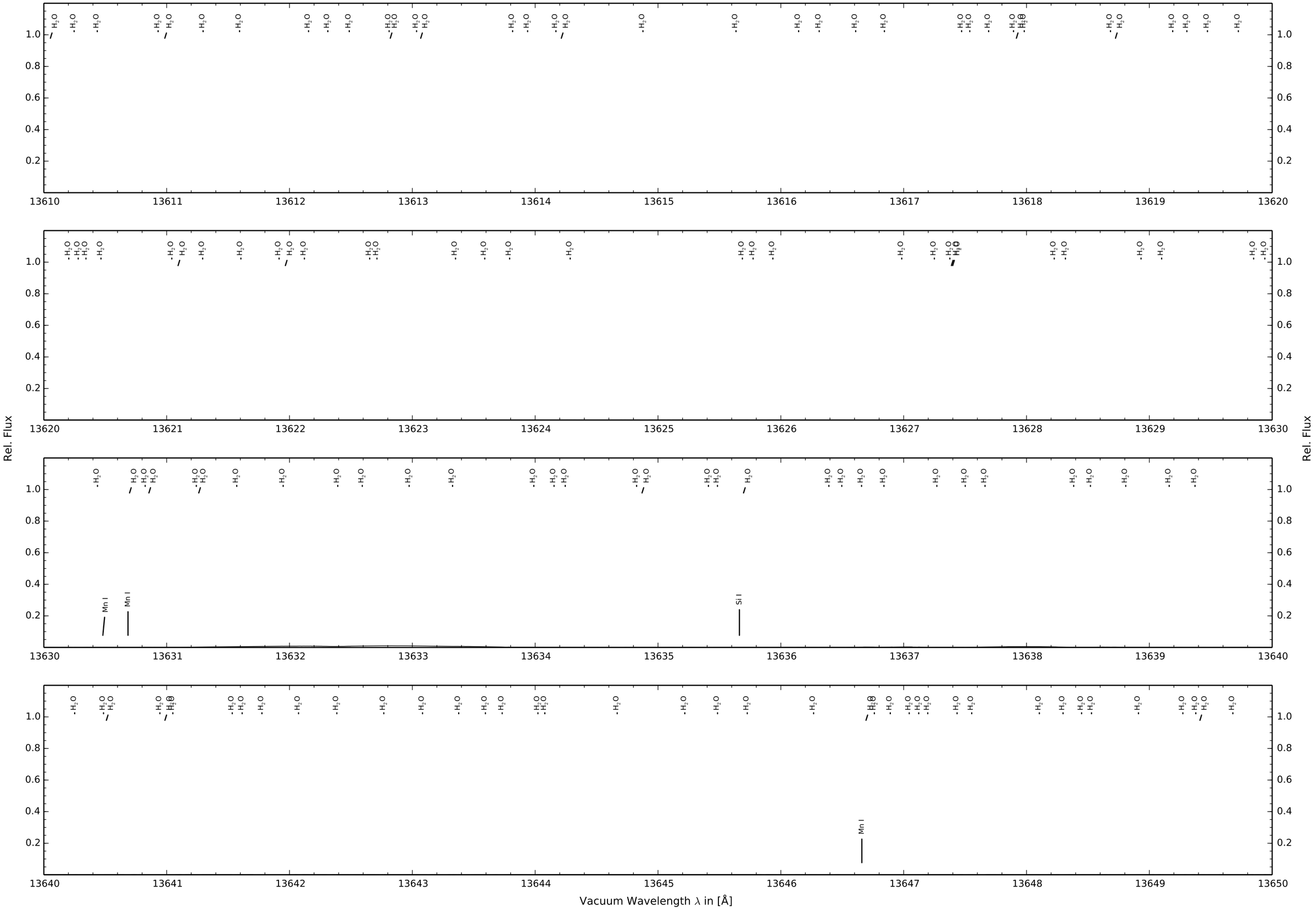

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I

Rel. Flux
Vacuum Wavelength λ in [Å]
-H2O

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Ni I
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]
Mn I


Rel. Flux
Vacuum Wavelength λ in [Å]
Mn I
Mn I
Si I
Mn I

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Fe I
Si I

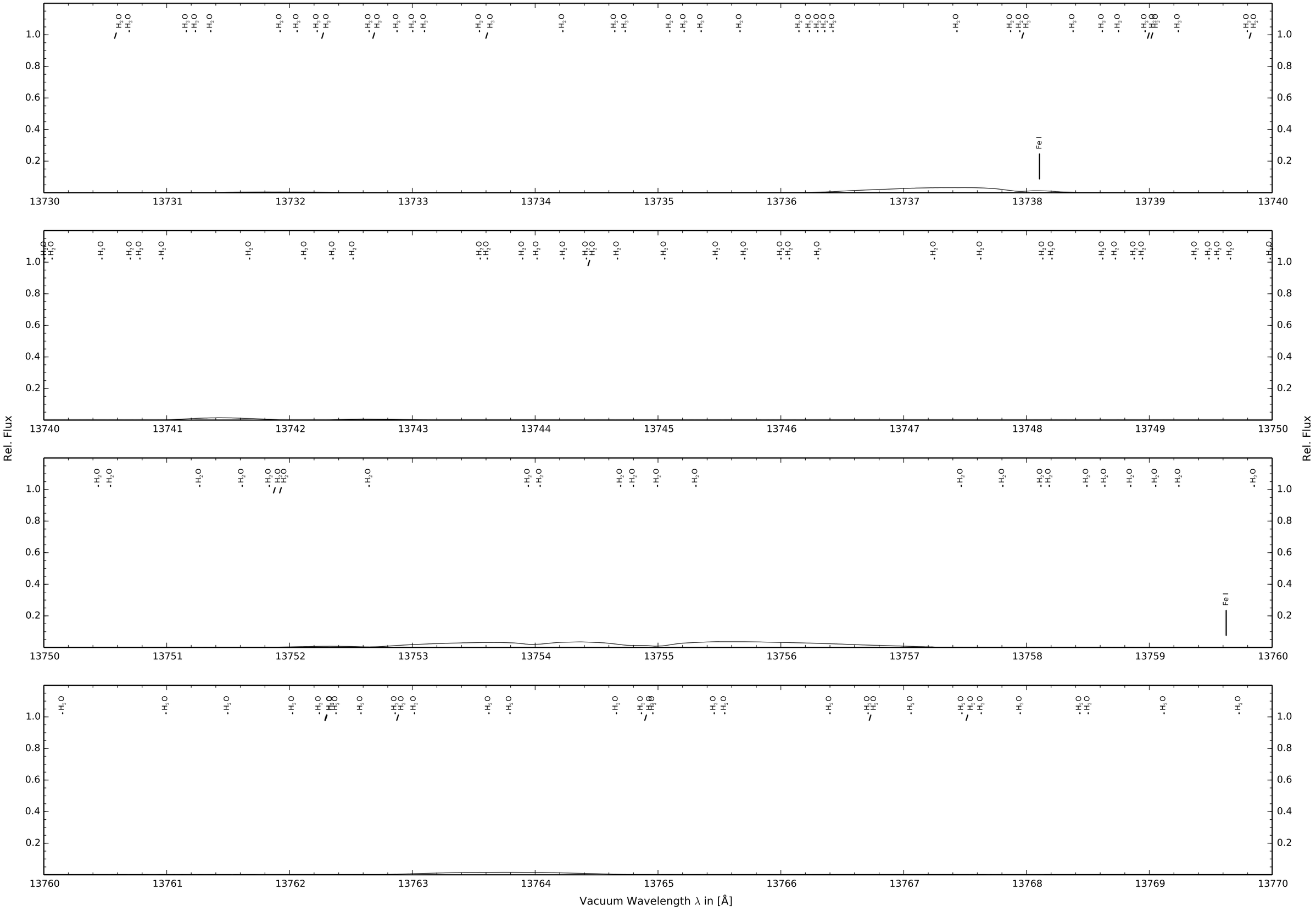
Rel. Flux

Si I

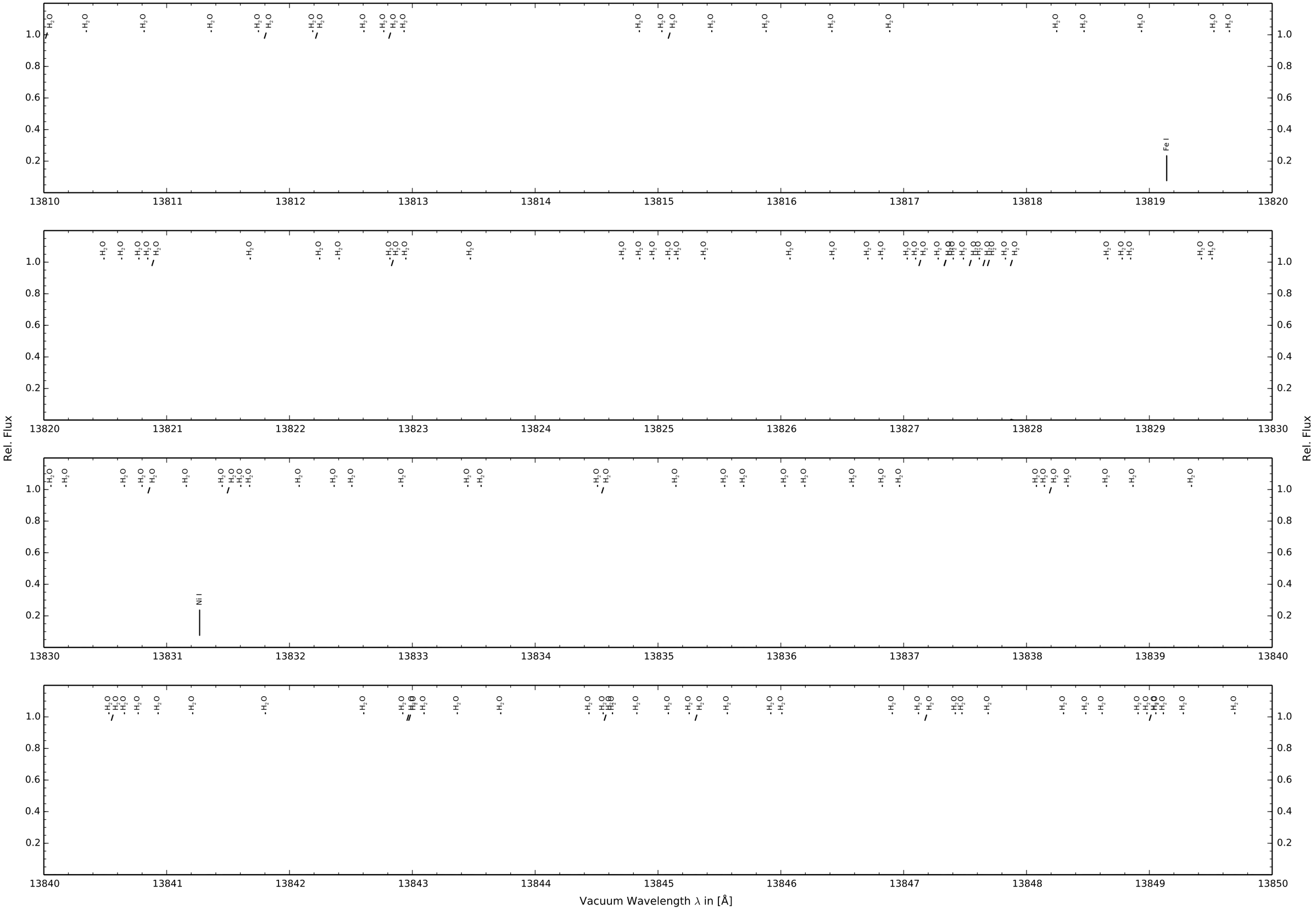
Si I

Ni I

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Ni I
Vacuum Wavelength λ in [Å]

Mn I
Ni I
Mn I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux

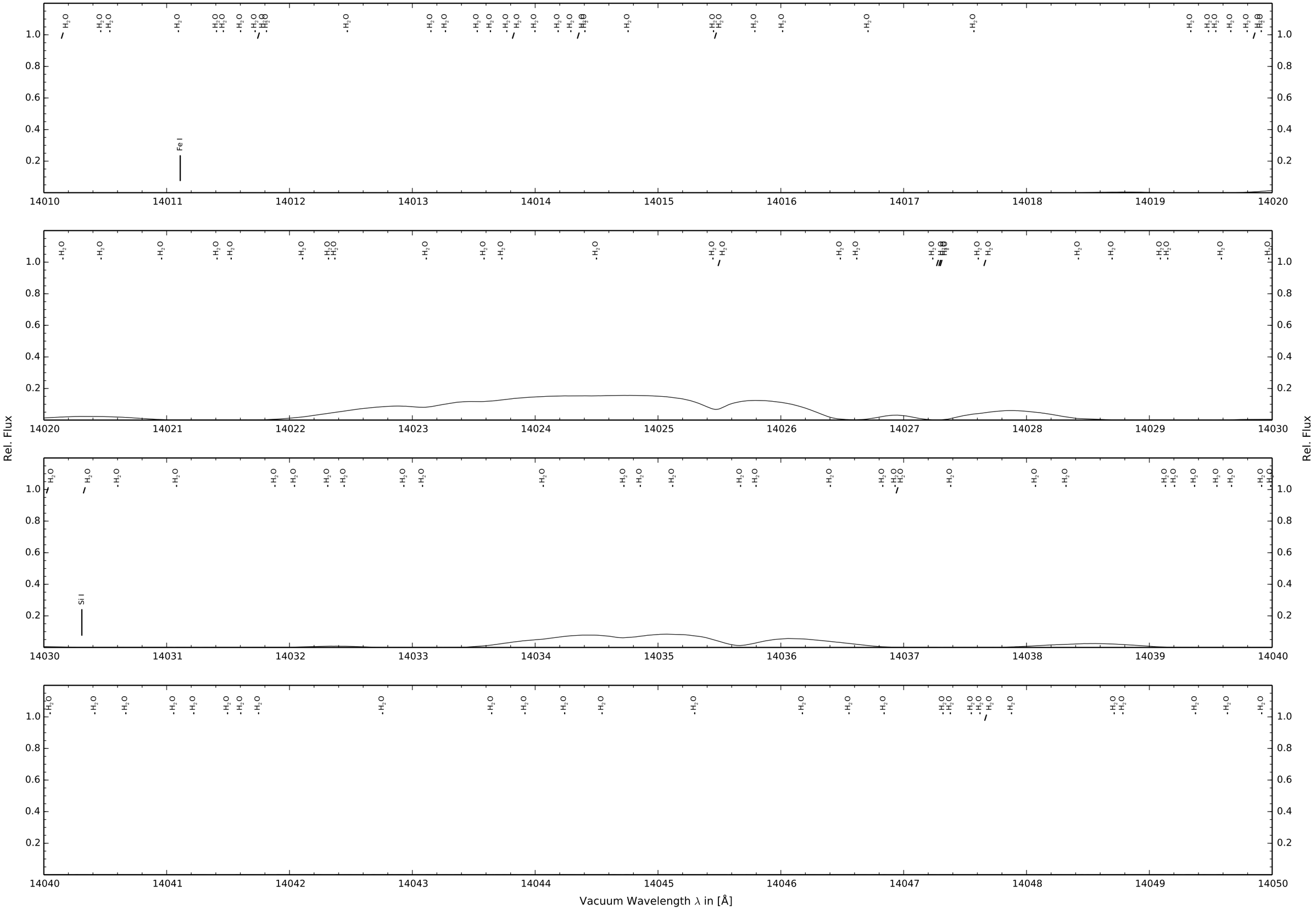
Vacuum Wavelength λ in [Å]

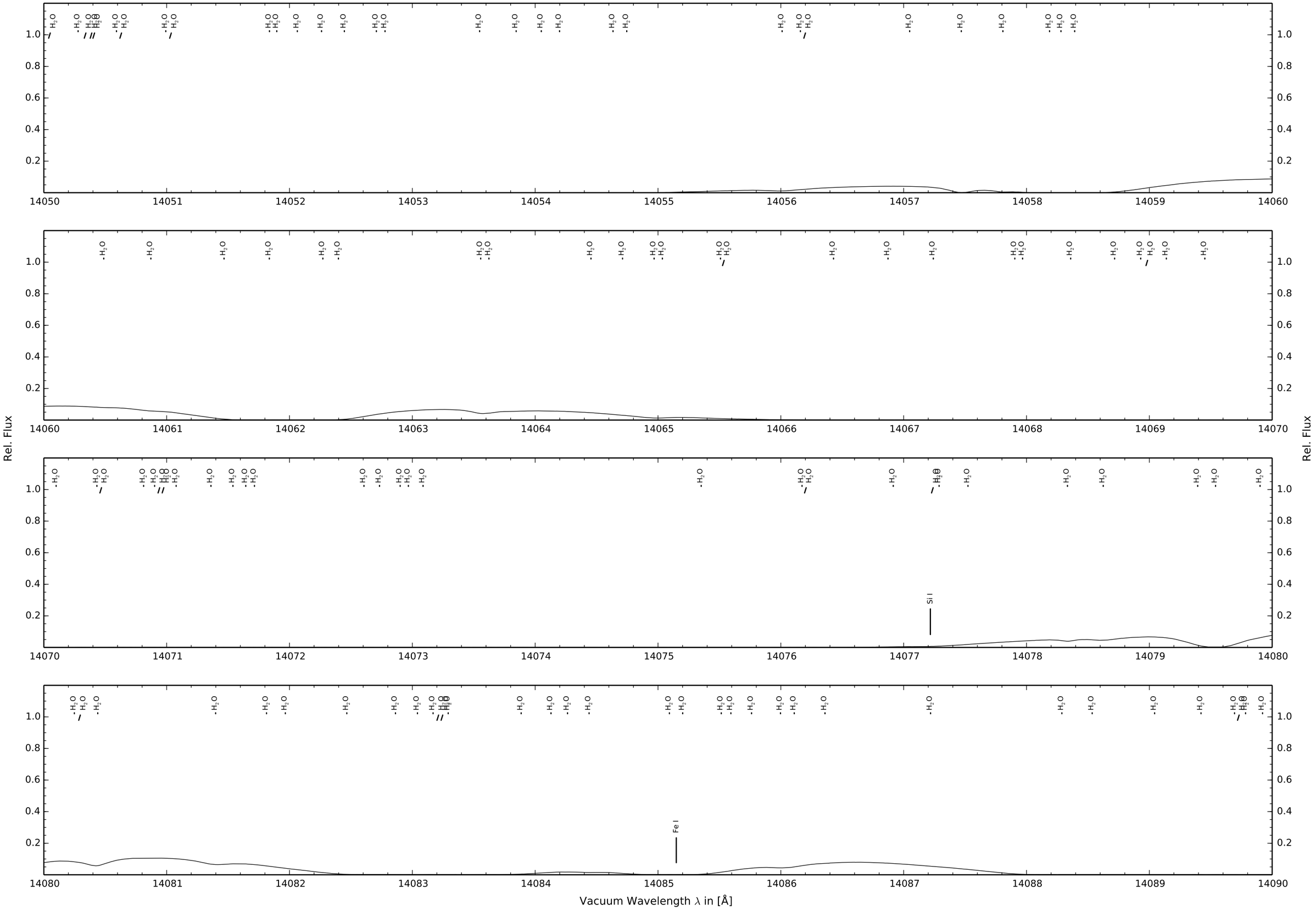
Rel. Flux

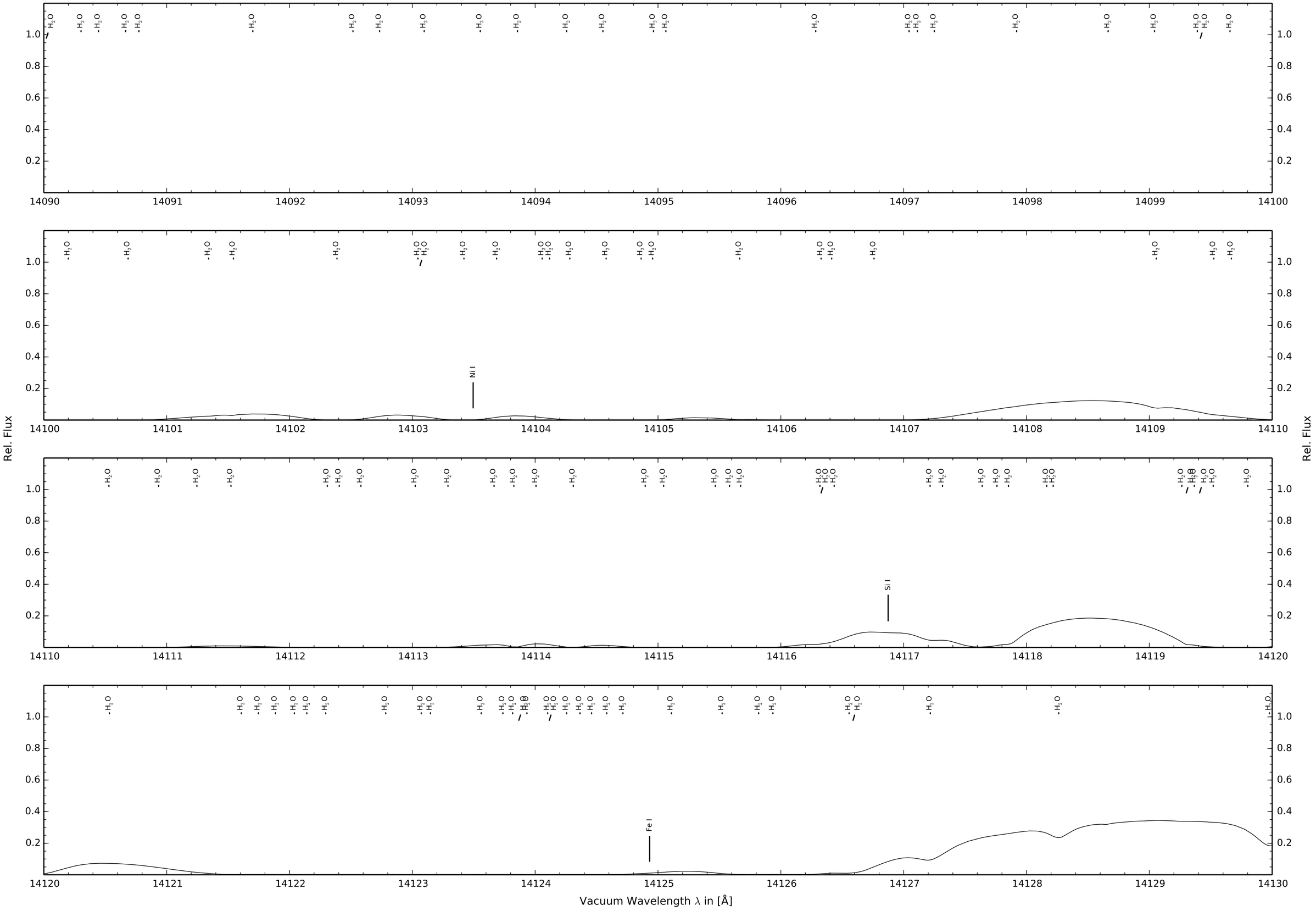
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Si I
Vacuum Wavelength λ in [Å]

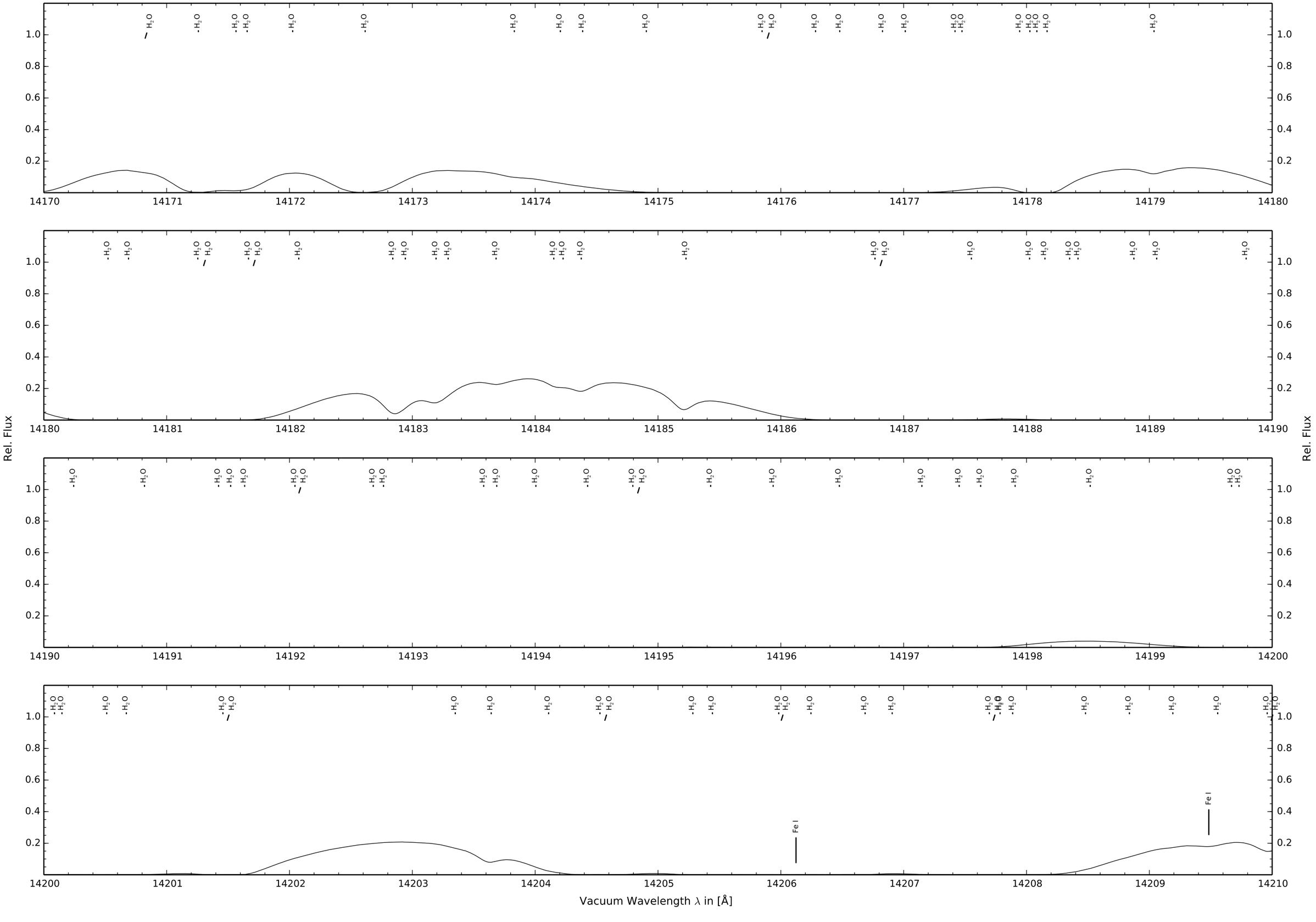

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Fe I


Rel. Flux
Ni I
Si I
Fe I
Vacuum Wavelength λ in [Å]

Rel. Flux

Fe I

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I

Rel. Flux

Si I

Si I

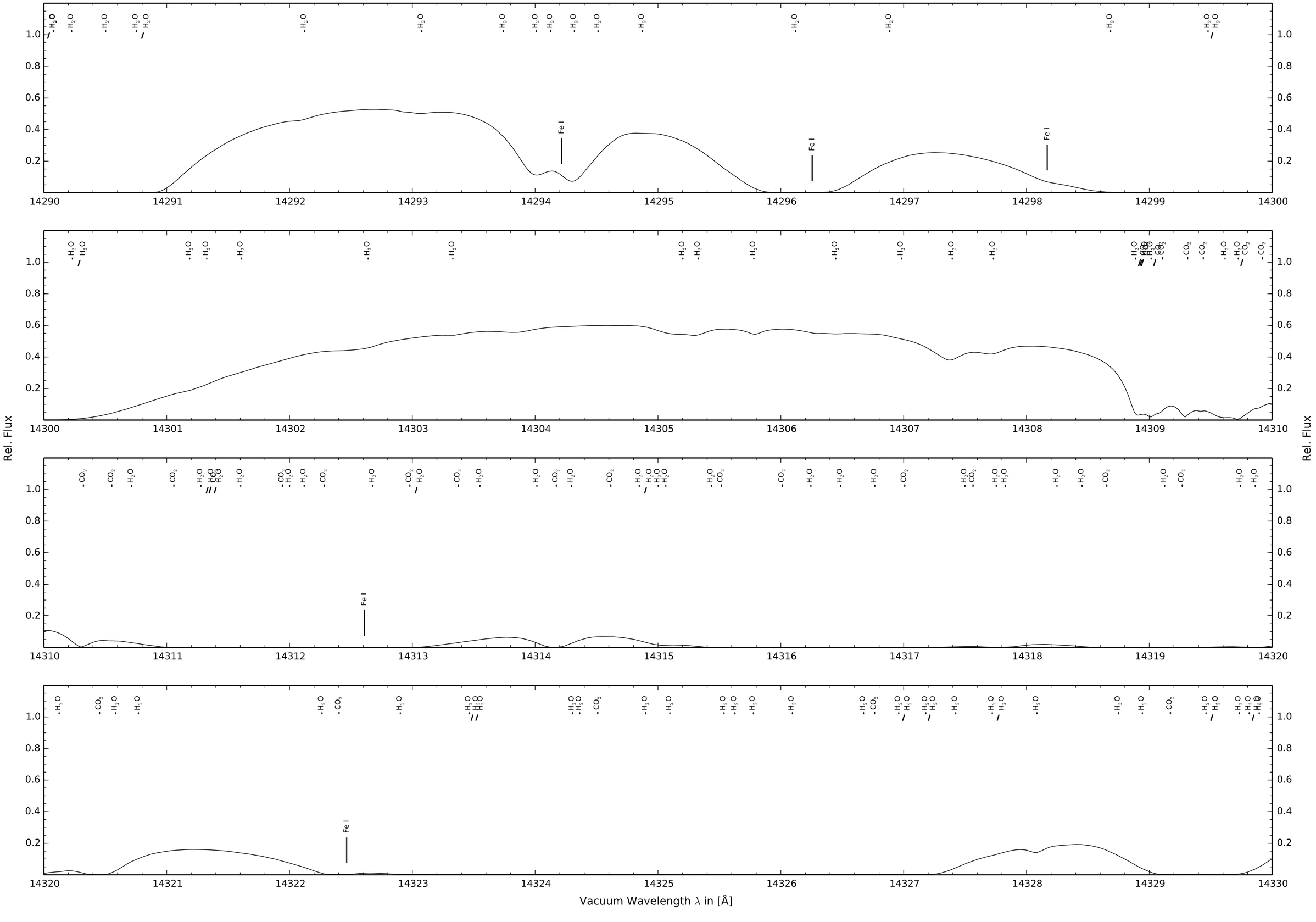
Fe I

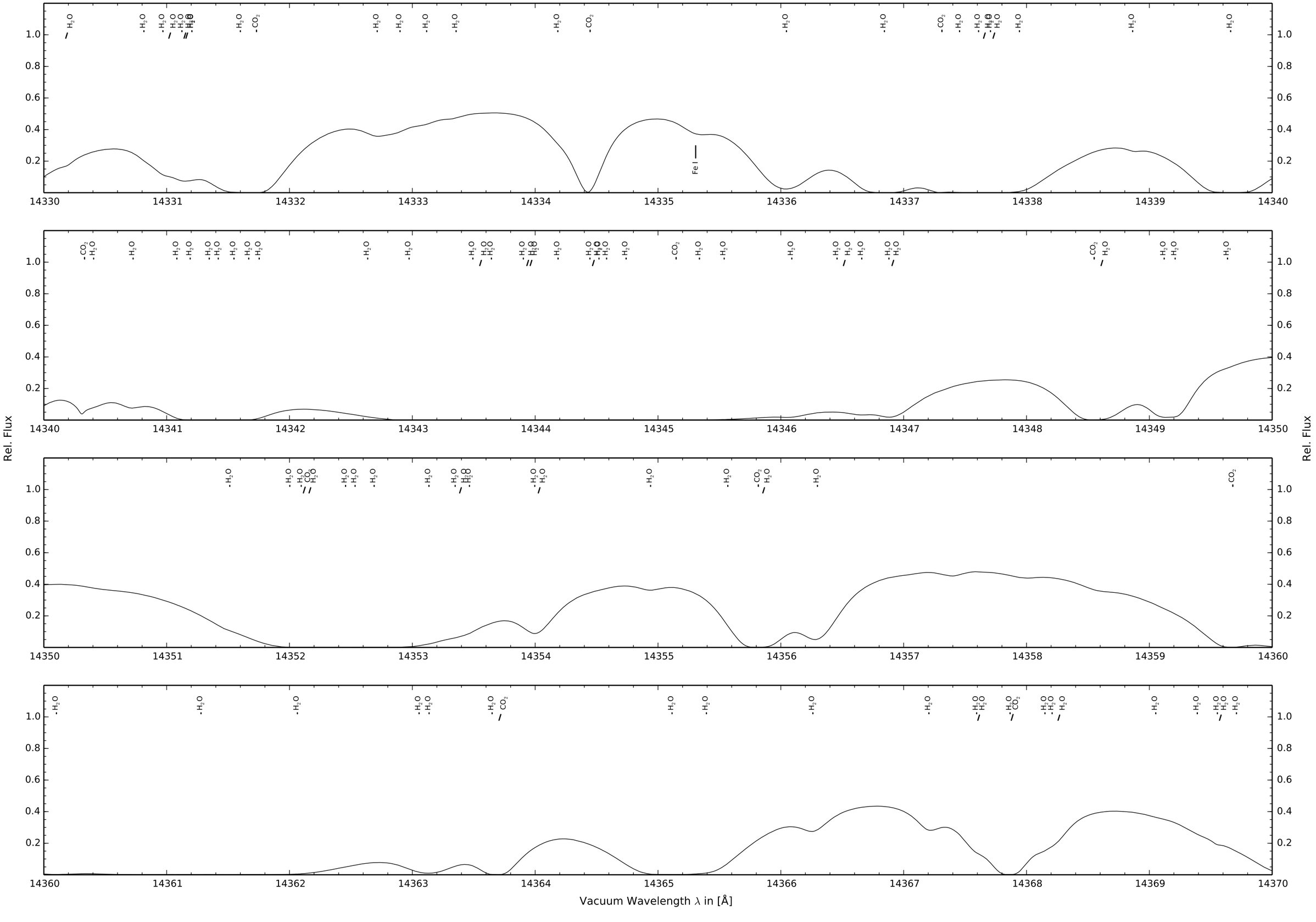
Fe I

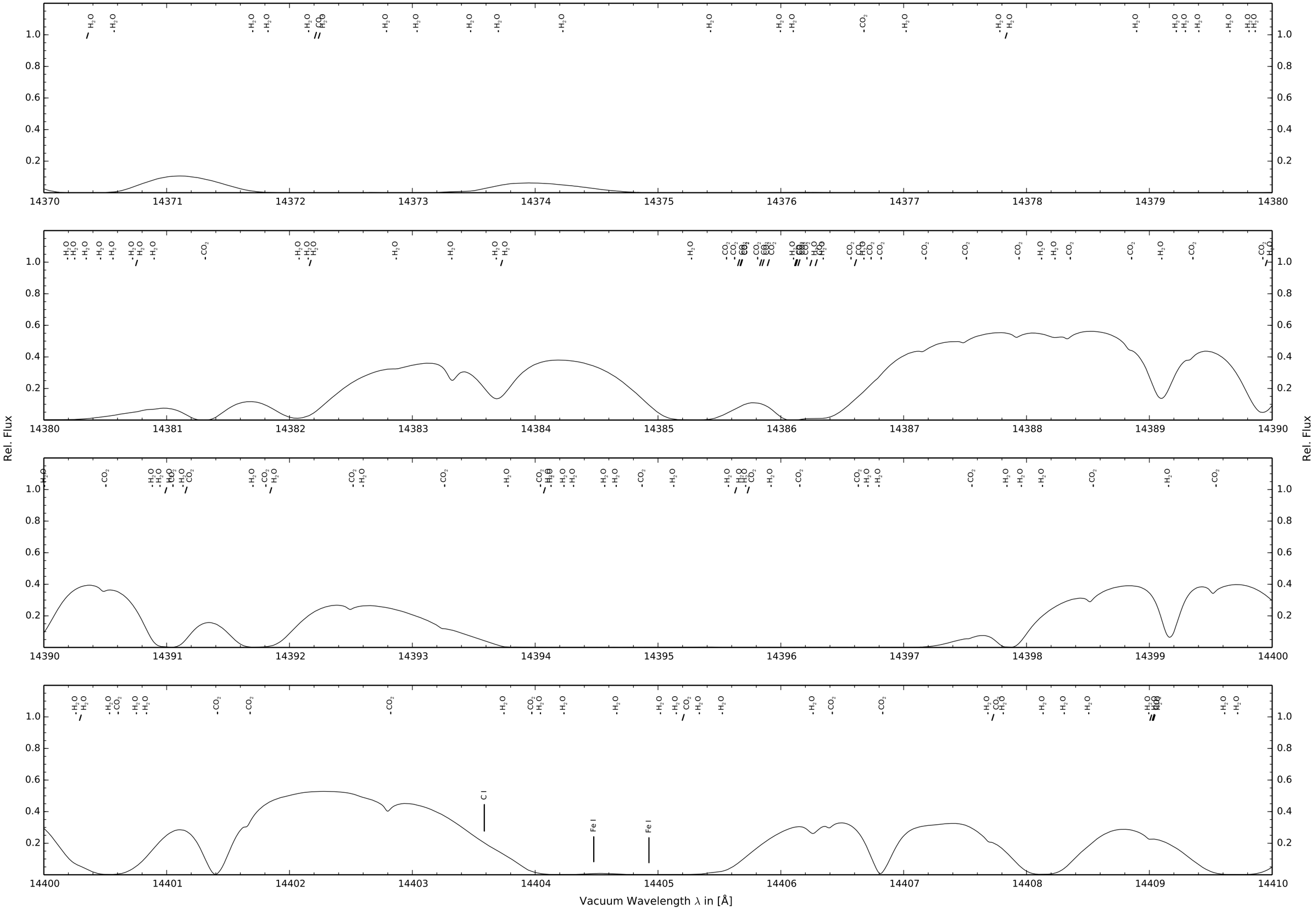
Vacuum Wavelength λ in [Å]

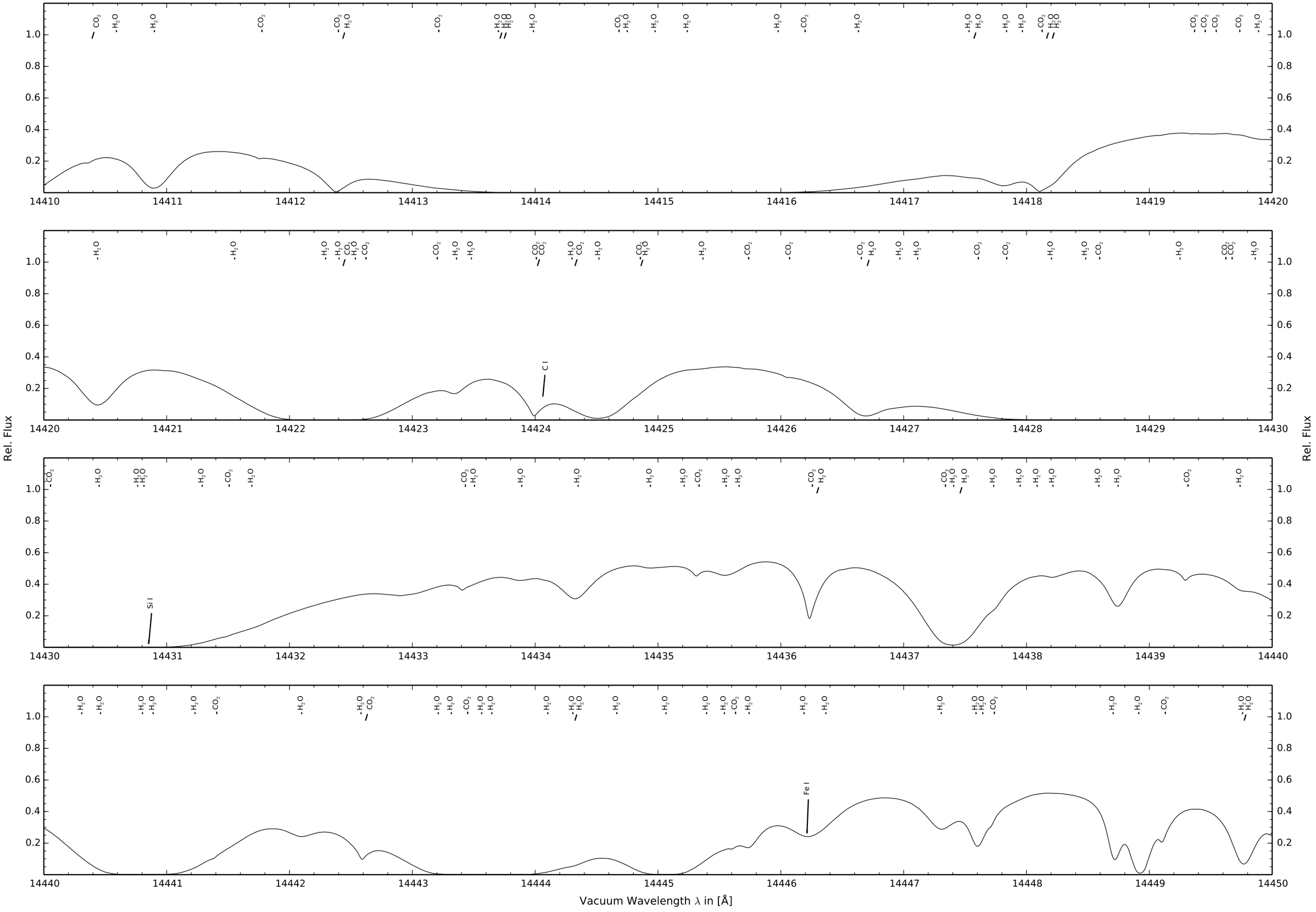
Rel. Flux

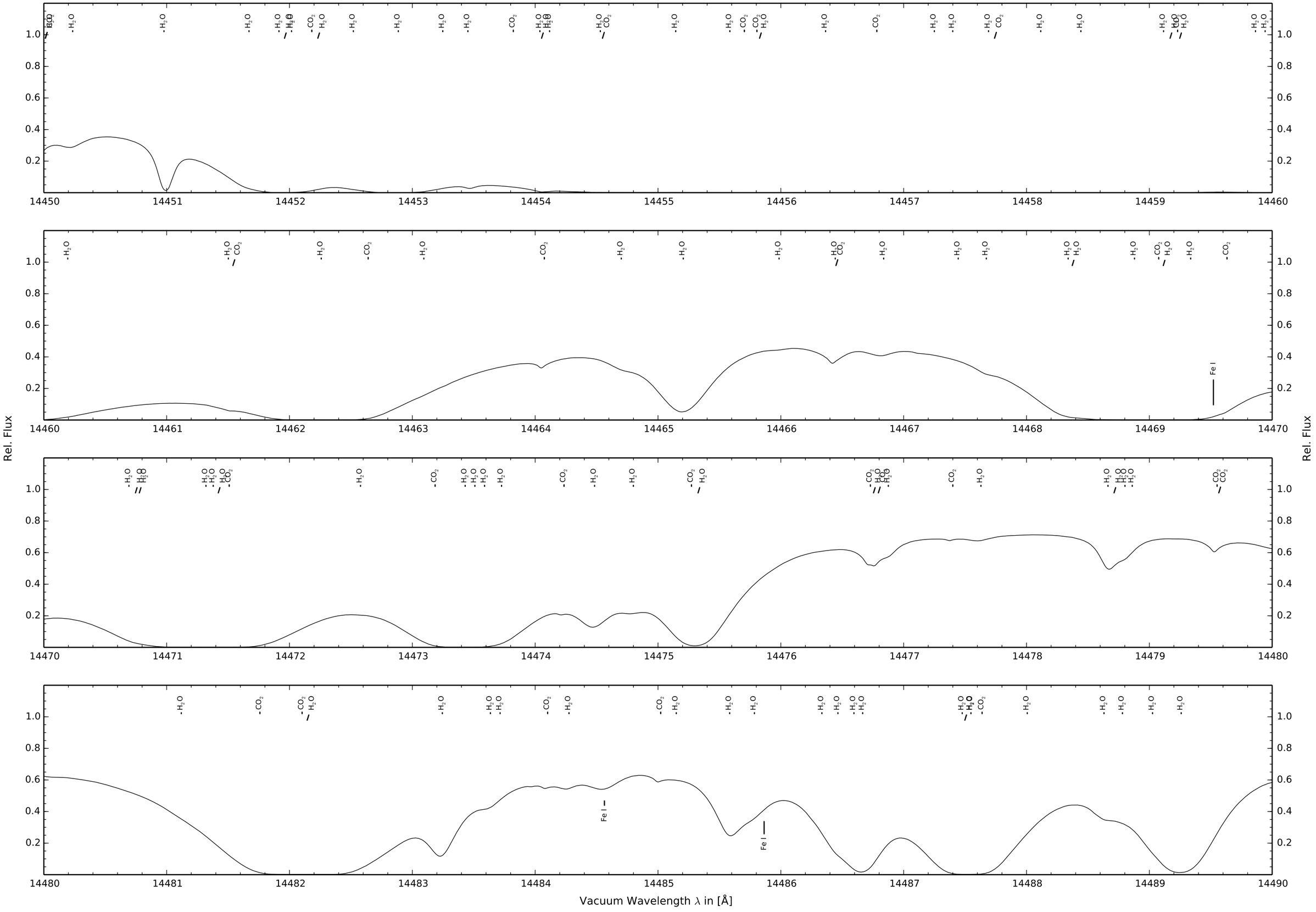
Vacuum Wavelength λ in [Å]

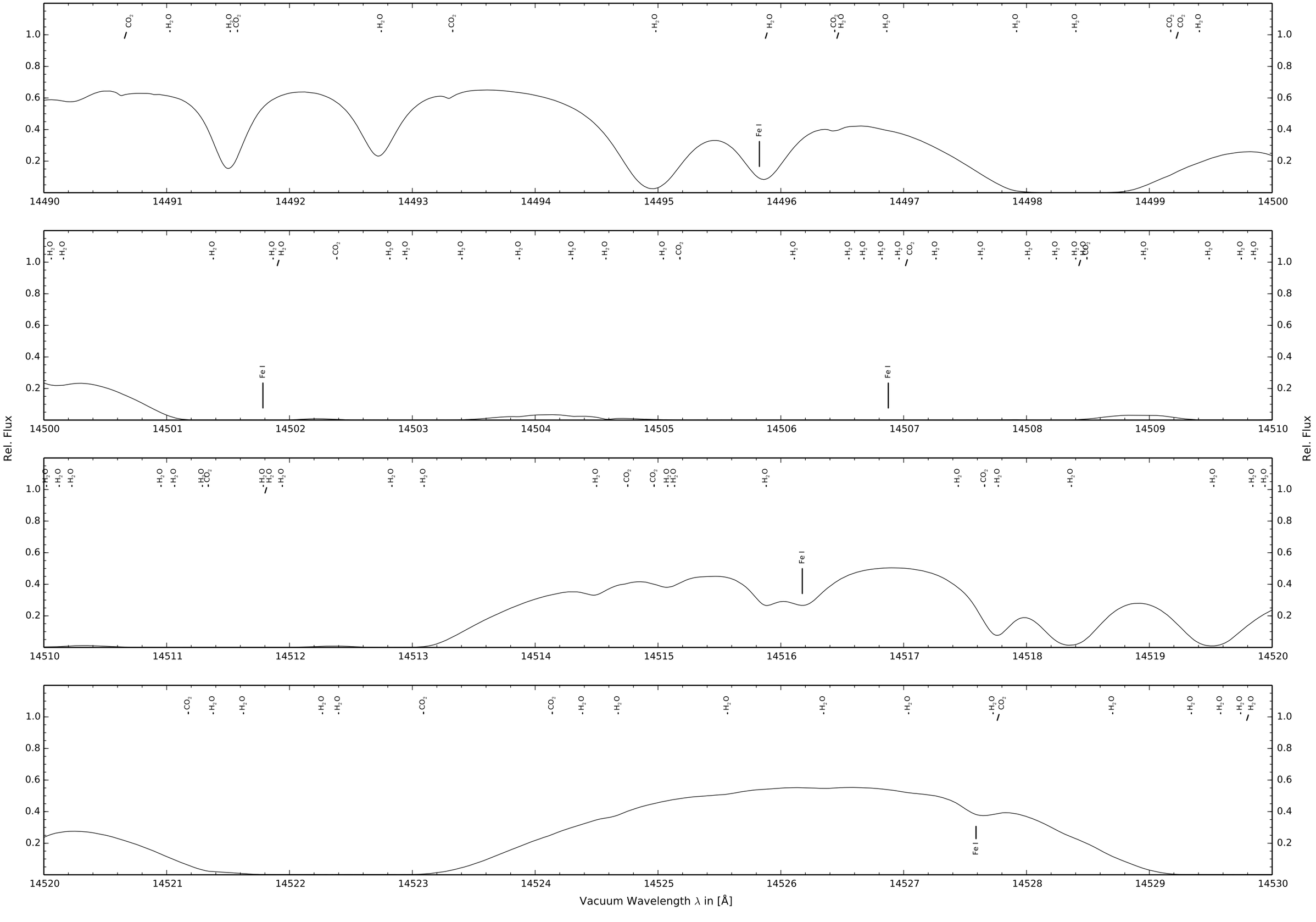

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
H_2O
CO_2

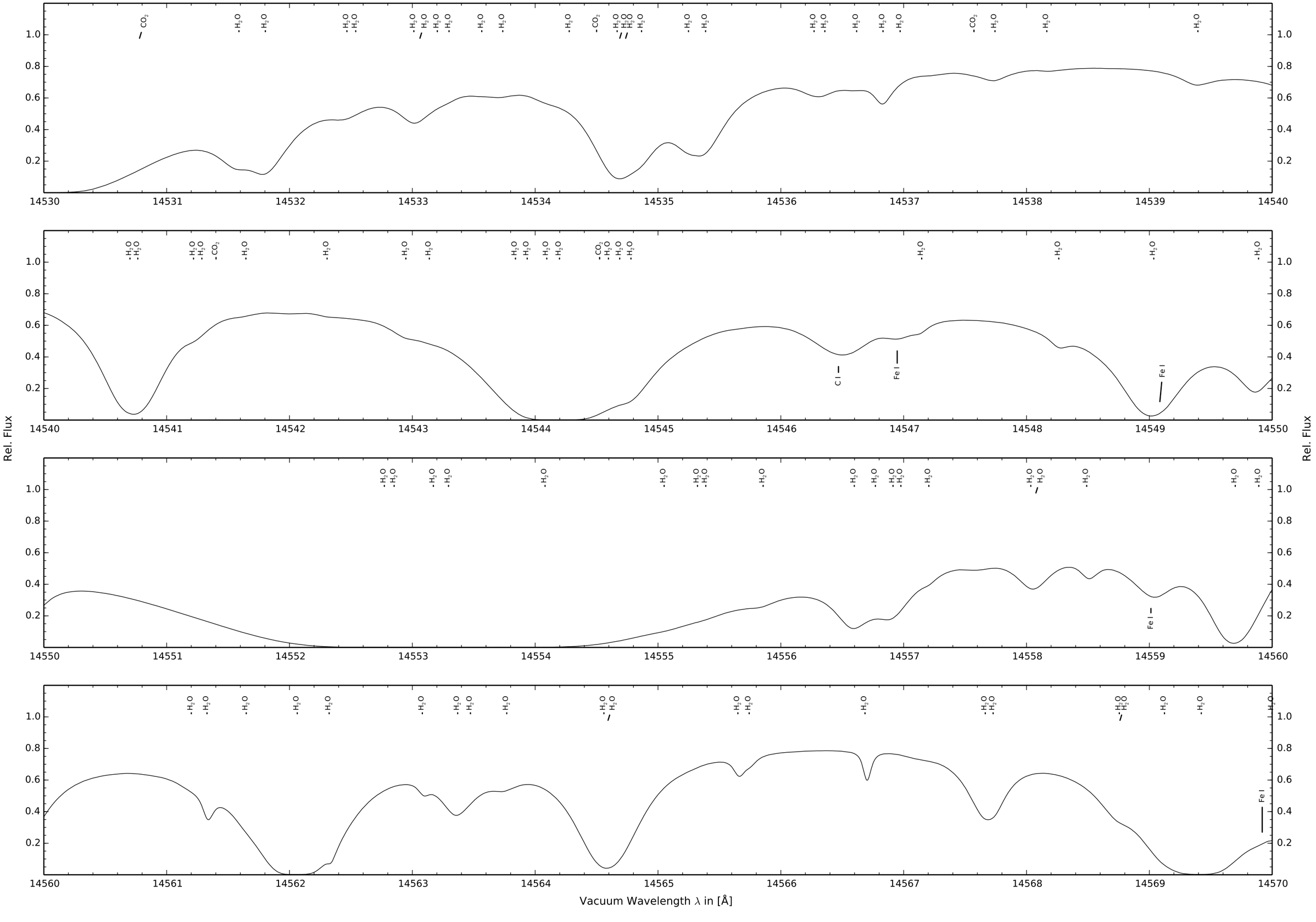

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
C I
Fe I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
C I
Si I
Fe I

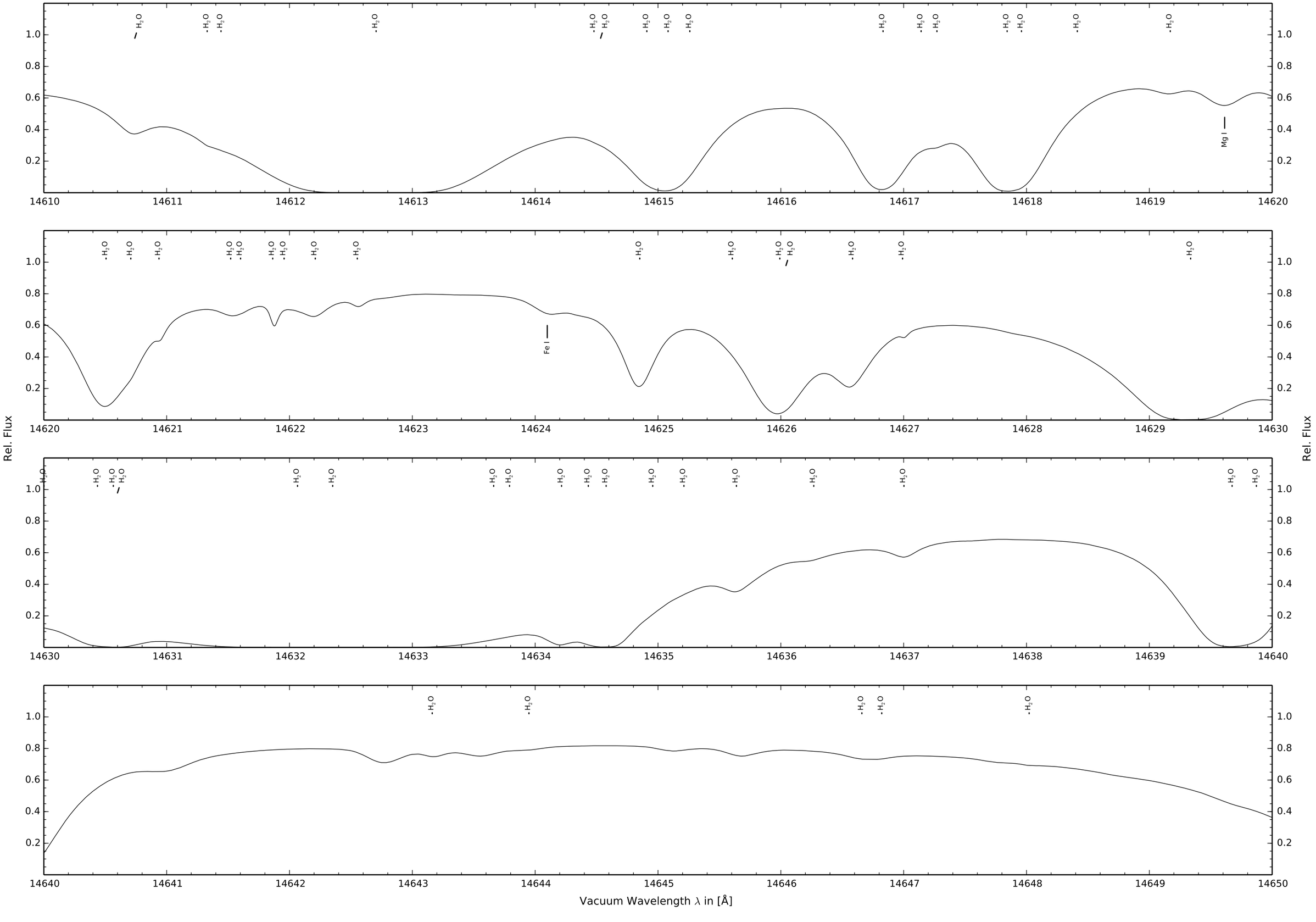

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
CO2
H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
C I

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Mg I
Fe I
H2O

Rel. Flux

Vacuum Wavelength λ in [Å]

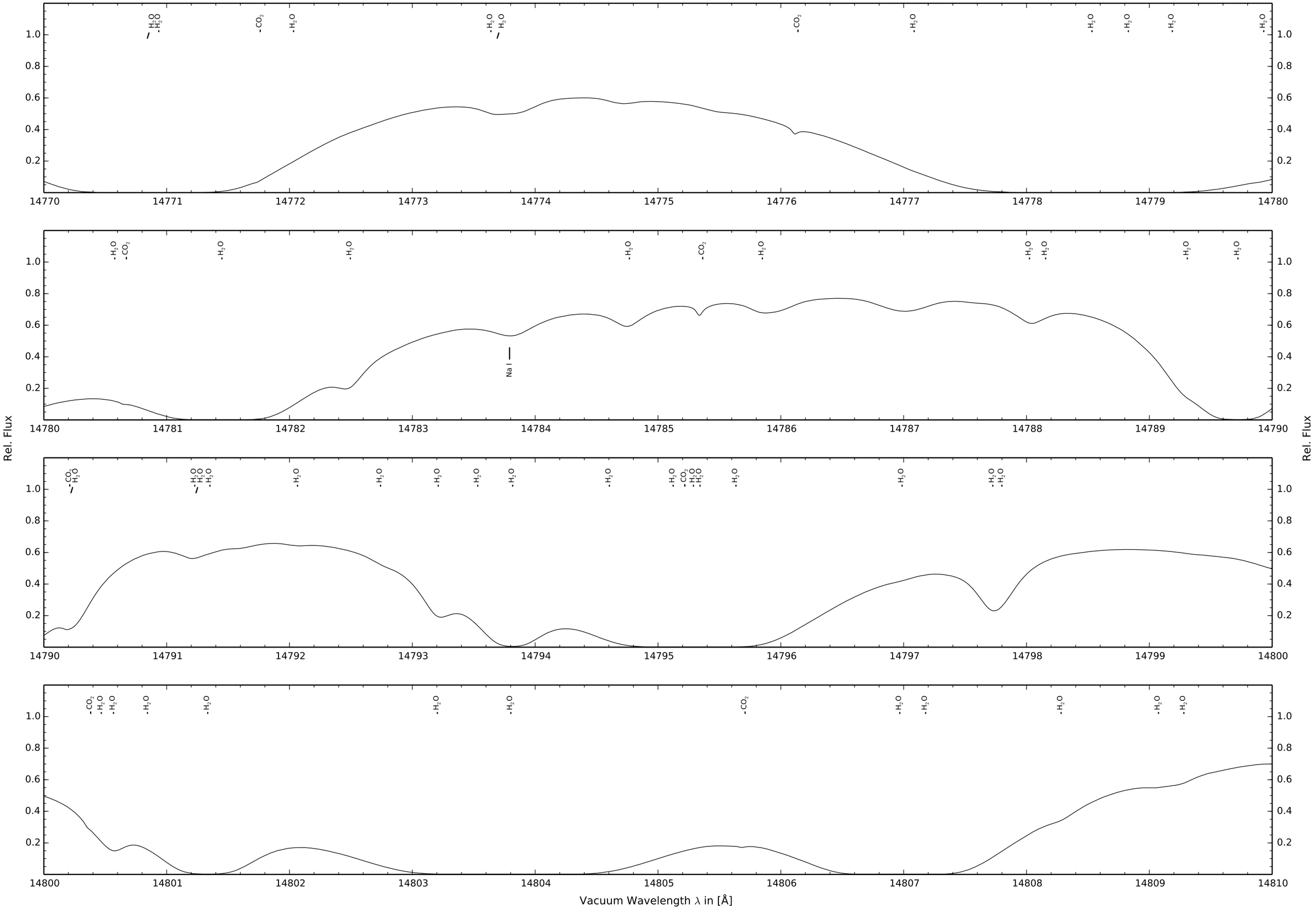
Rel. Flux

Fe I
Mg I
Fe I
Fe I
Fe I
Fe I

Vacuum Wavelength λ in [Å]

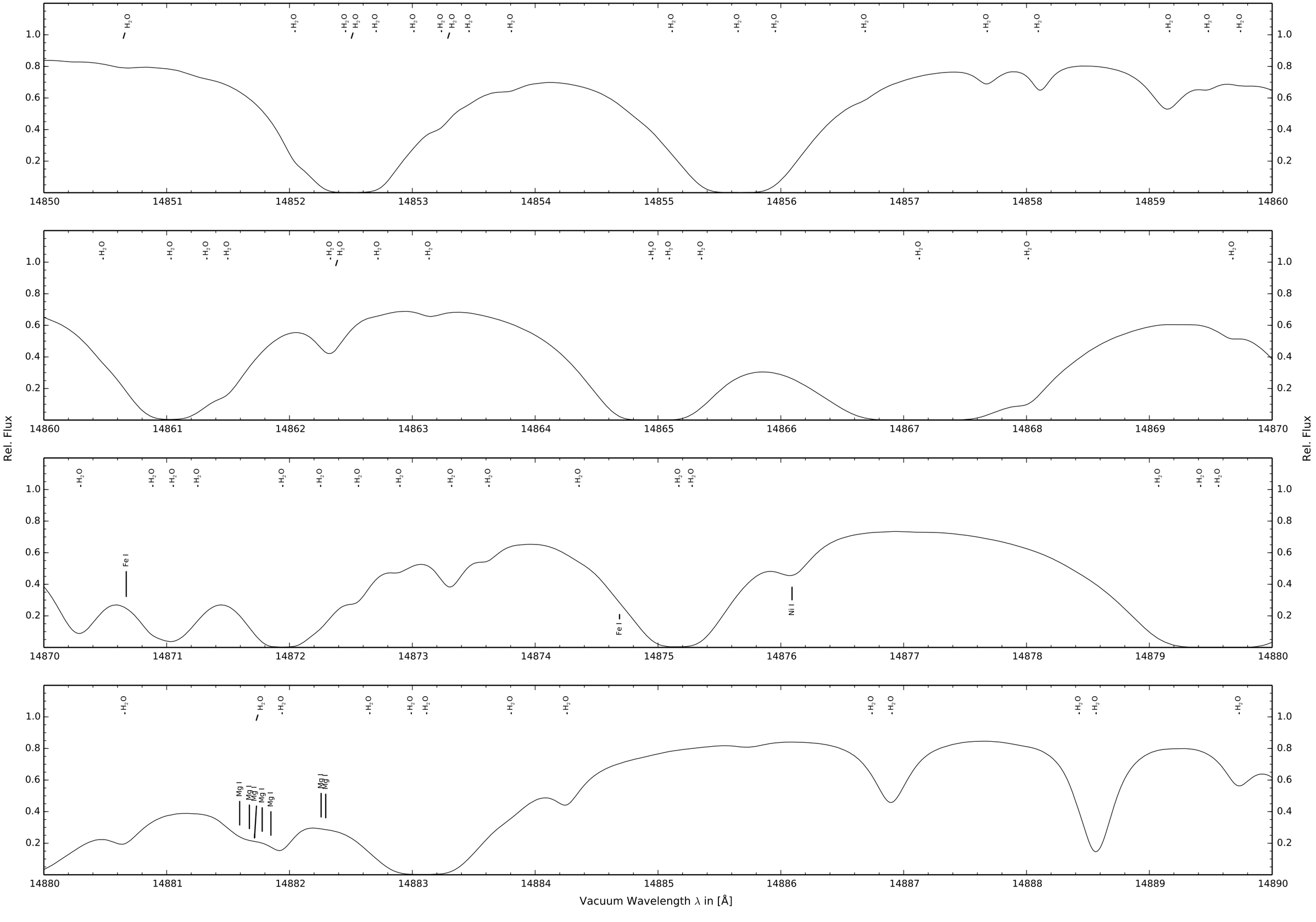
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Na I
H_2O
CO_2

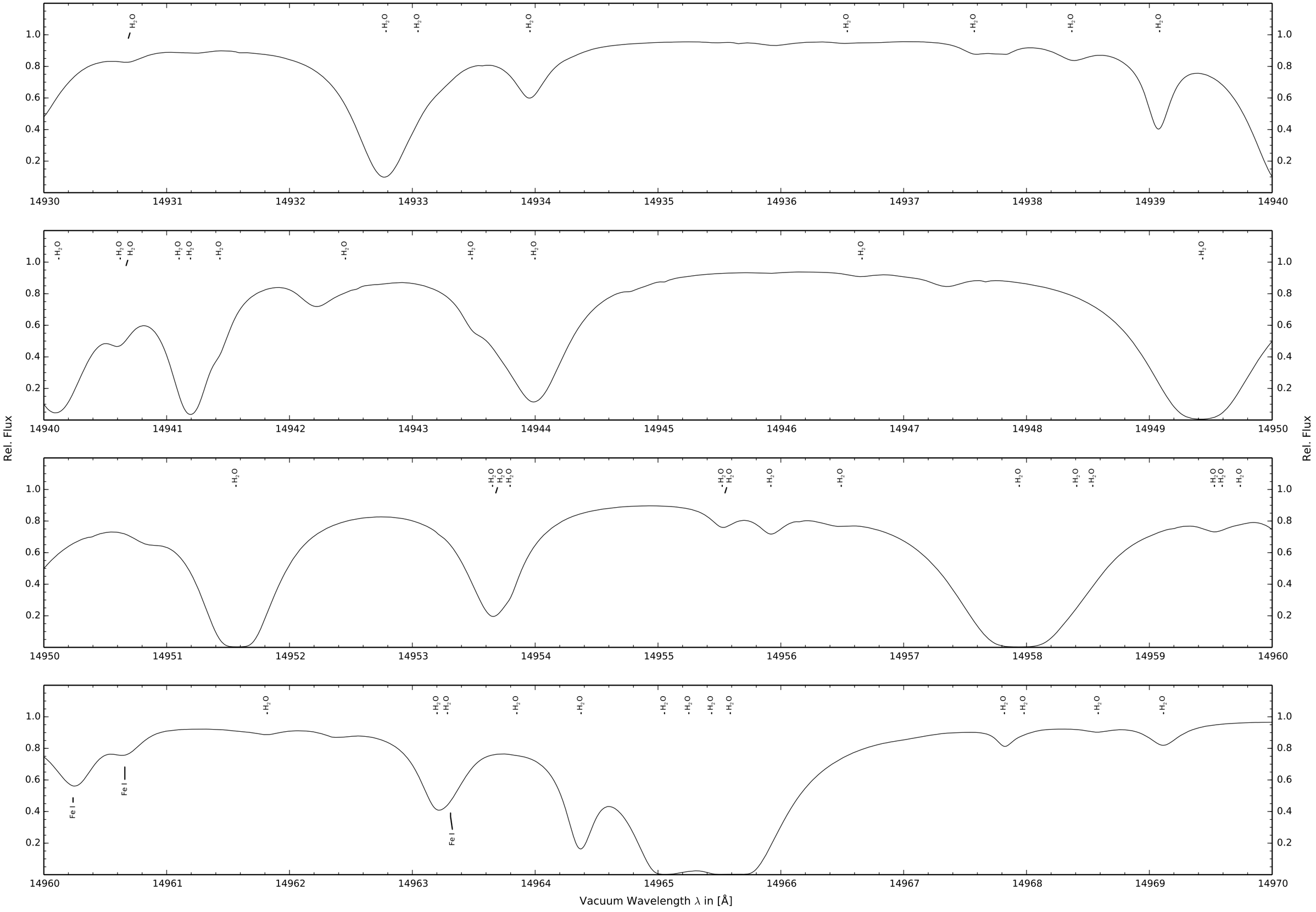
Rel. Flux

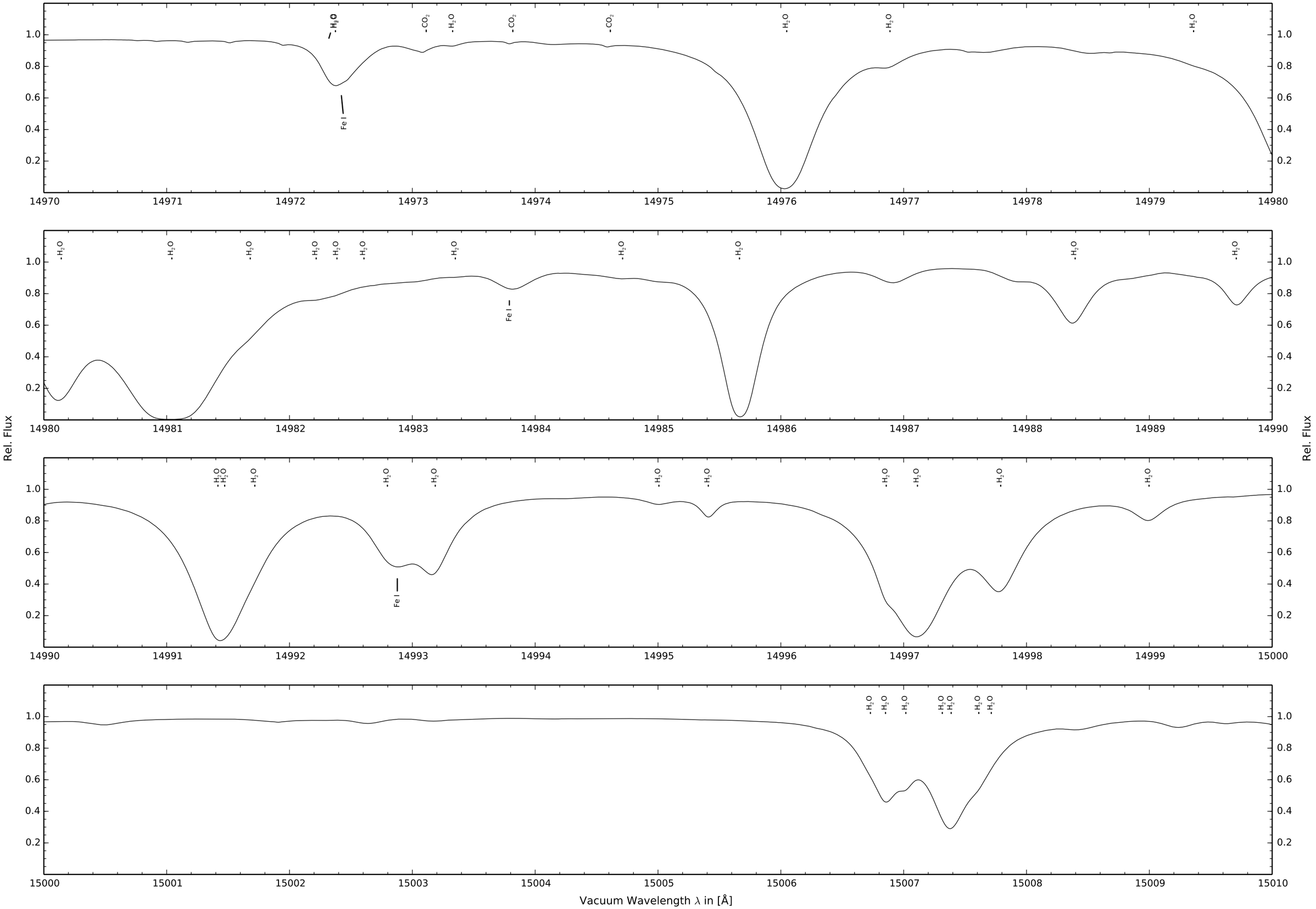
Vacuum Wavelength λ in [Å]

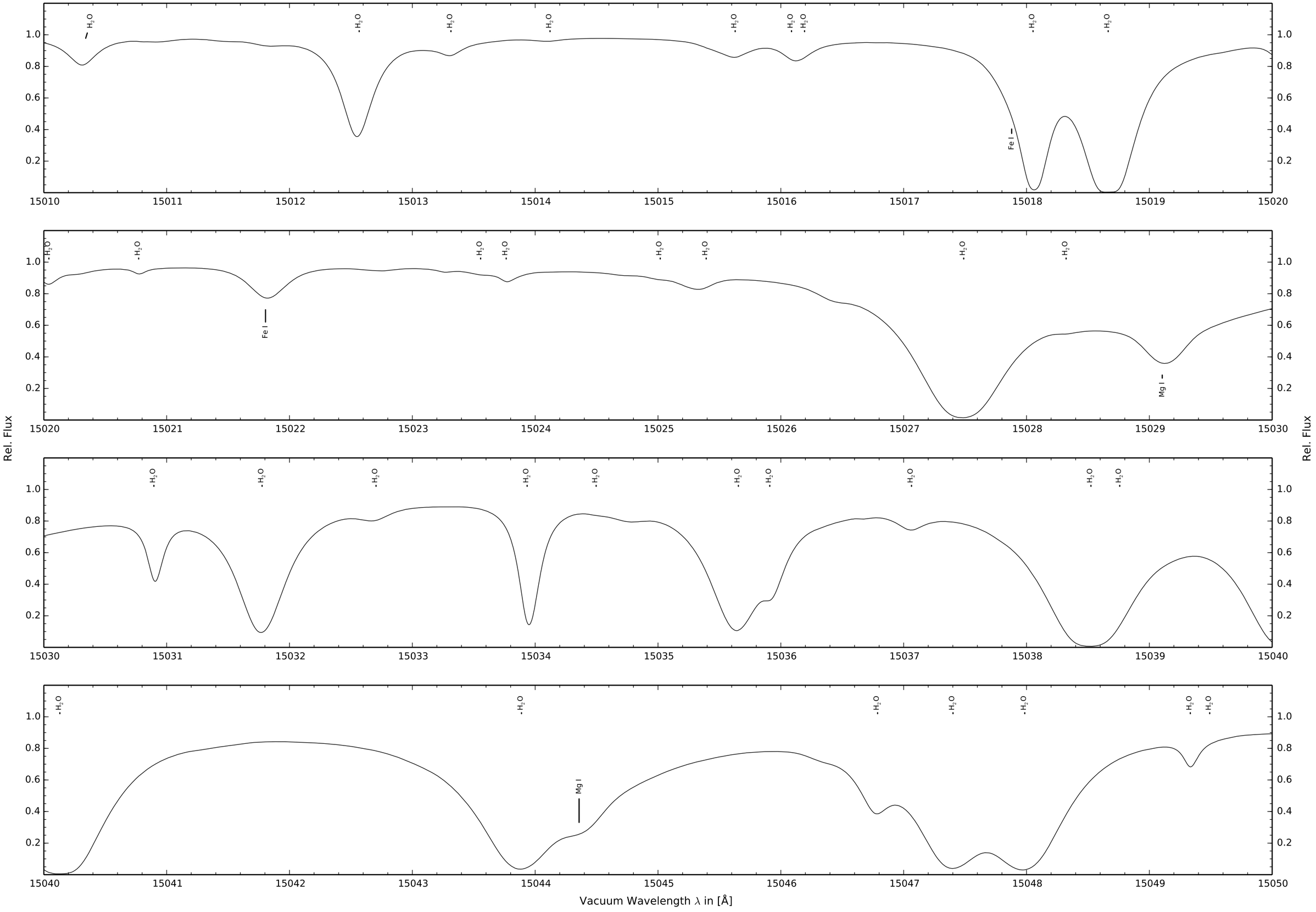

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Mg I
Ni I

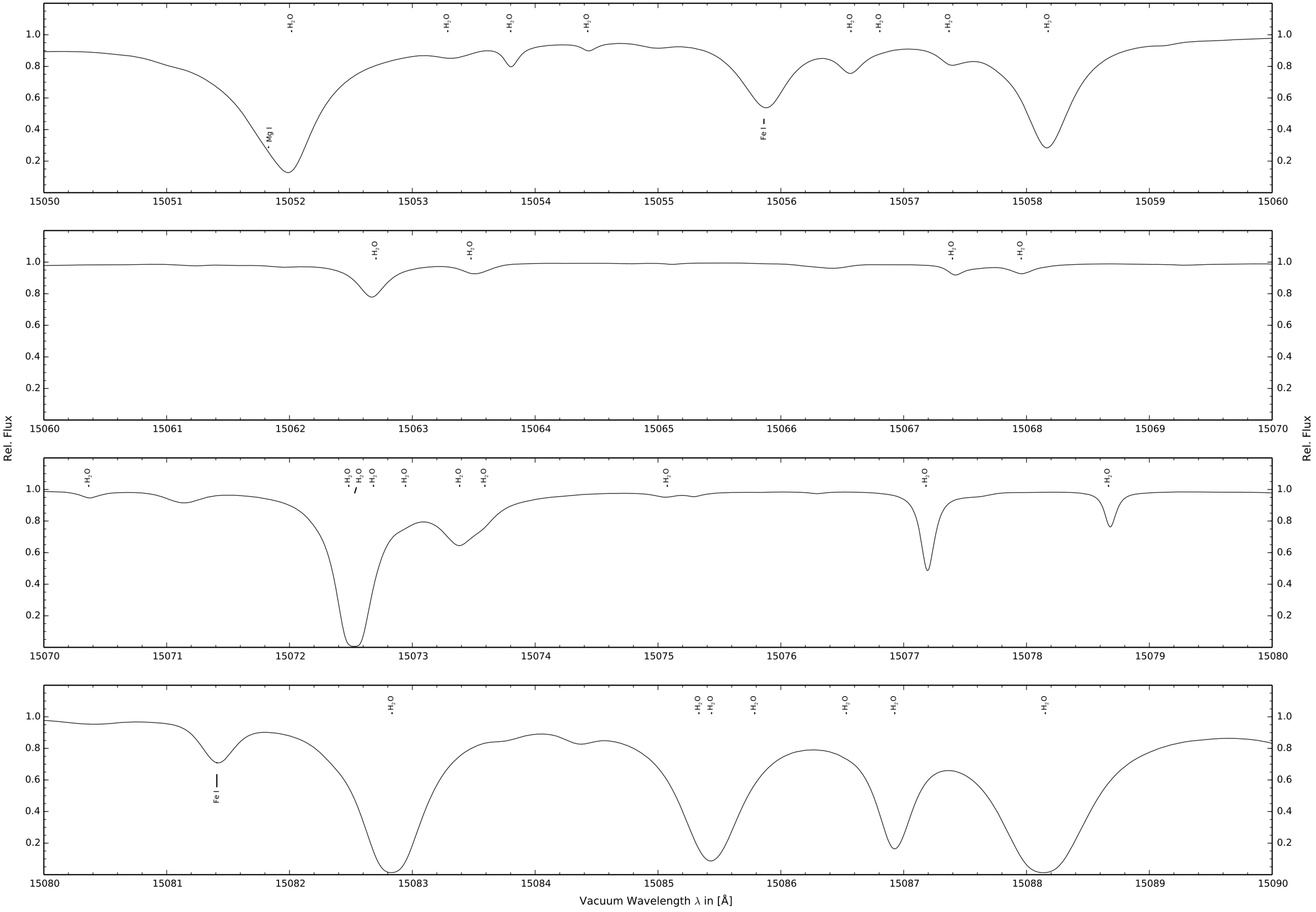
Rel. Flux

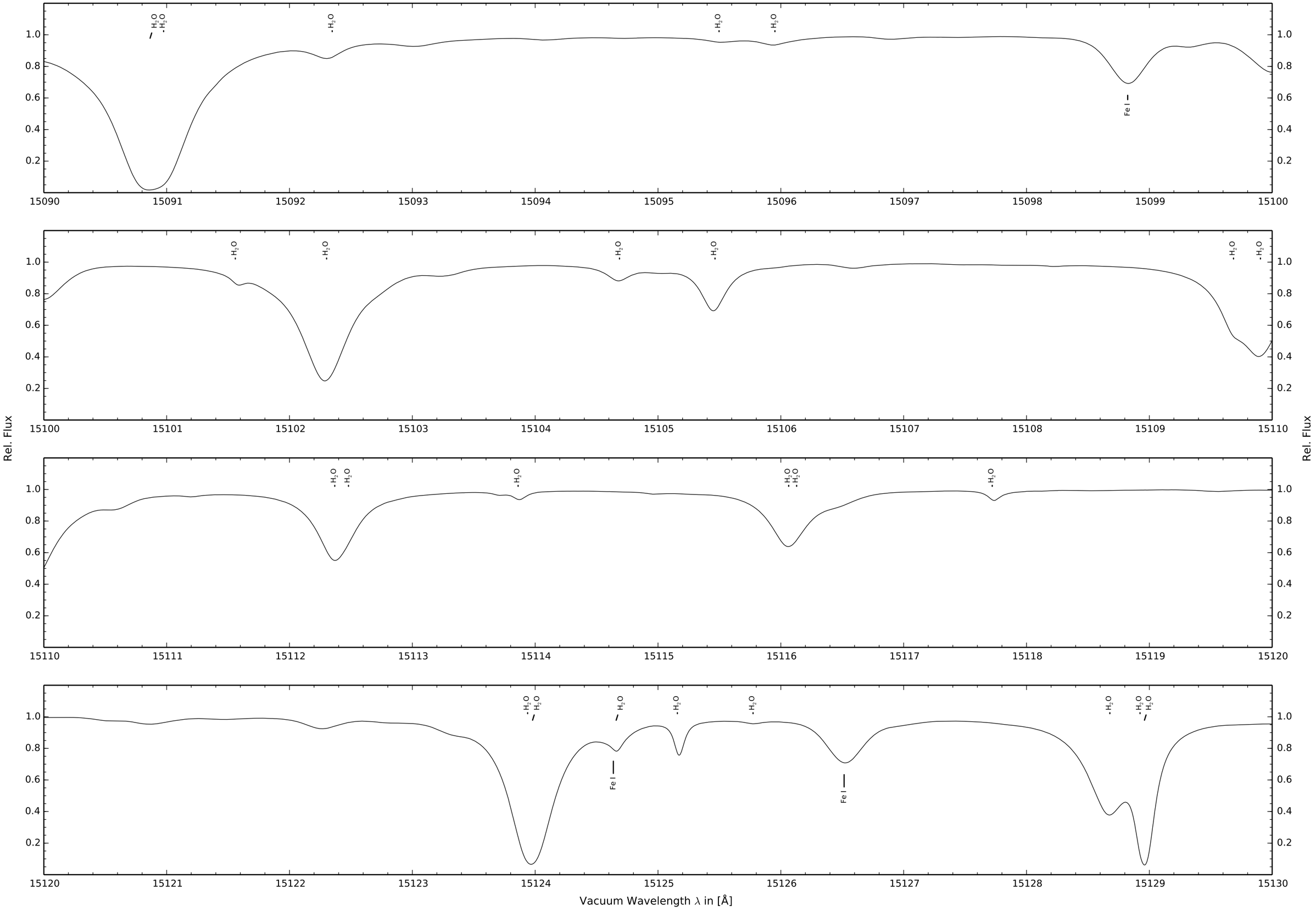
Vacuum Wavelength λ in [Å]

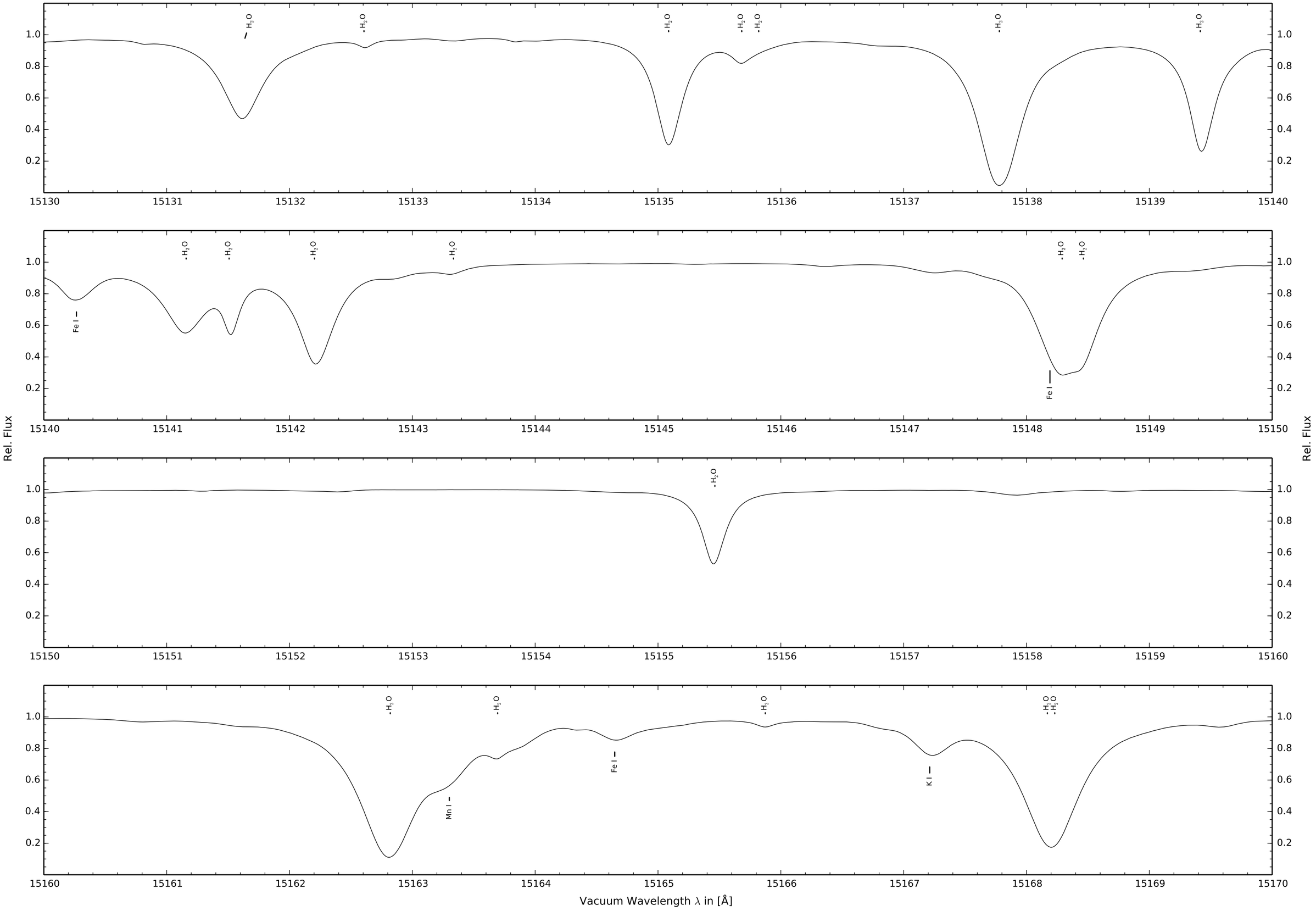

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

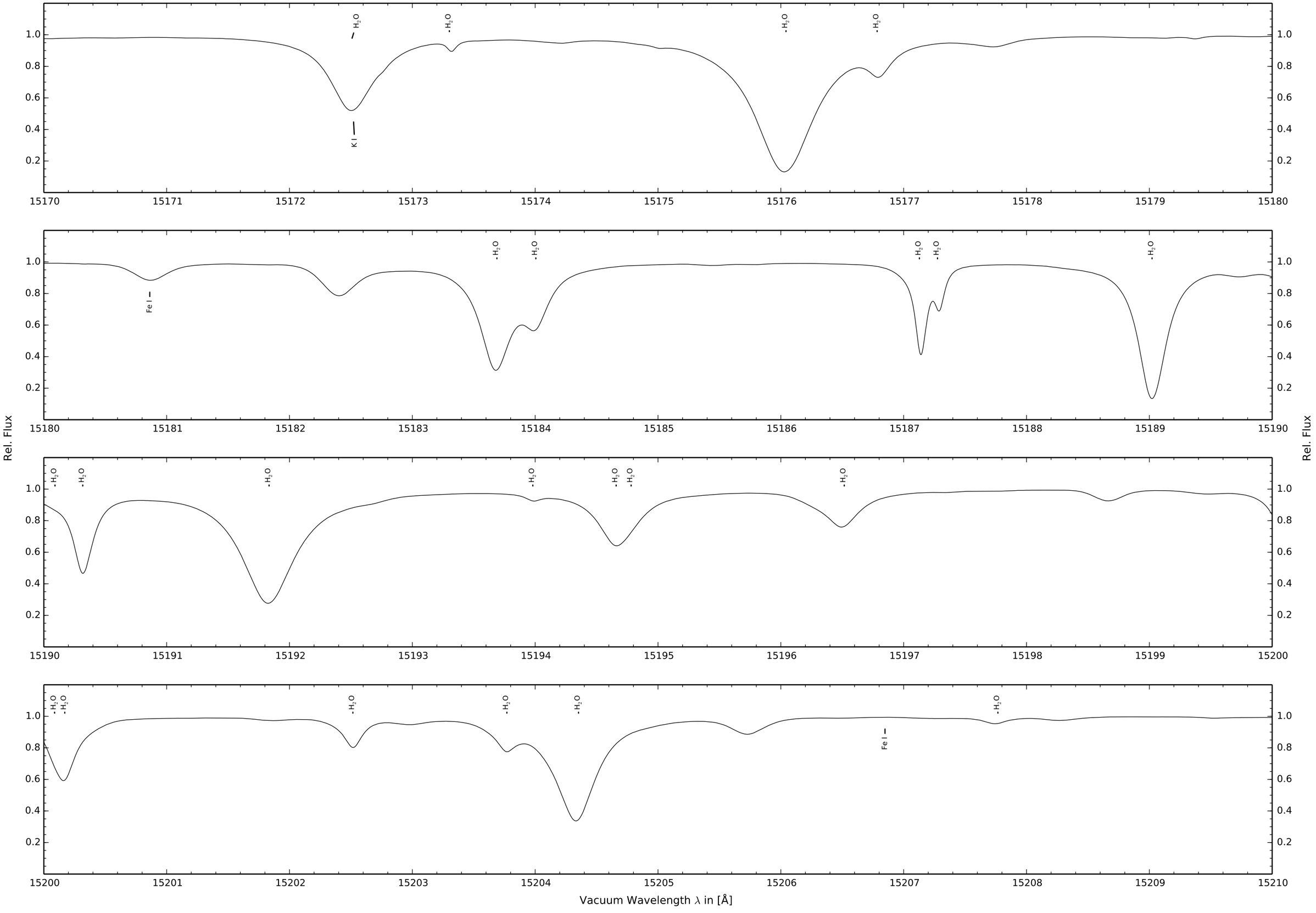

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
H_2O
CO_2

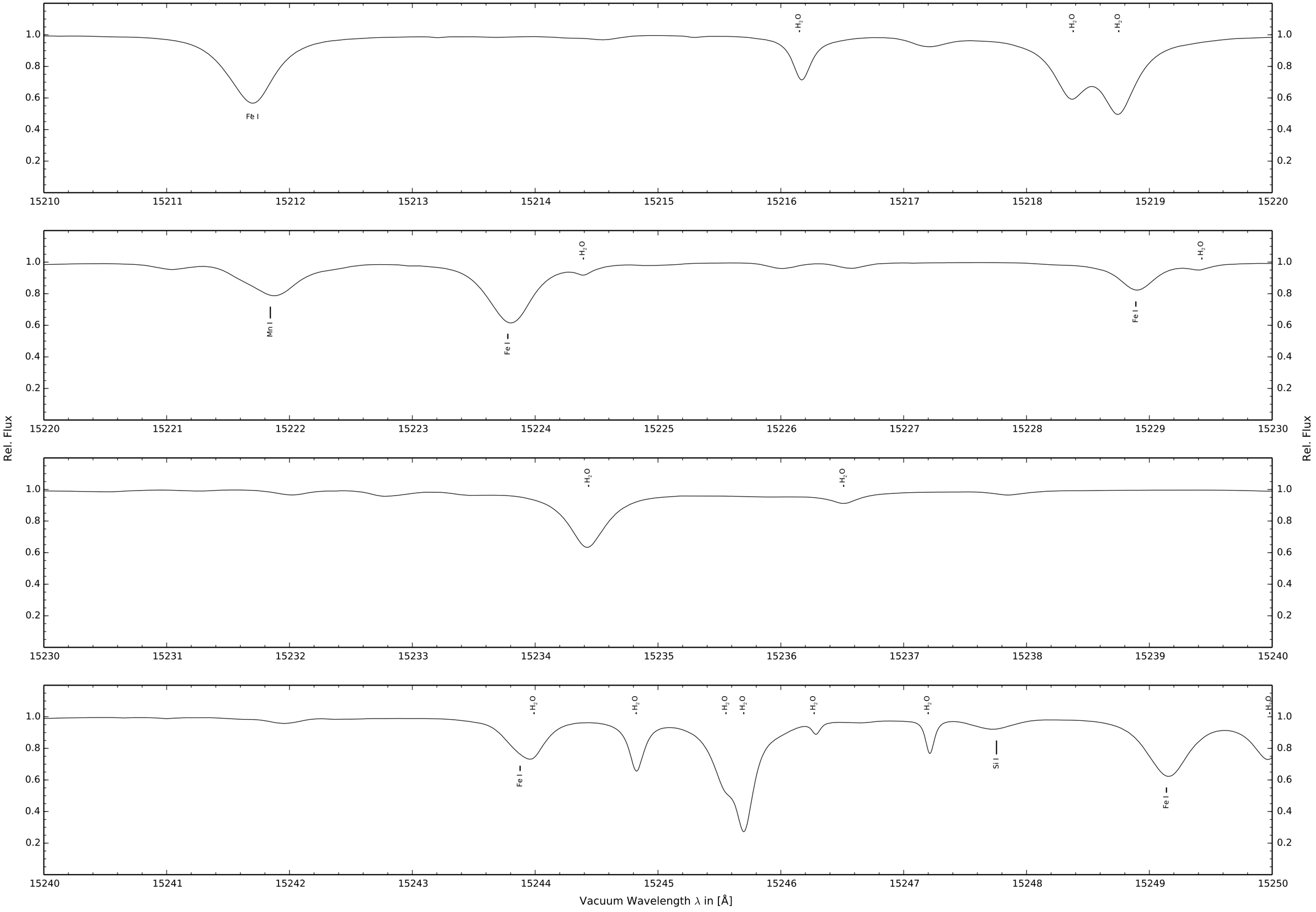

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Mg I


Rel. Flux
Vacuum Wavelength λ in [Å]
Mg I
Fe I
Fe I
H2O

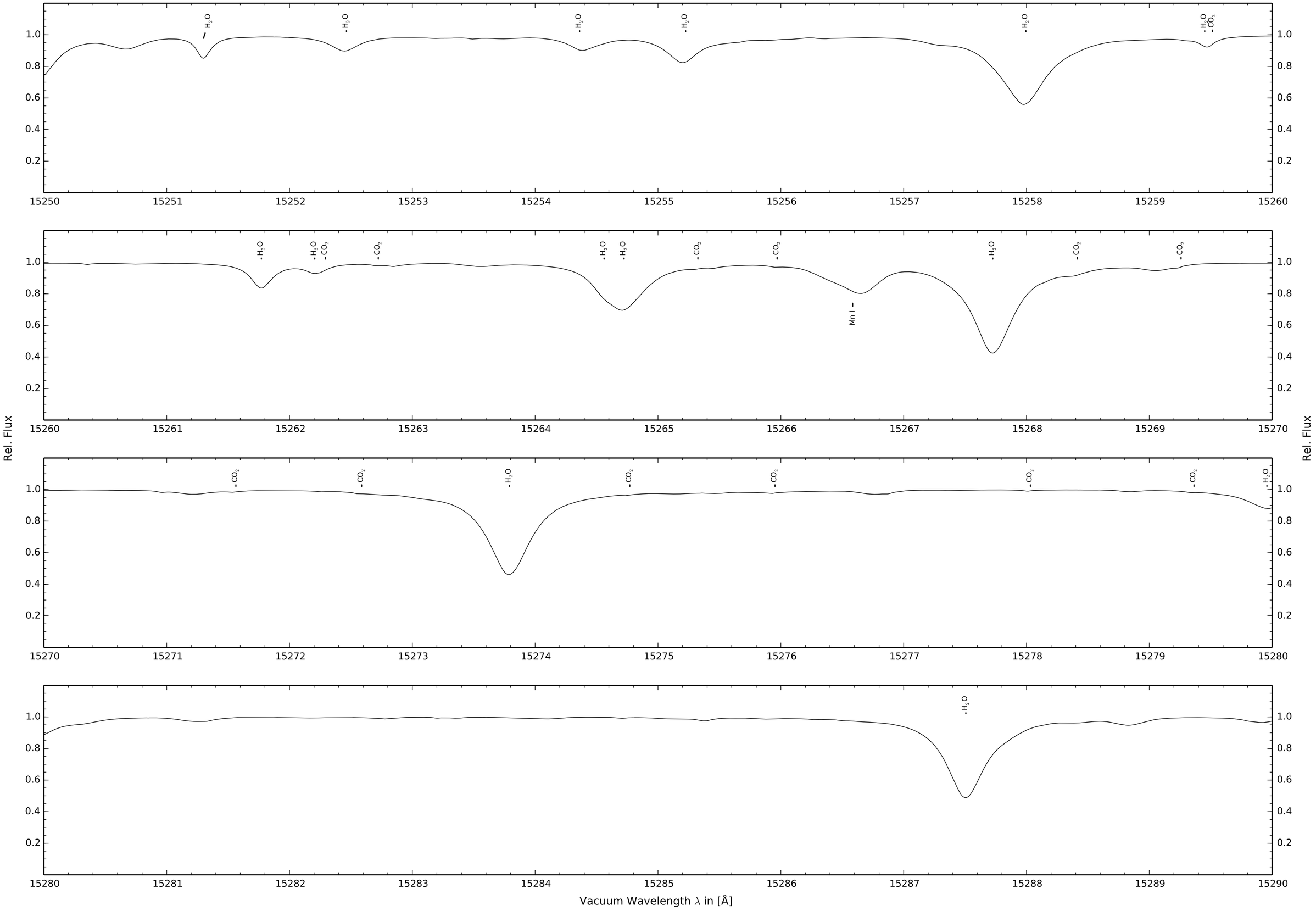

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Mn I
K I


H2O
K I
Fe I
Rel. Flux
Vacuum Wavelength λ in [Å]

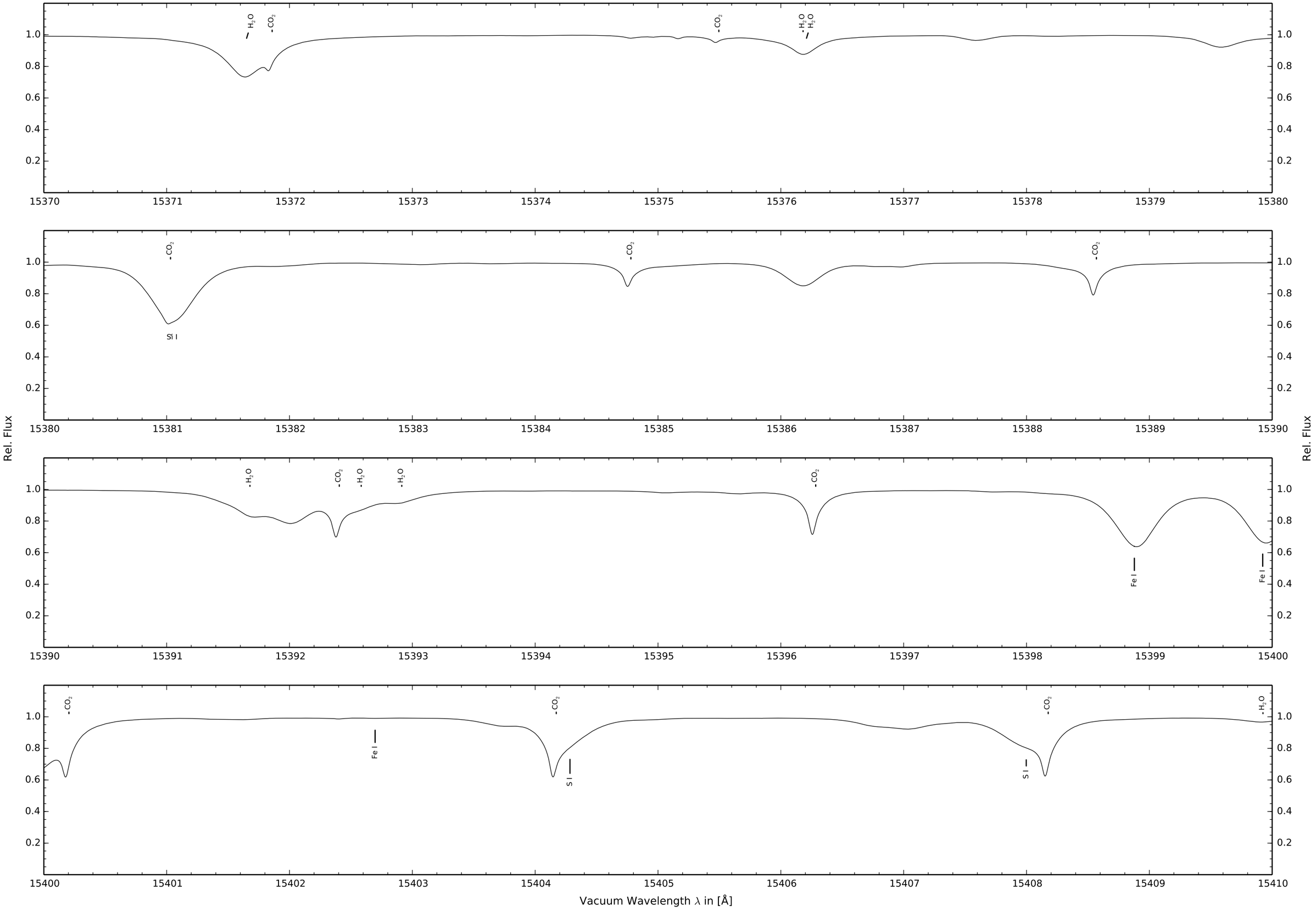


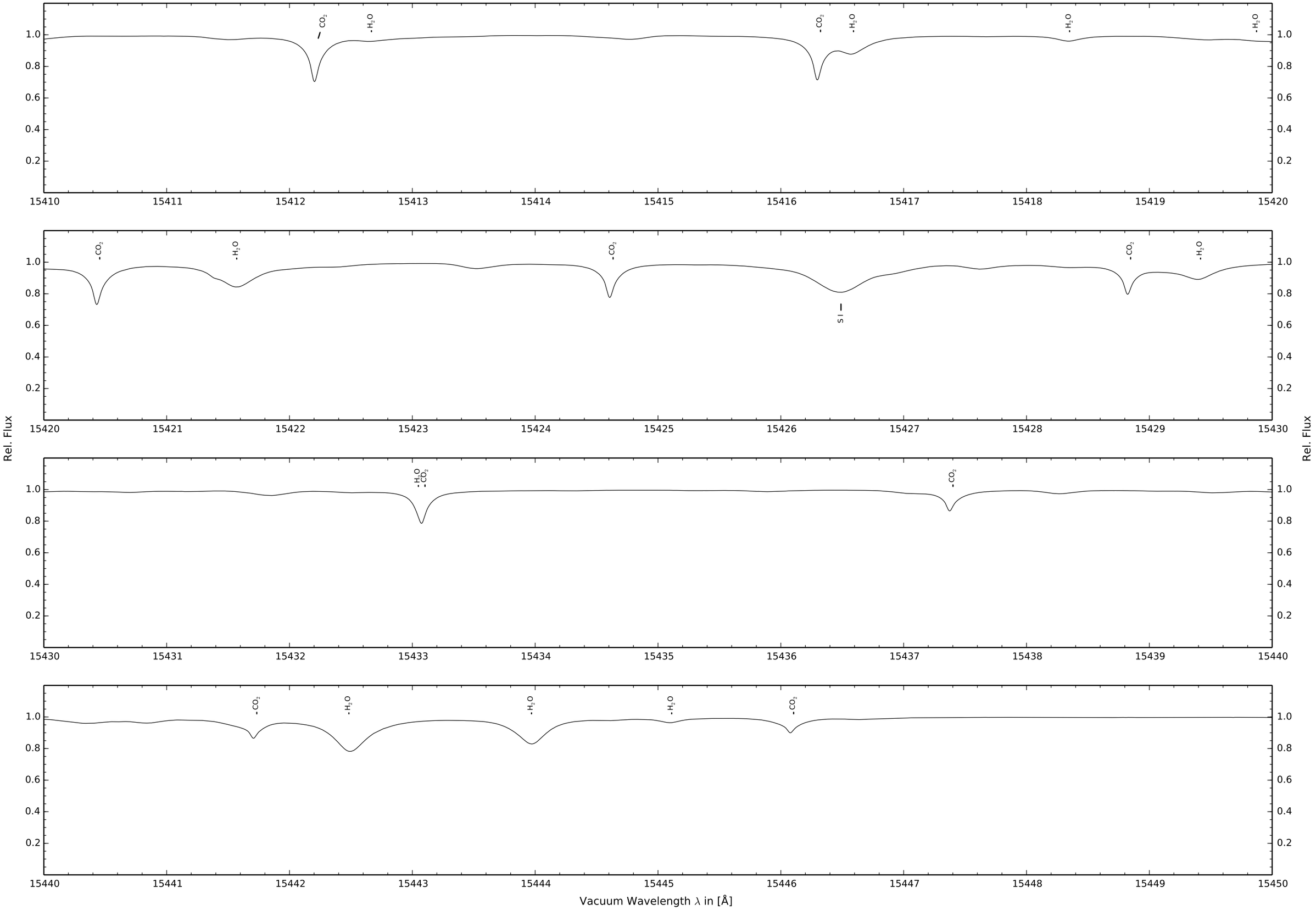
Rel. Flux
Fe I
H2O
Mn I
Si I
Vacuum Wavelength λ in [Å]

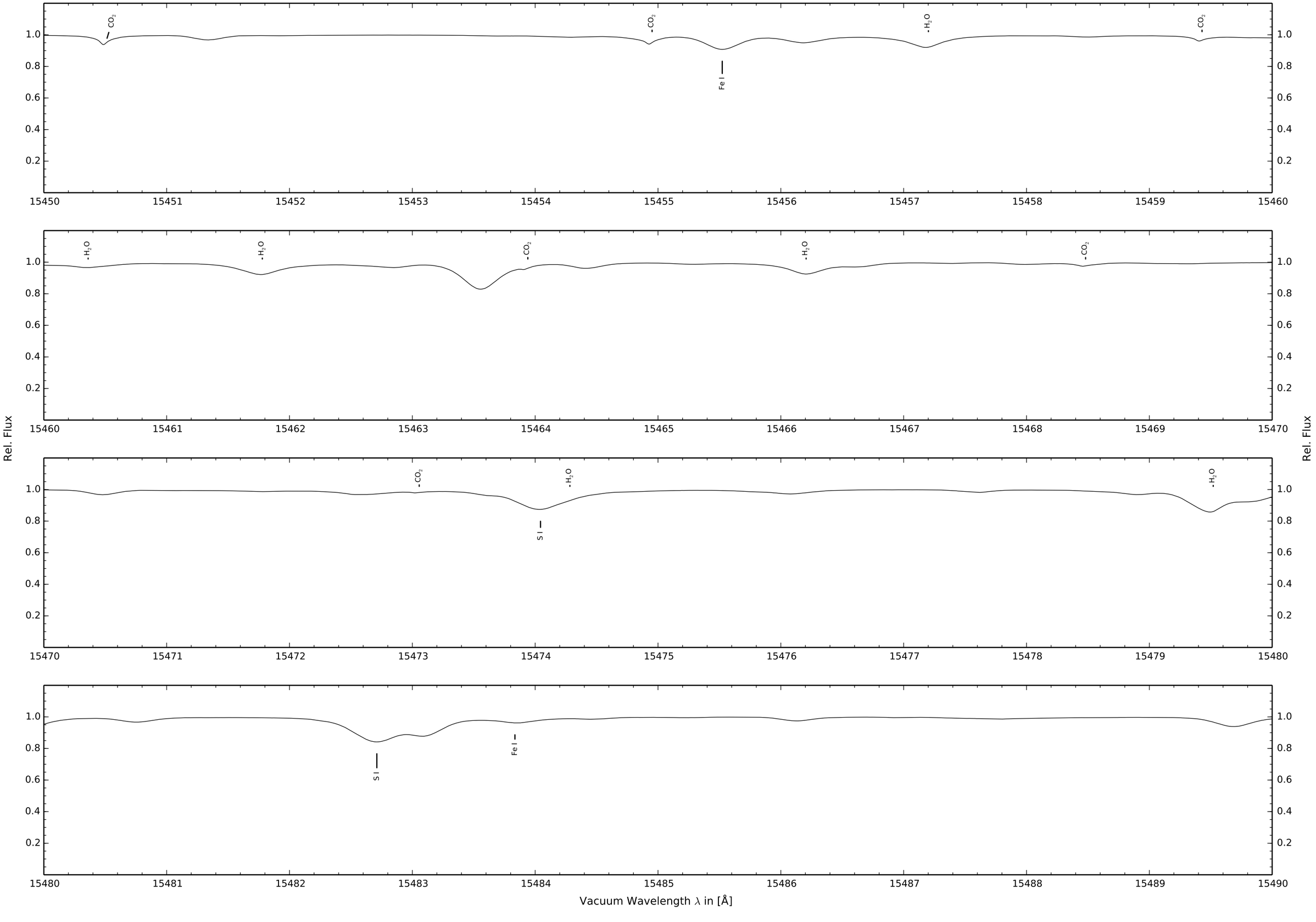

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Mn I

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Fe I

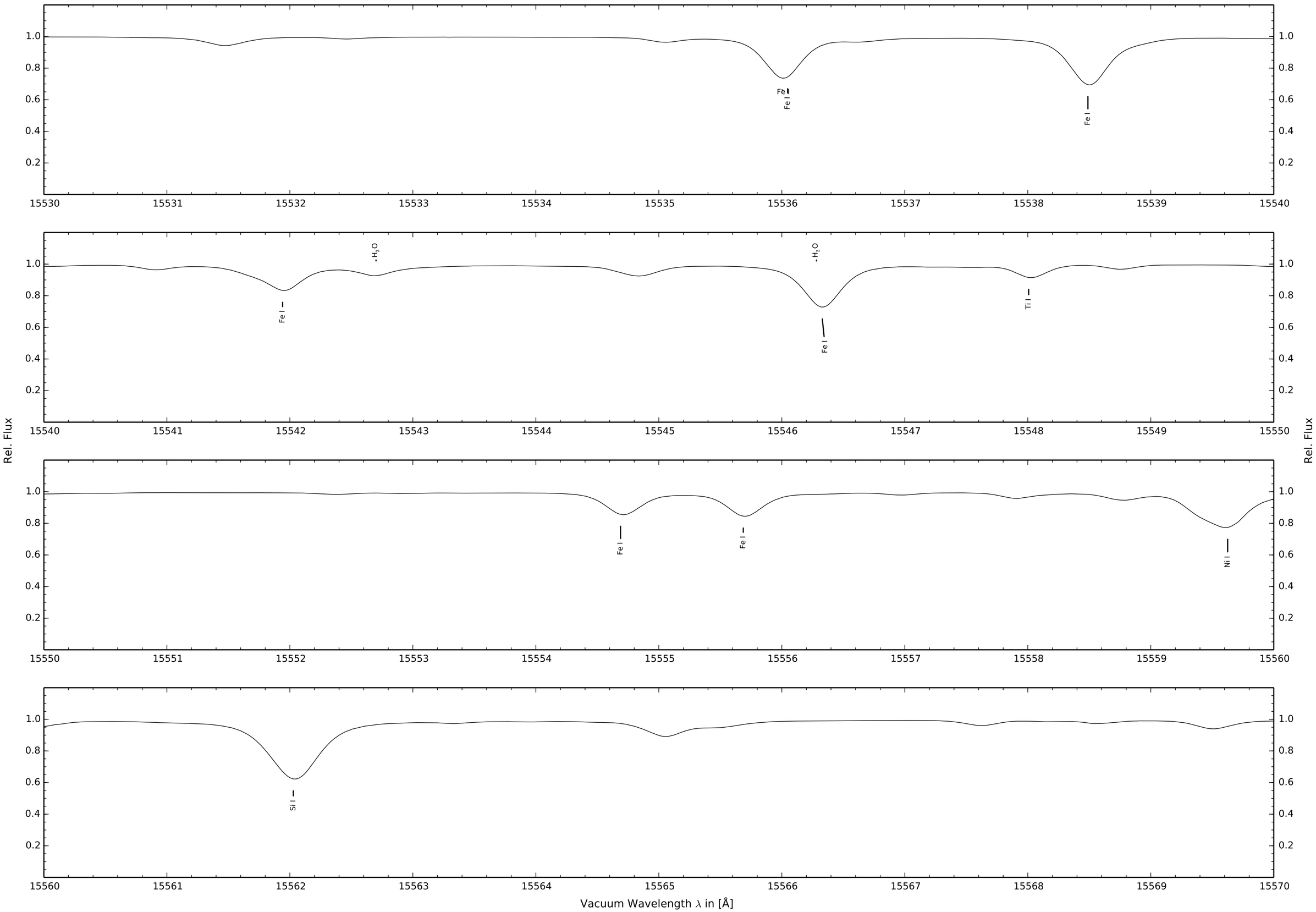
Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Ti I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Si I
Fe I
S I


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
S I

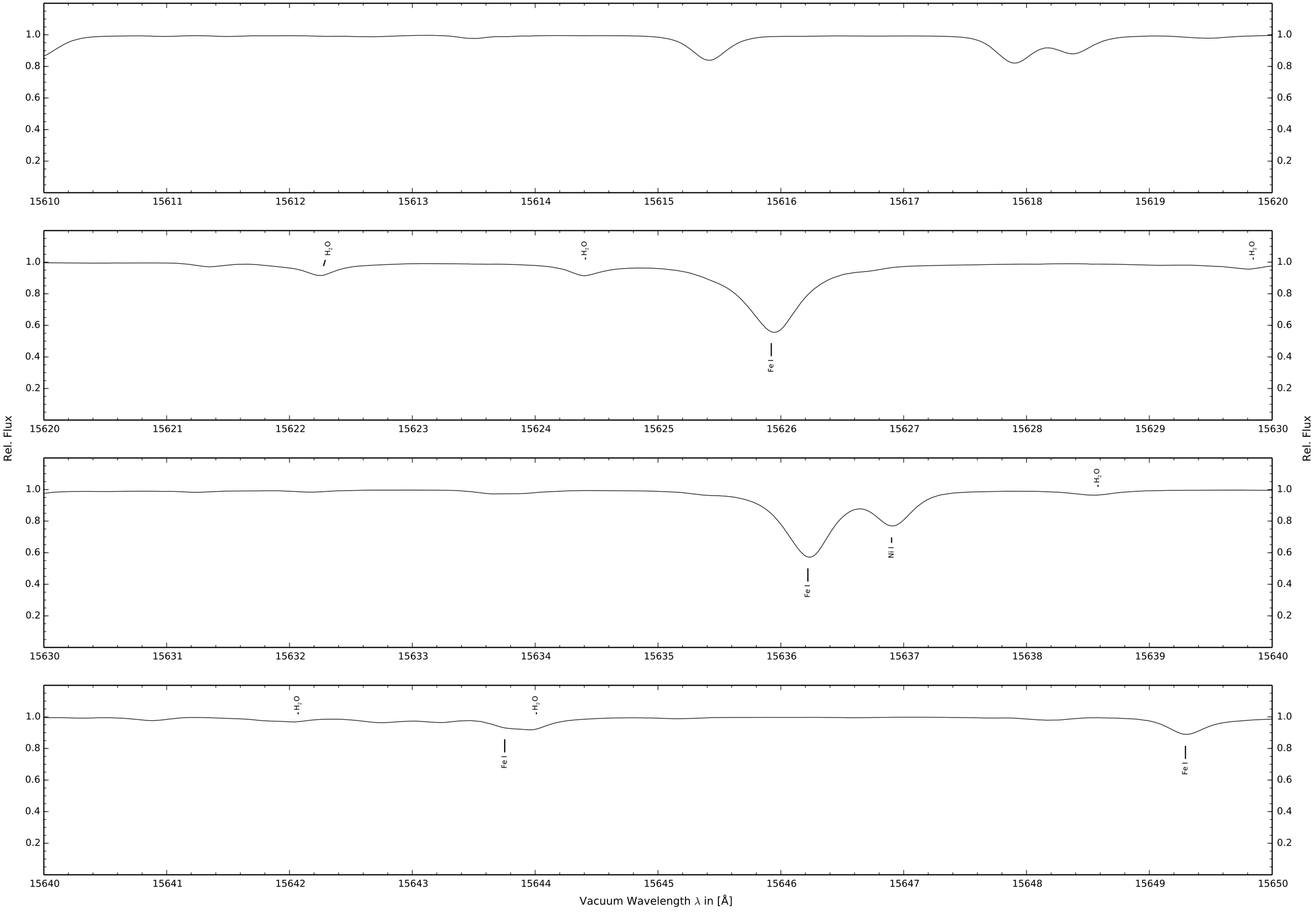

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
S I

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I



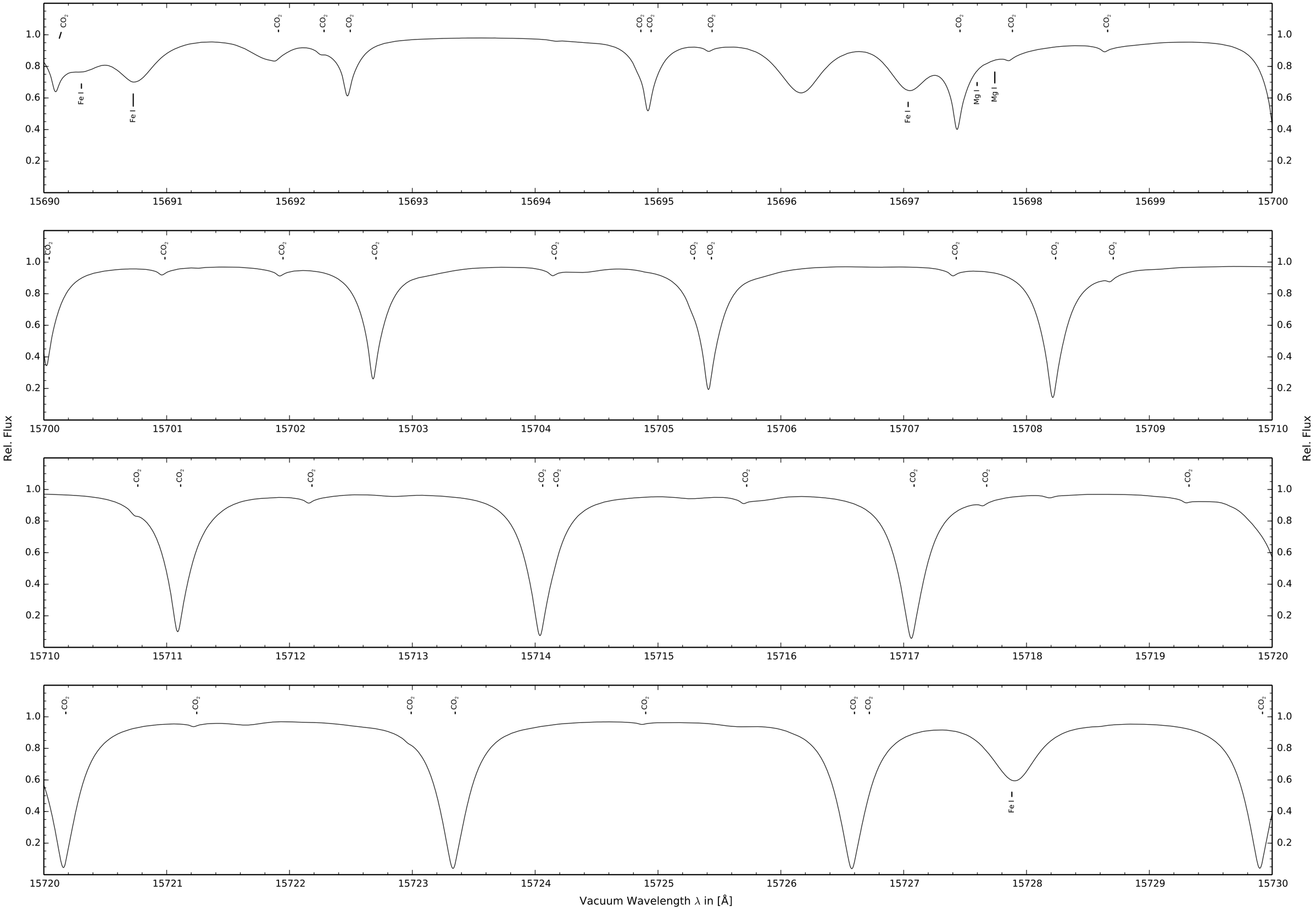
Rel. Flux
Fe I
Fe I
Fe I
H2O
H2O
Fe I
Fe I
Ti I
Fe I
Fe I
Ni I
Si I
Vacuum Wavelength λ in [Å]

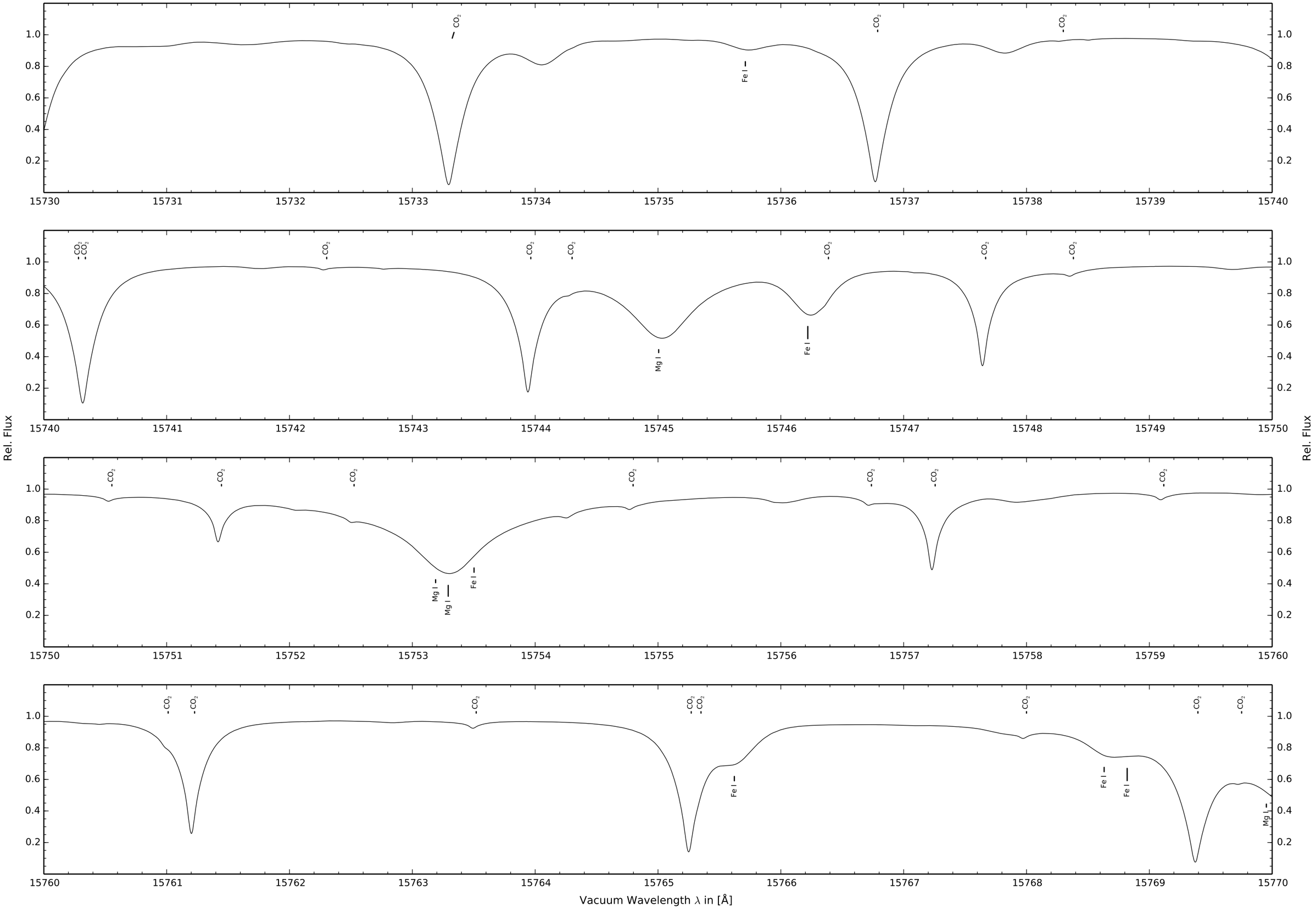
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ni I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ni I

Rel. Flux

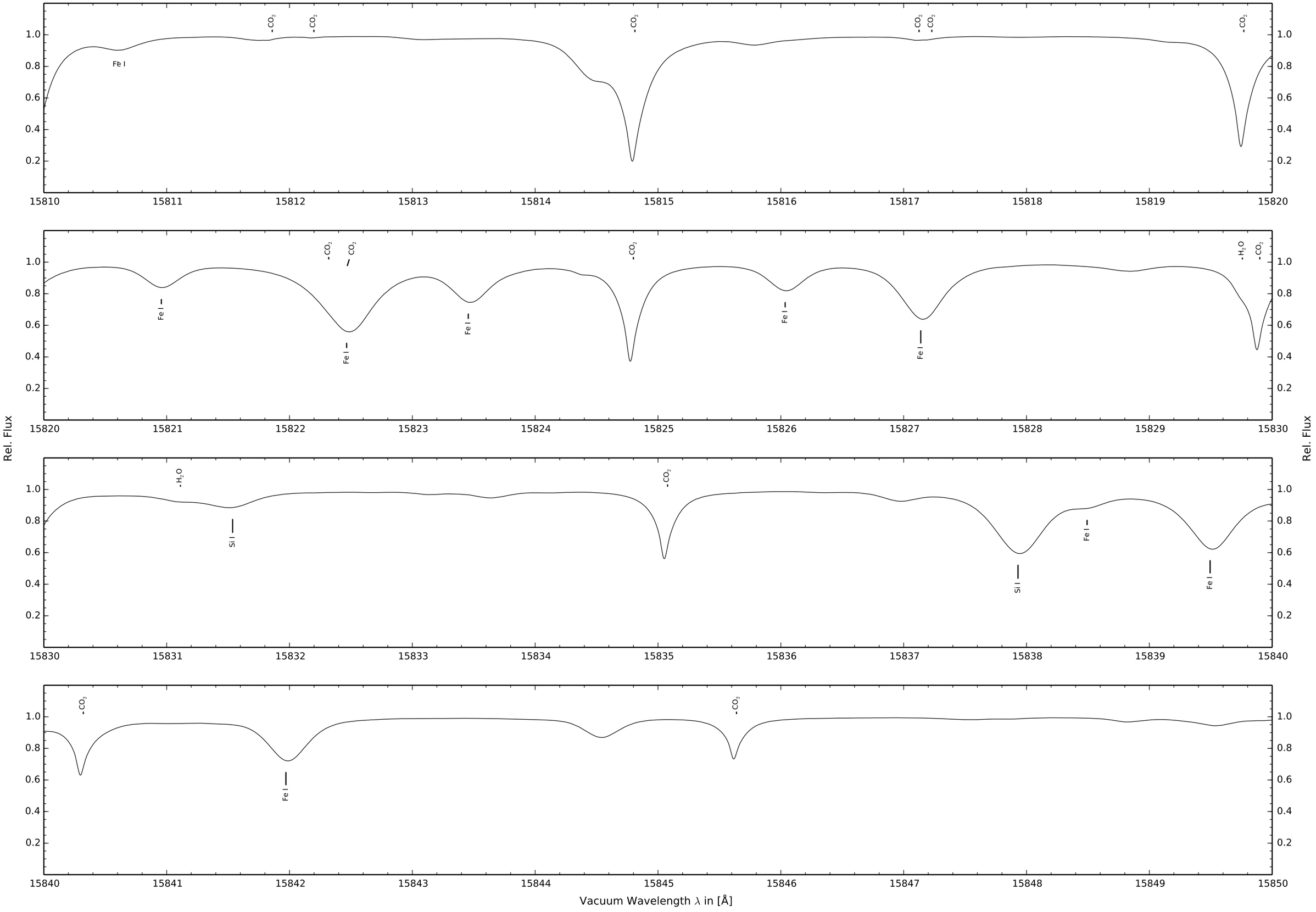
Vacuum Wavelength λ in [Å]

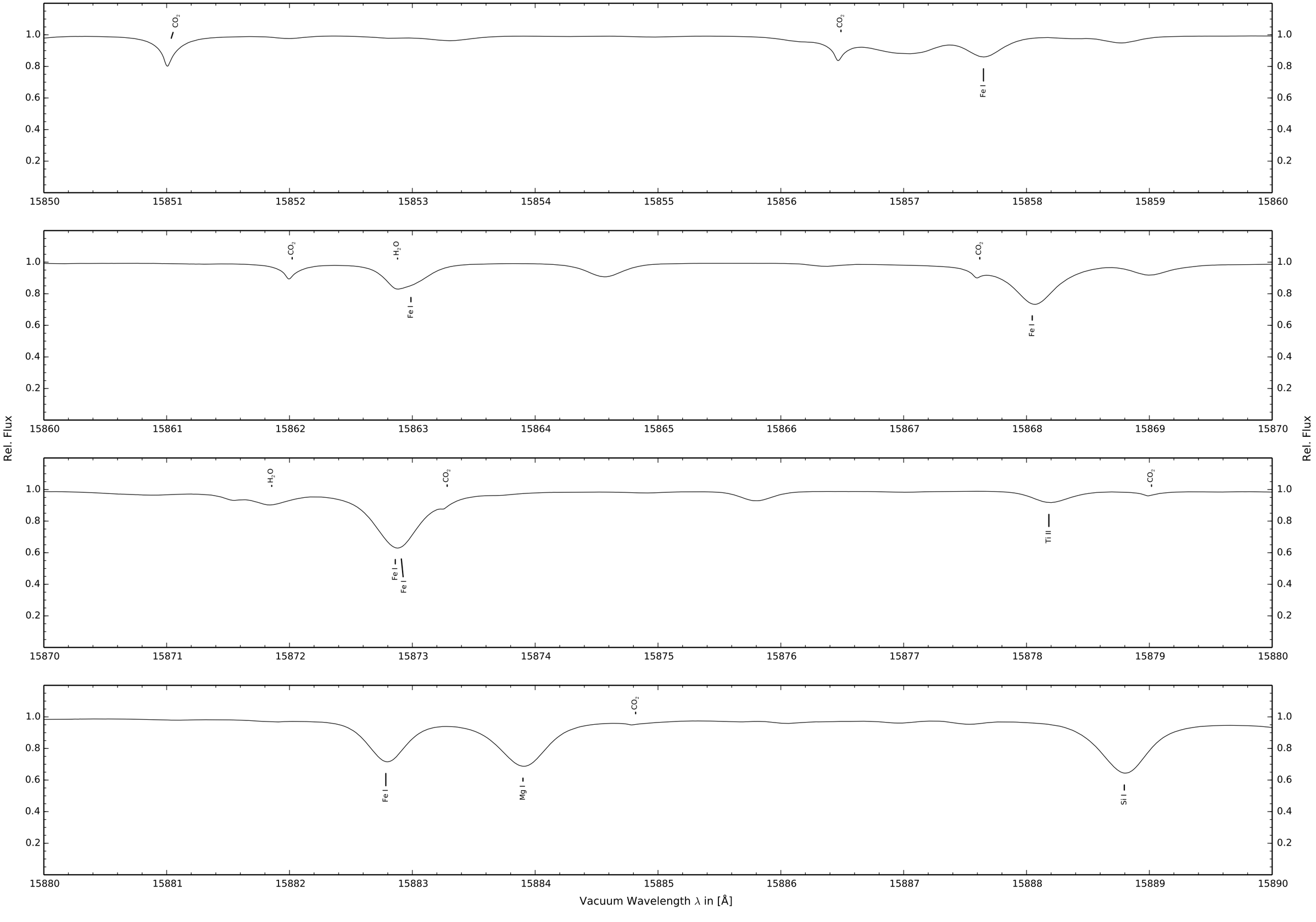

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
Fe I
Mg I

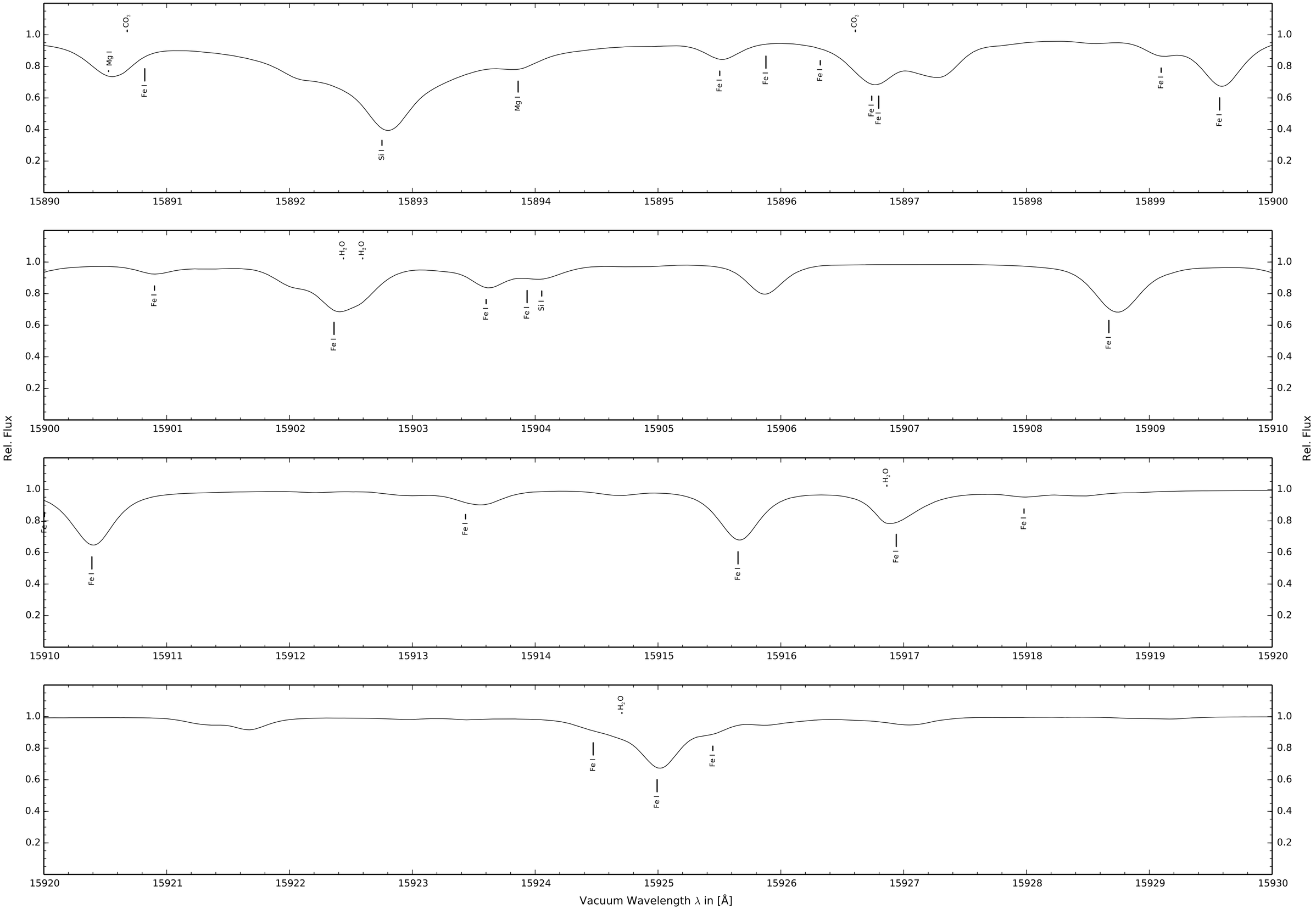

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
Fe I
Mg I

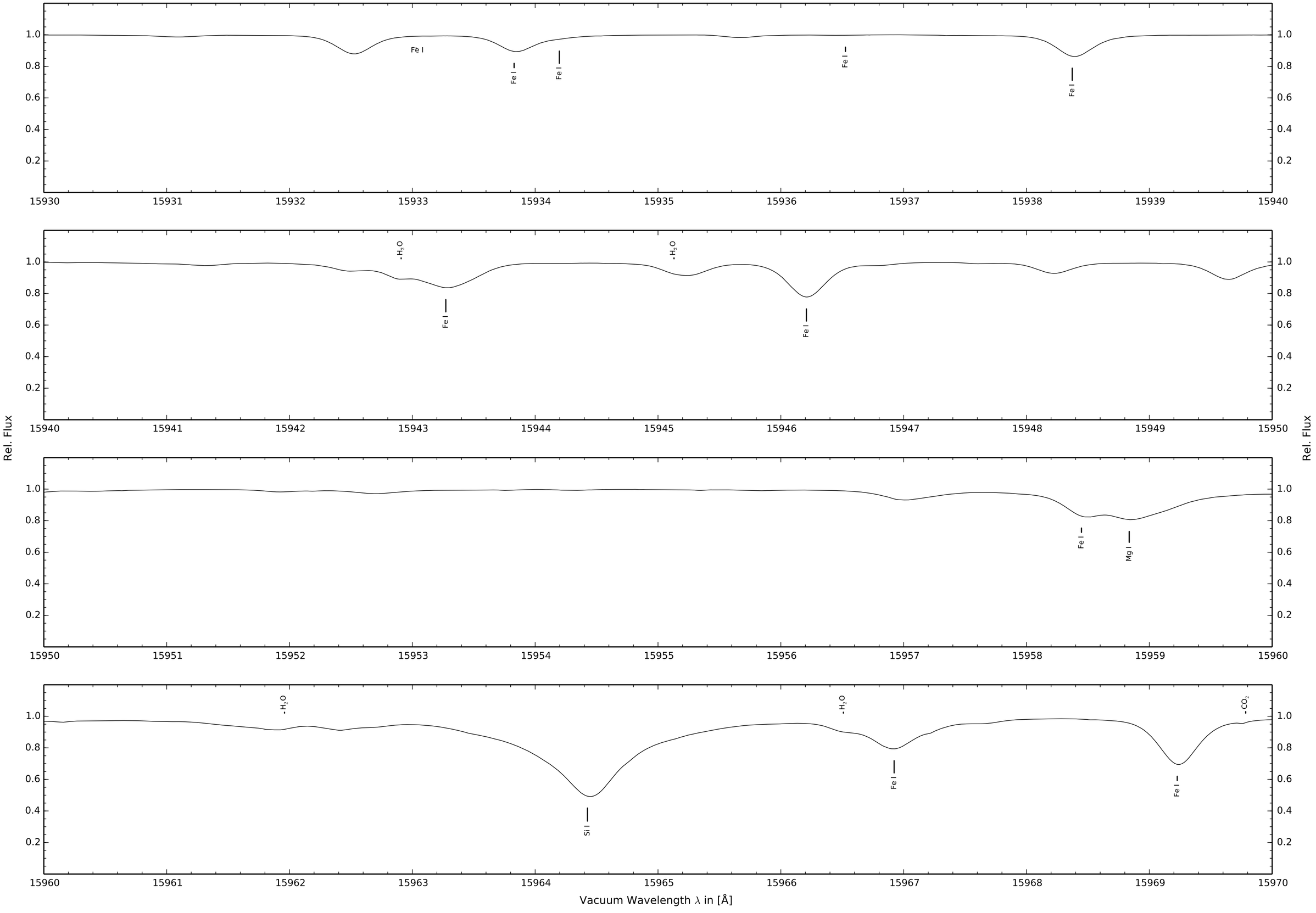
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
CO2
H2O
Si I


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
Ti II
Mg I
Si I


Rel. Flux
Mg I
CO_2
Fe I
Si I
Mg I
Fe I
Fe I
Fe I
CO_2
Fe I
Fe I
Fe I
Fe I
H_2O
H_2O
Fe I
Fe I
Fe I
Fe I
Si I
Fe I
Fe I
H_2O
Fe I
Fe I
H_2O
Fe I
Fe I
H_2O
Fe I
Fe I
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Fe I
Fe I
Fe I
-H2O
-H2O
Fe I
Fe I
Fe I
Mg I
-H2O
-H2O
-CO2
Fe I
Si I
Fe I
1.0
0.8
0.6
0.4
0.2
15930
15931
15932
15933
15934
15935
15936
15937
15938
15939
15940
15941
15942
15943
15944
15945
15946
15947
15948
15949
15950
15951
15952
15953
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15955
15956
15957
15958
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15962
15963
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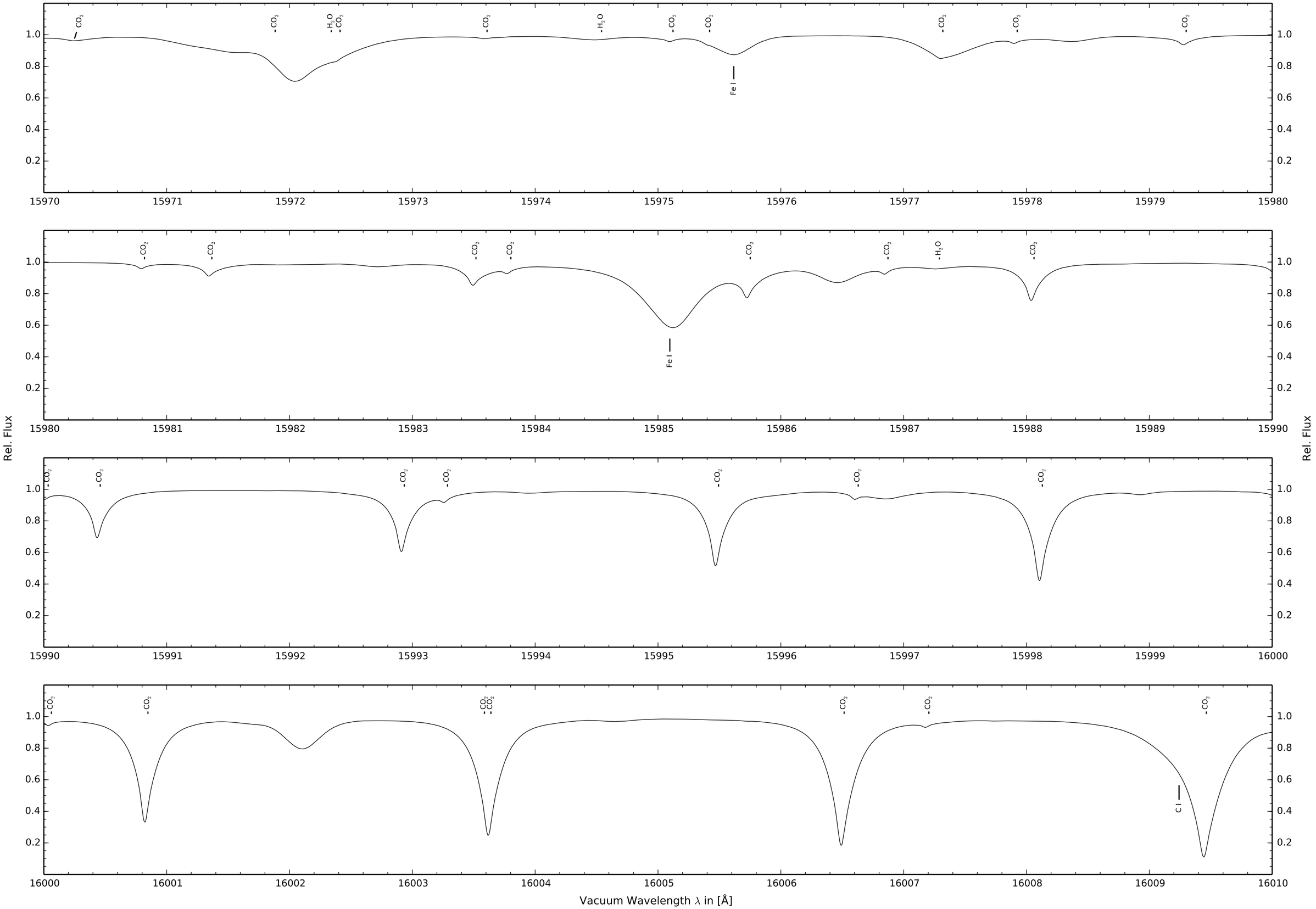
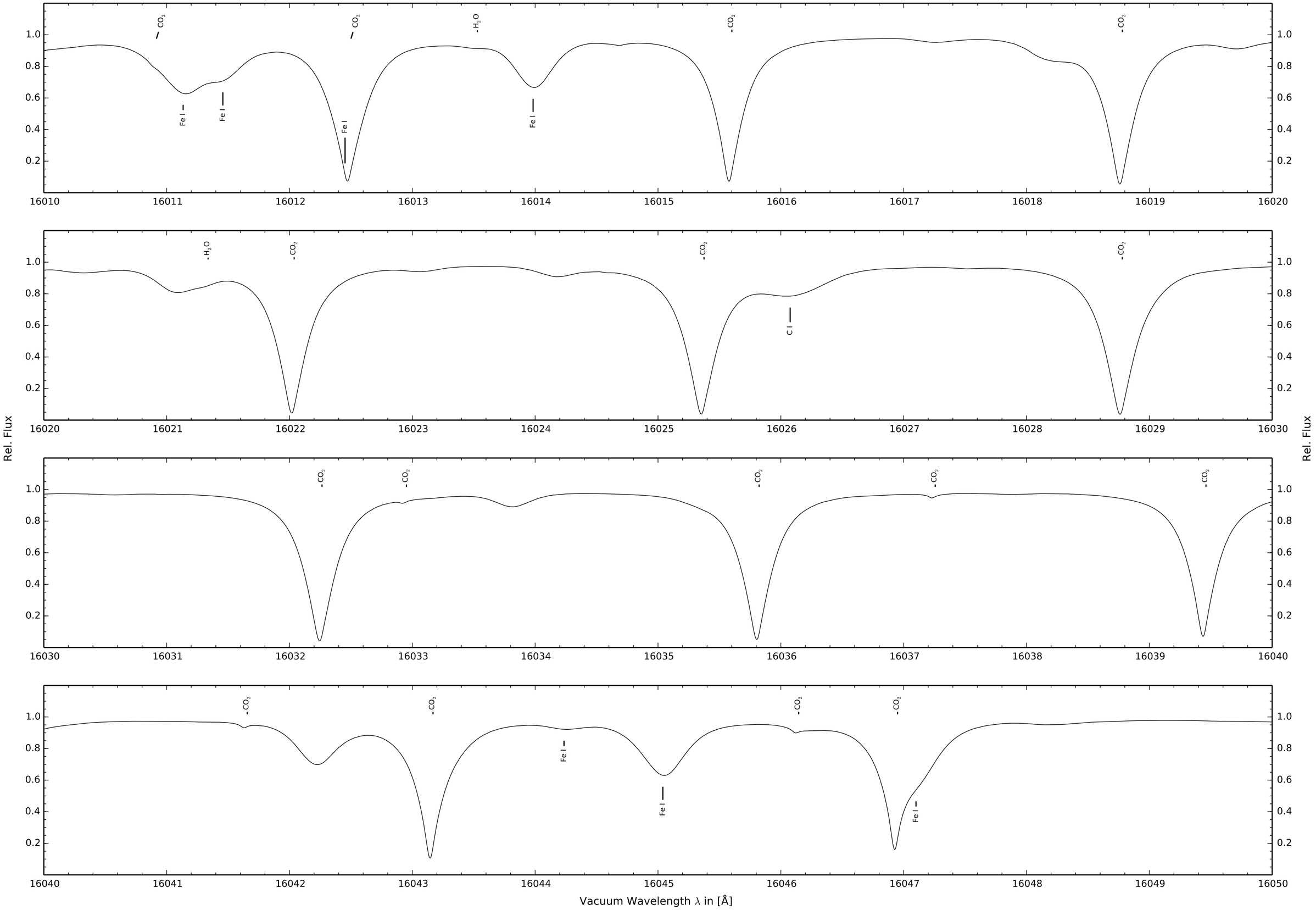
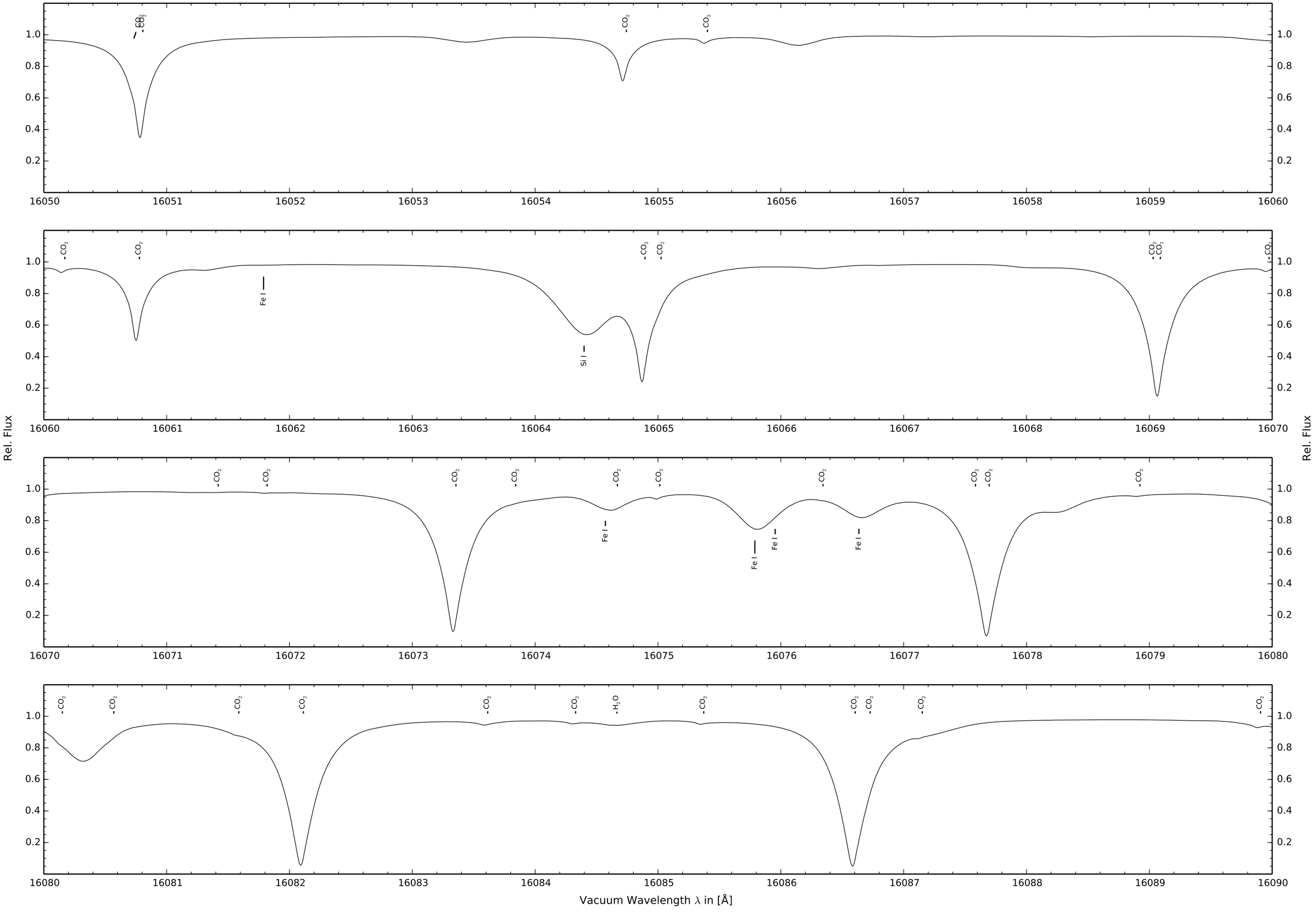
15965
15966
15967
15968
15969
15970
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
C I


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
C I

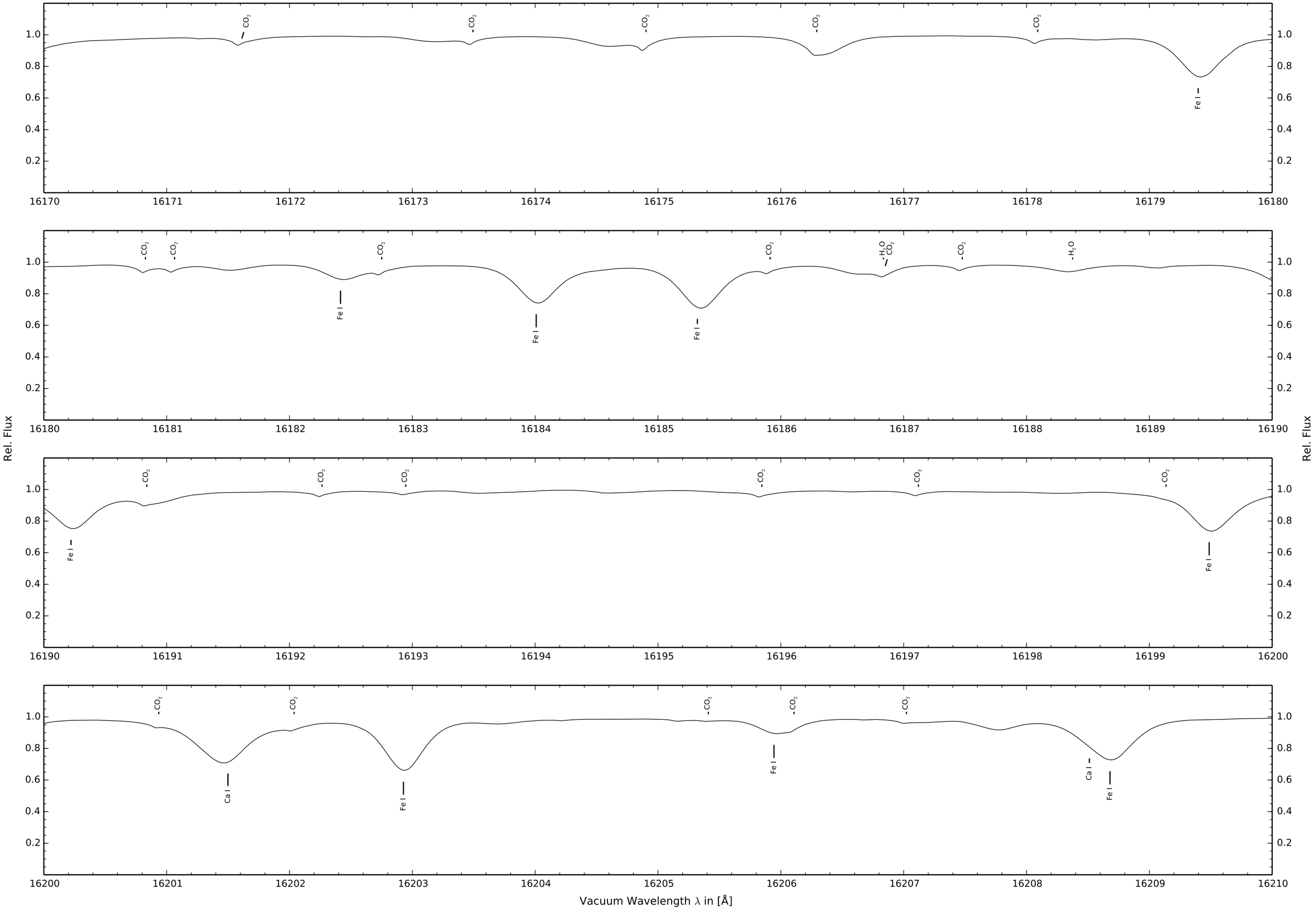

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
Si I

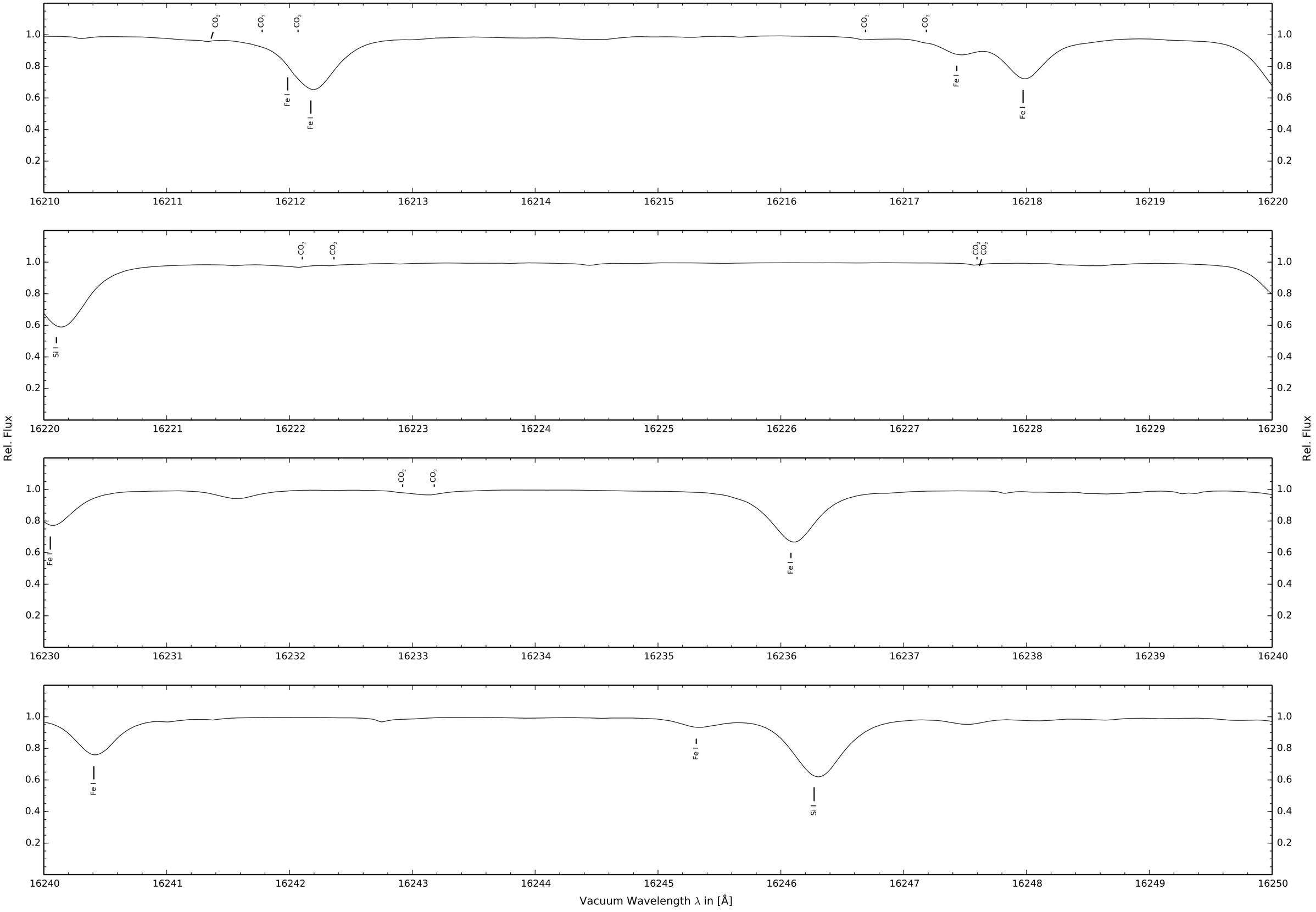
Rel. Flux

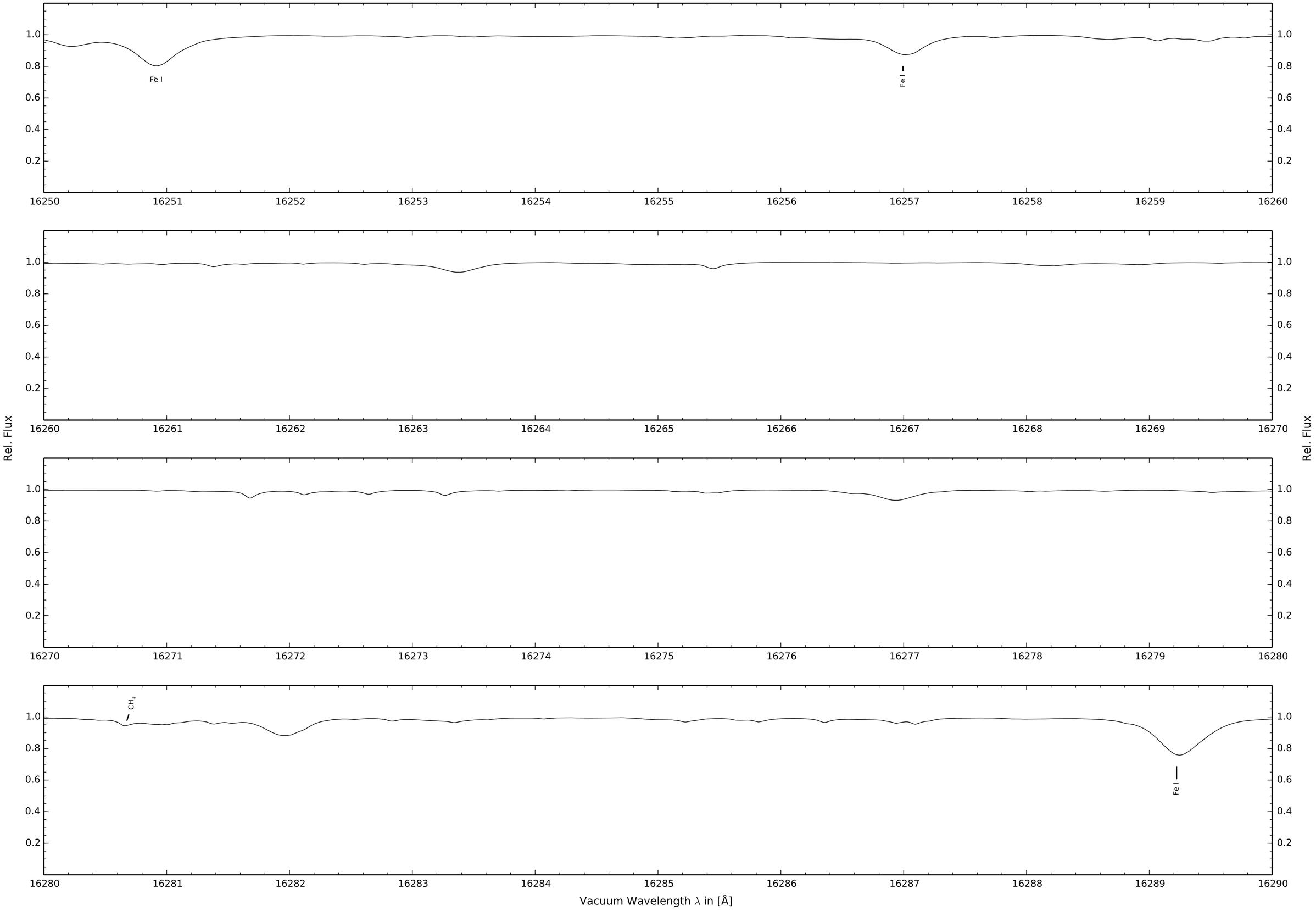
Vacuum Wavelength λ in [Å]

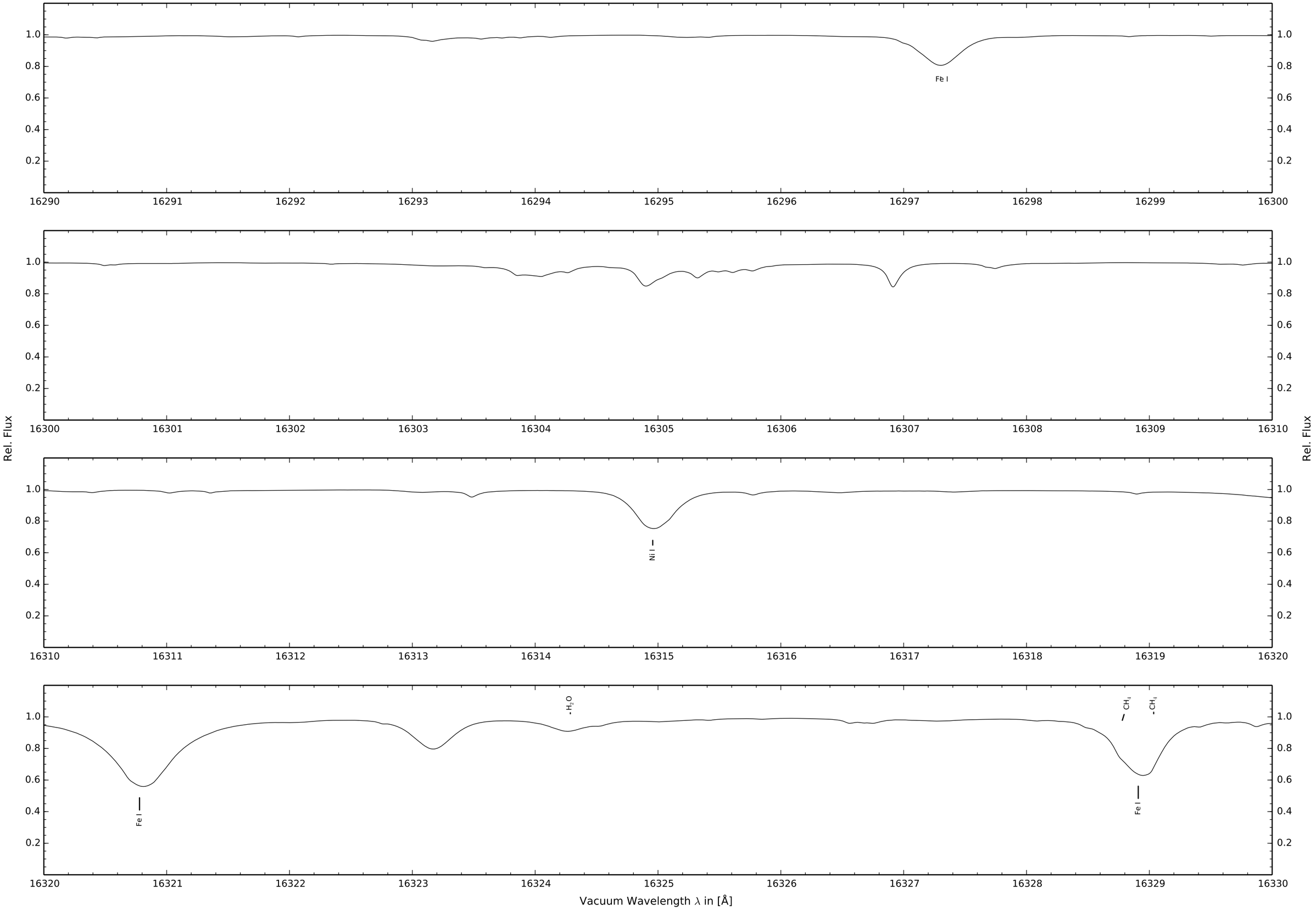
Rel. Flux

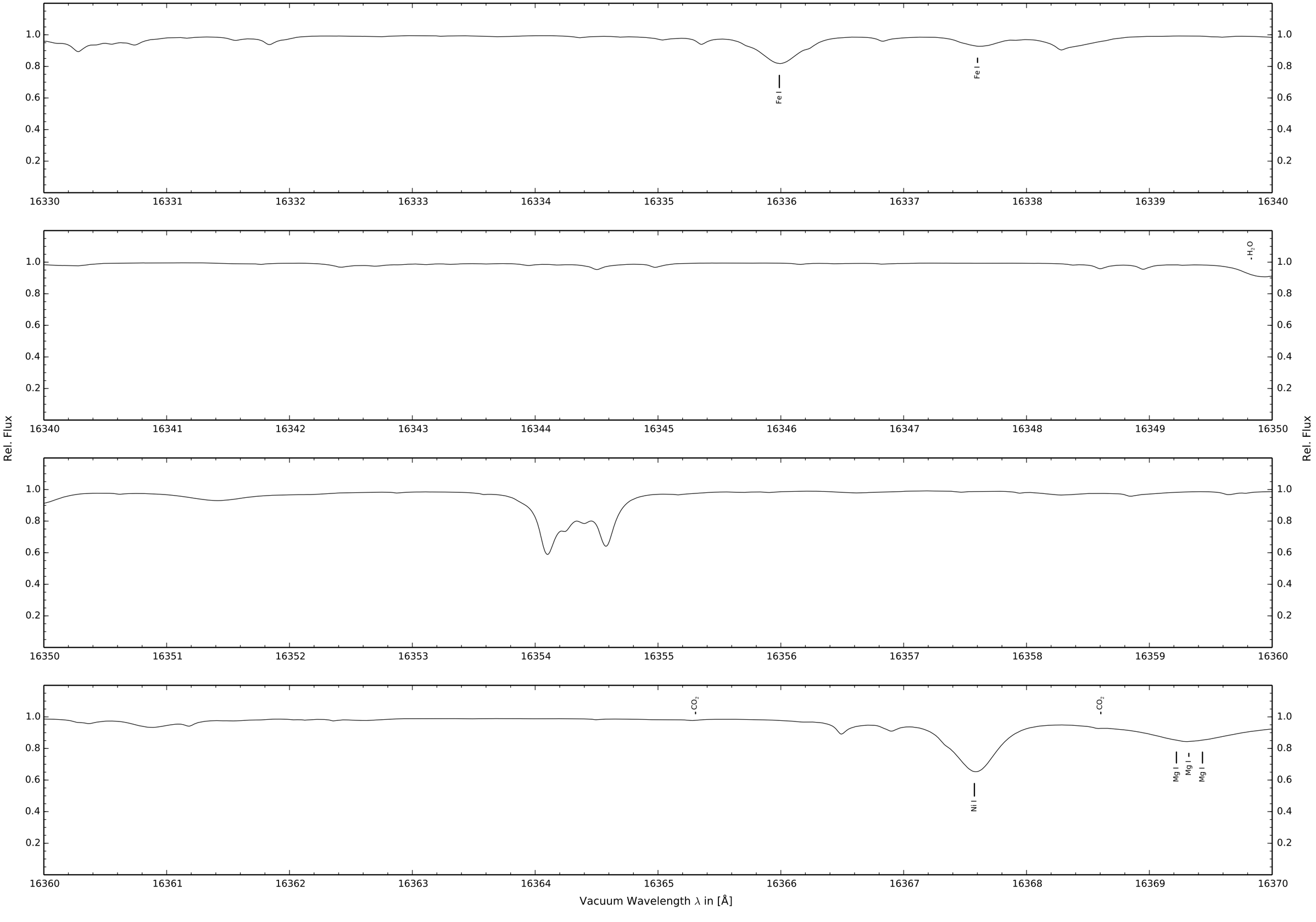
Vacuum Wavelength λ in [Å]

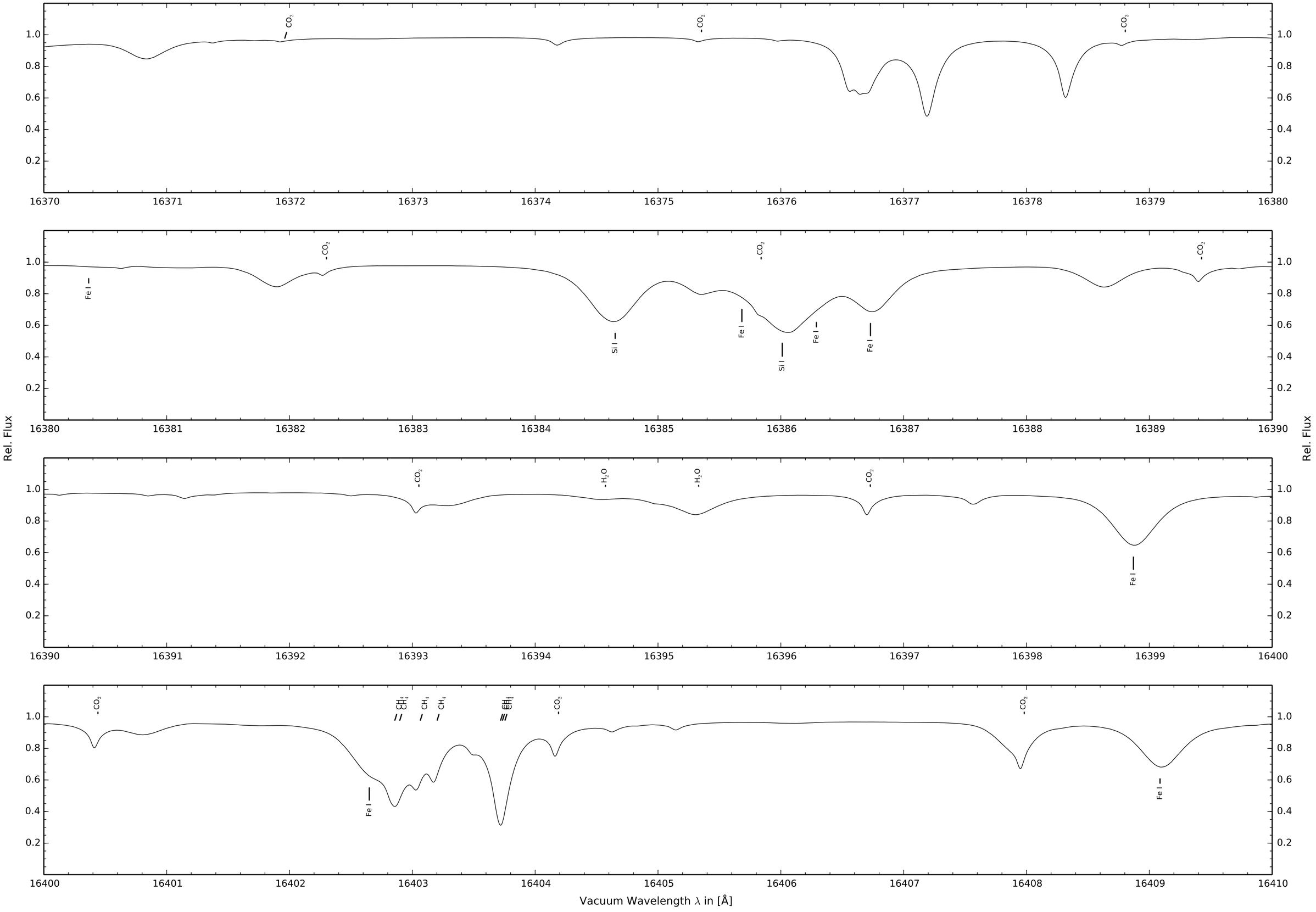

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
Fe I
H2O
Ca I

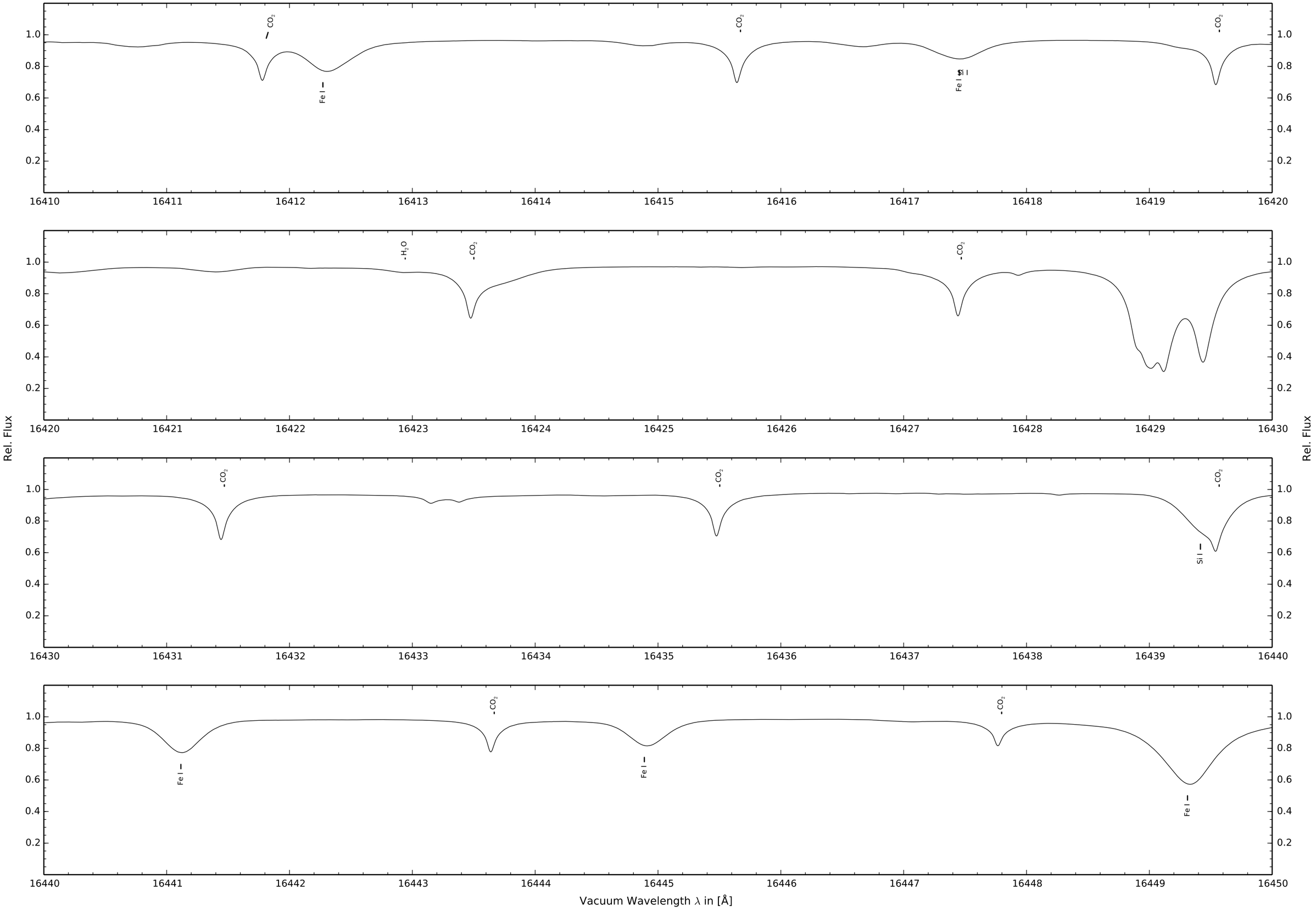

Rel. Flux
1.0
0.8
0.6
0.4
0.2
16210
16211
16212
16213
16214
16215
16216
16217
16218
16219
16220
16221
16222
16223
16224
16225
16226
16227
16228
16229
16230
16231
16232
16233
16234
16235
16236
16237
16238
16239
16240
16241
16242
16243
16244
16245
16246
16247
16248
16249
16250
Vacuum Wavelength λ in [Å]
CO2
Fe I
Si I

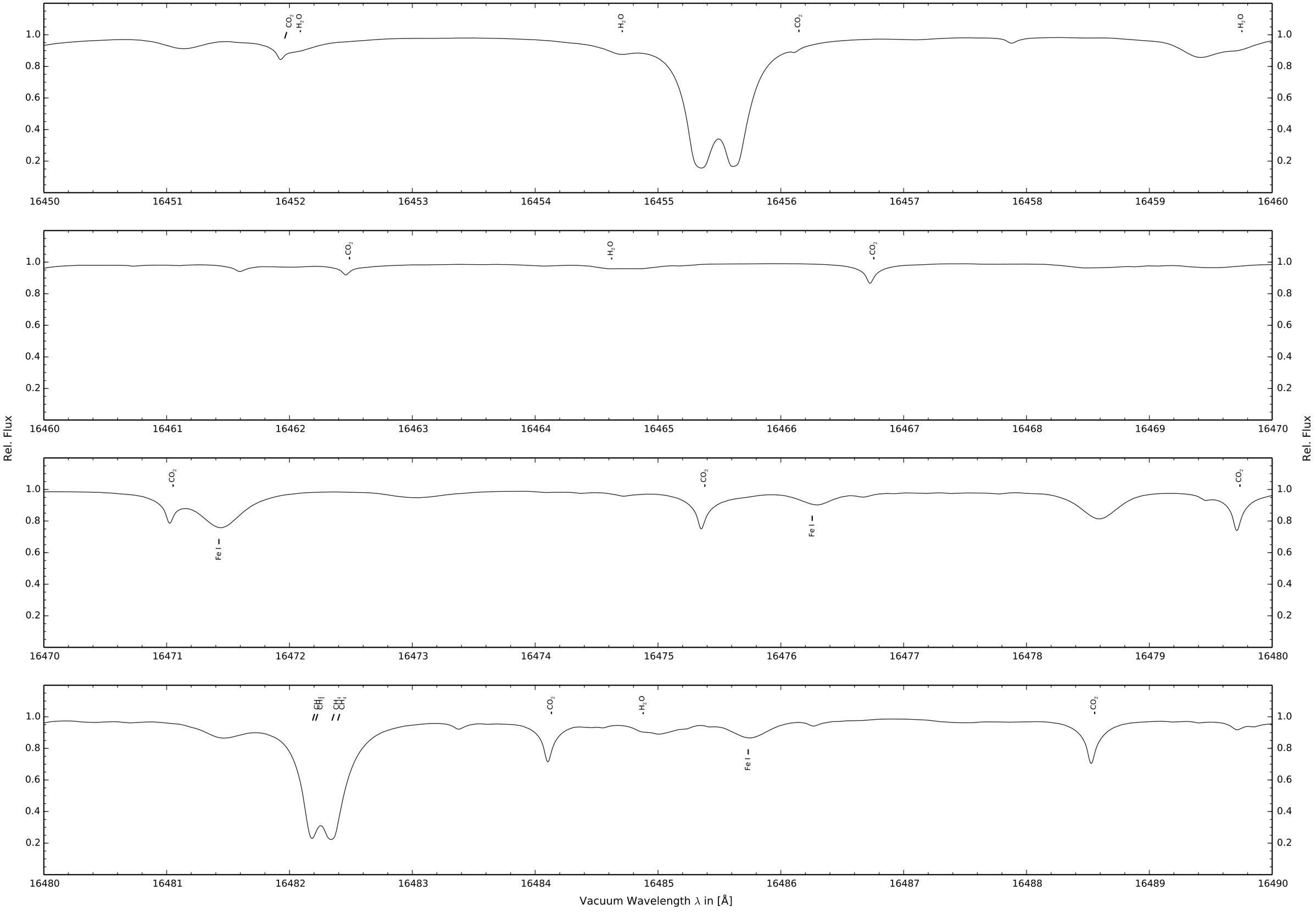

Fe I
Fe I
CH4
Fe I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Ni I
$-H_2O$
$-CH_4$
$-CH_4$
Fe I
Fe I
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Fe I
- H_2O
- CO_2
- CO_2
Ni I
Mg I
Mg I
Mg I
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
CH4
Fe I
Si I


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
Fe I
H2O
Si I


Rel. Flux
1.0
0.8
0.6
0.4
0.2
CO_2
H_2O
Fe I
CH_4
16450
16451
16452
16453
16454
16455
16456
16457
16458
16459
16460
16461
16462
16463
16464
16465
16466
16467
16468
16469
16470
16471
16472
16473
16474
16475
16476
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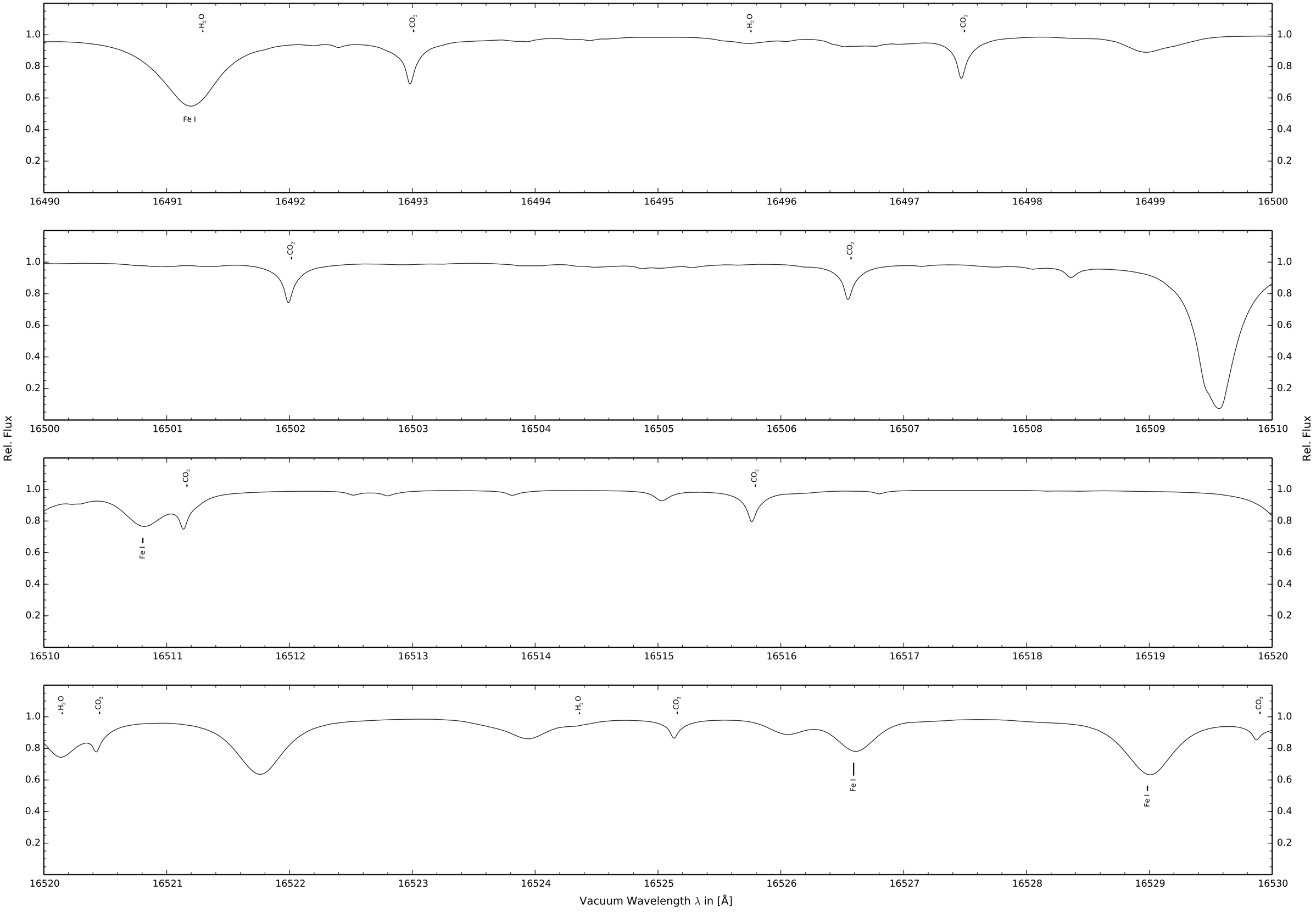
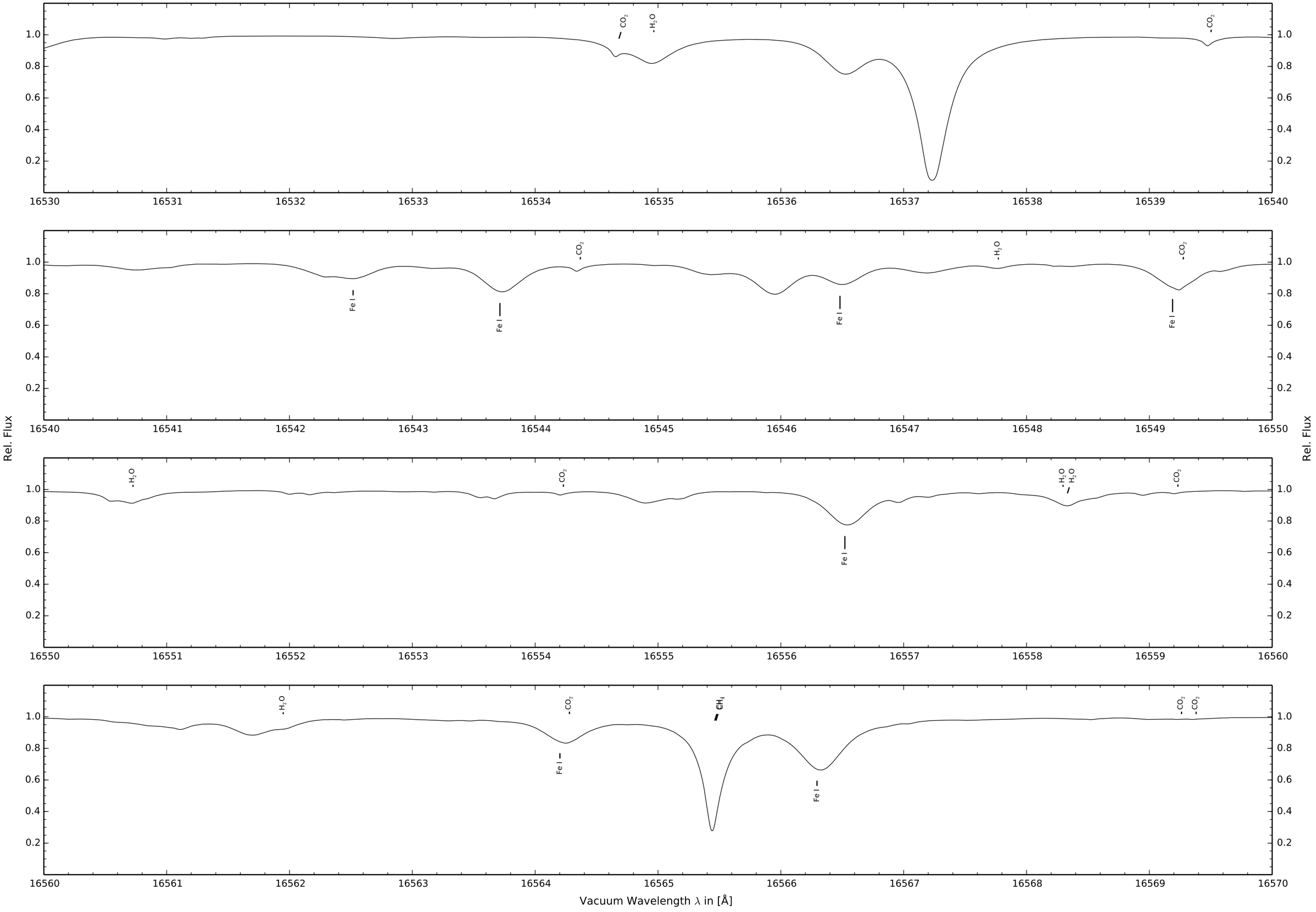
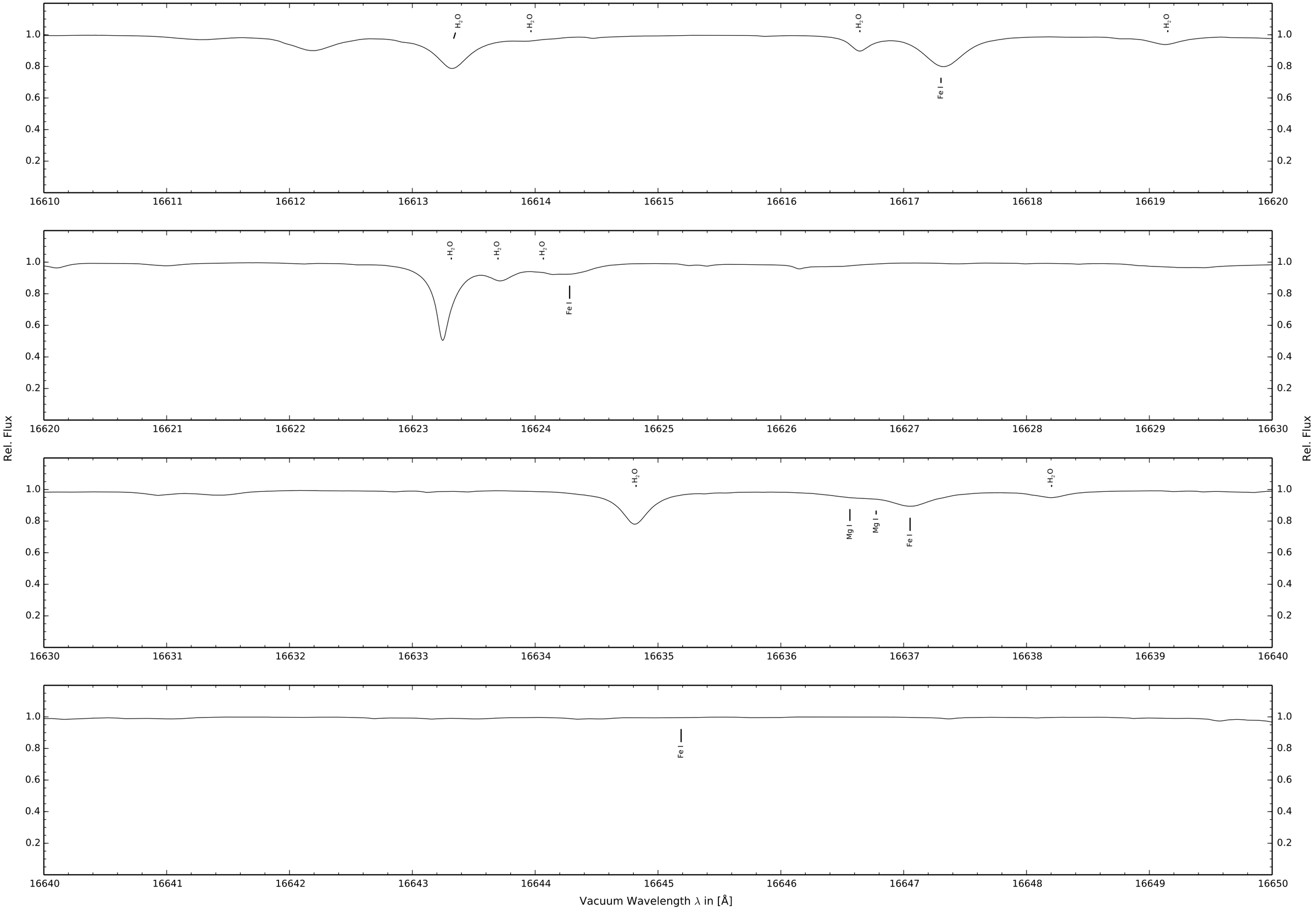
16486
16487
16488
16489
16490
Vacuum Wavelength λ in [Å]

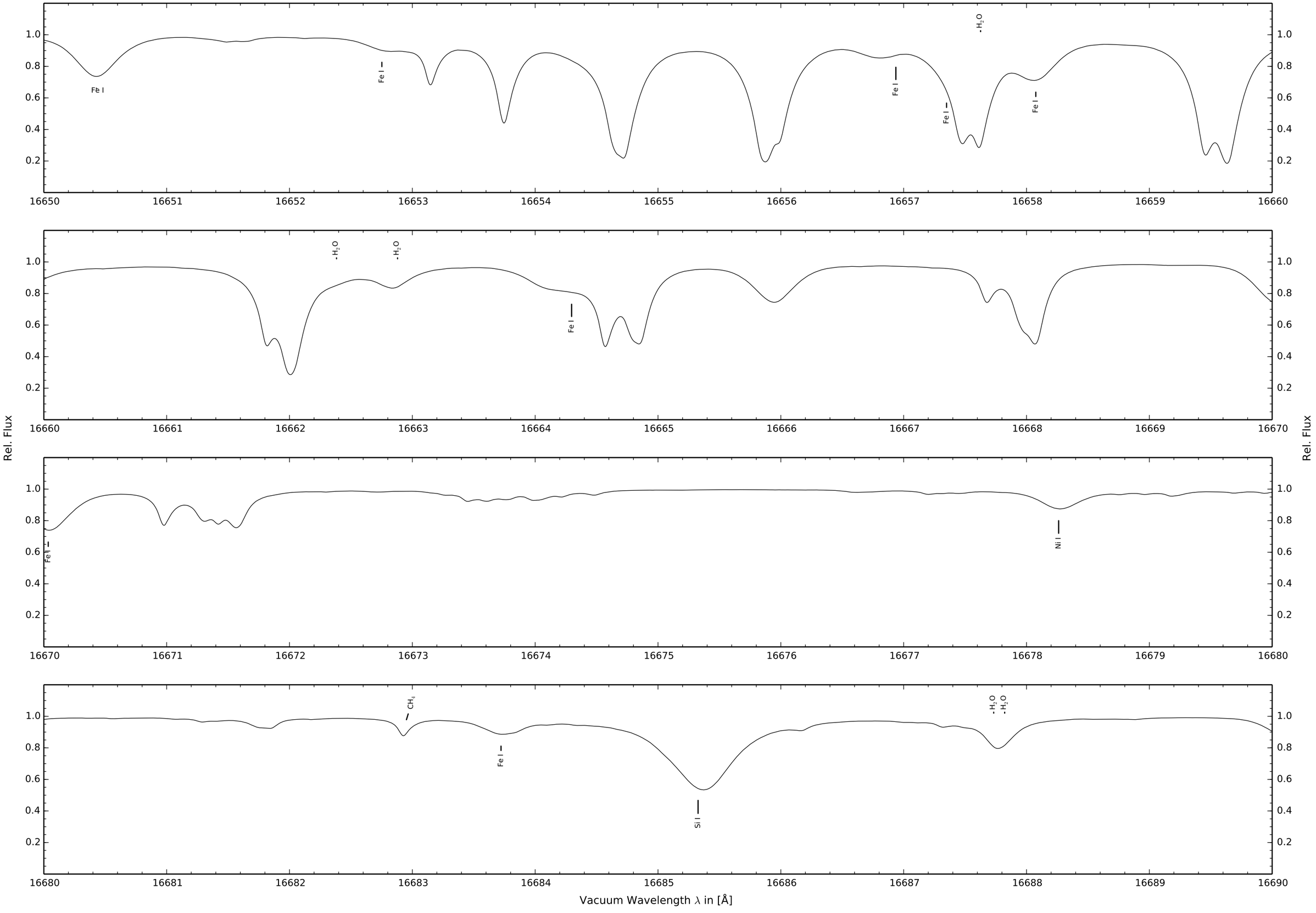


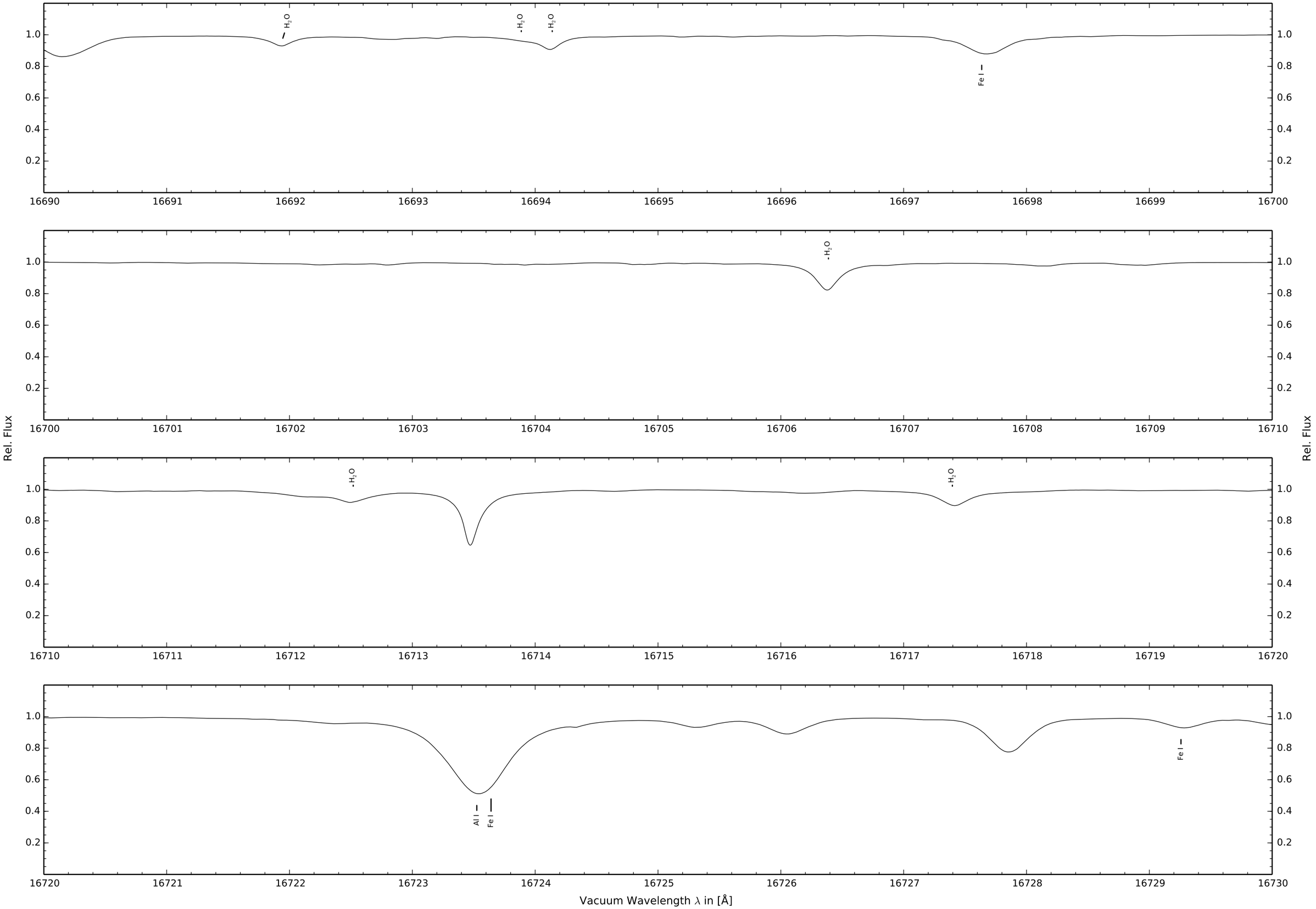
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Fe I

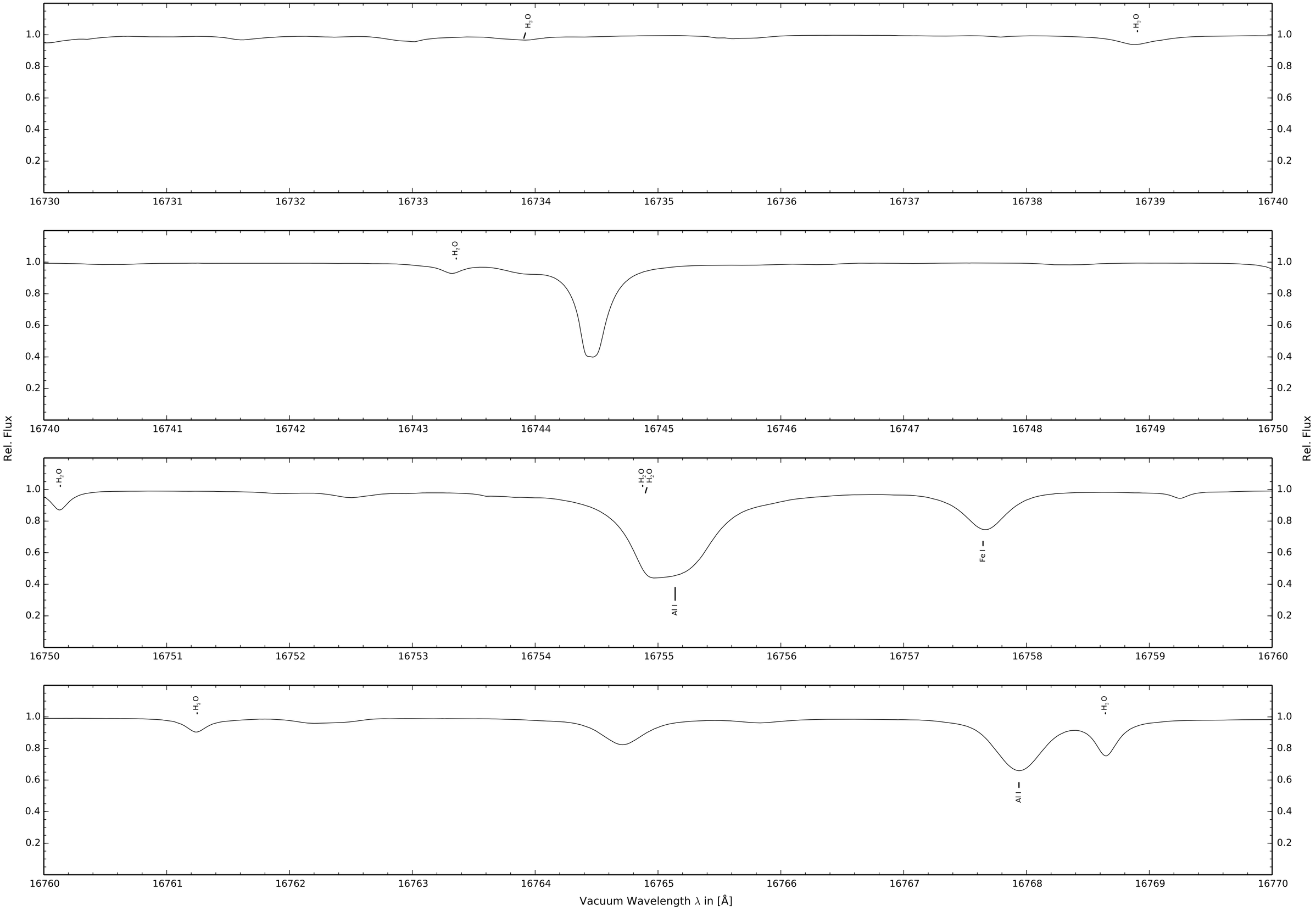

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
CH4

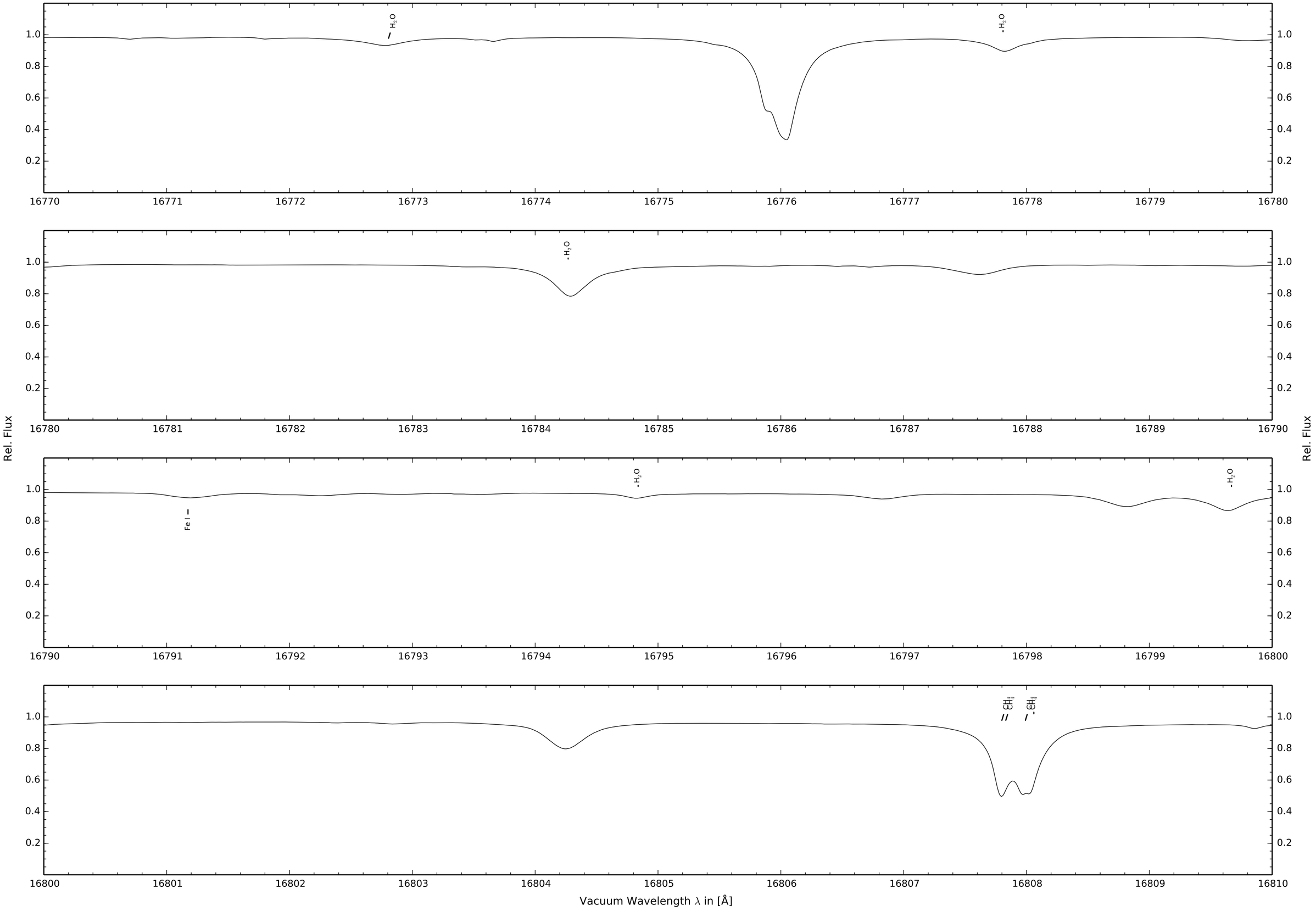
H2O
CO2
H2O
CO2
CO2
CO2
H2O
Fe I
Ni I
CH4
Rel. Flux
Vacuum Wavelength λ in [Å]

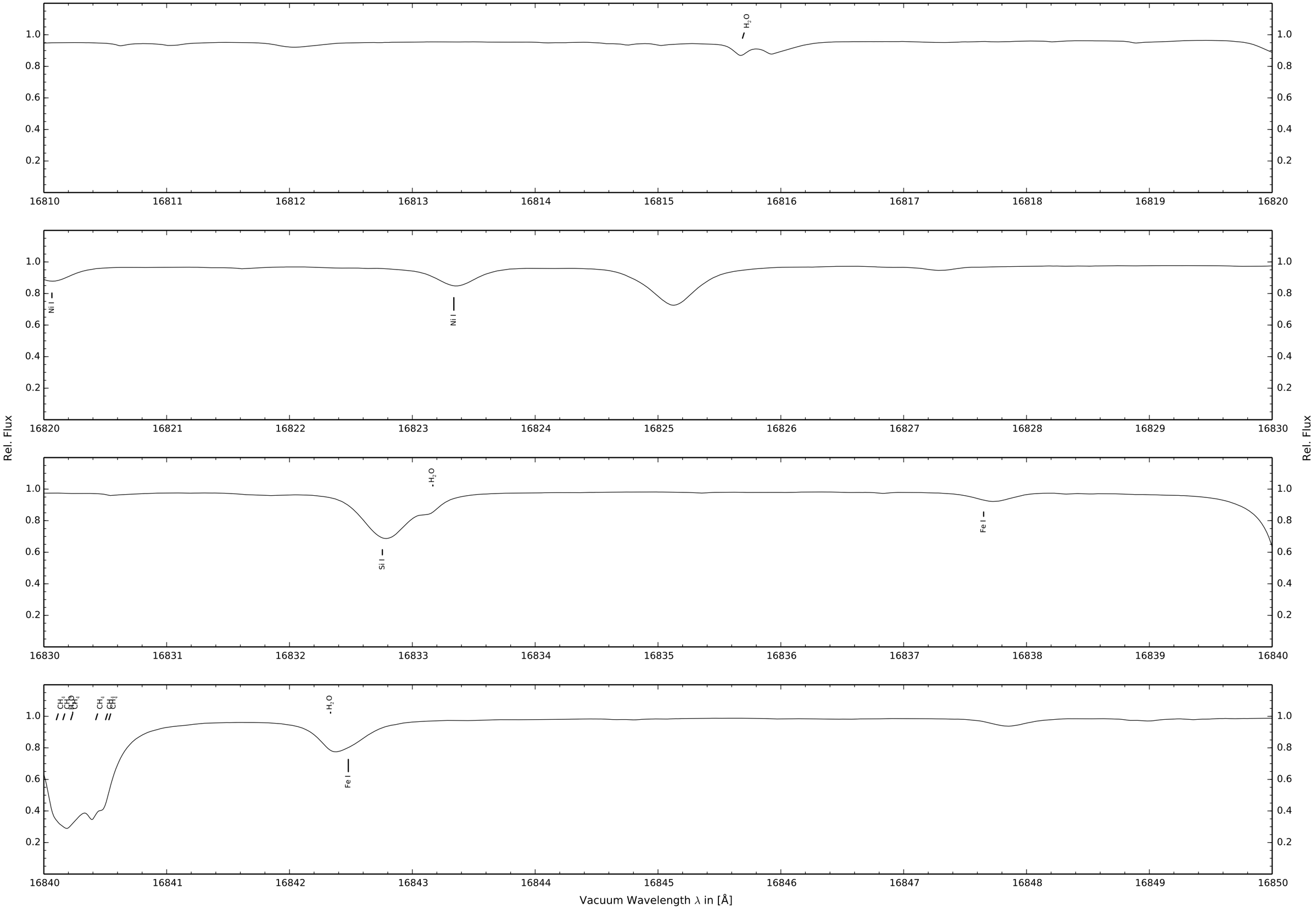

Rel. Flux
1.0
0.8
0.6
0.4
0.2
H_2O
Fe I
Mg I
16610
16611
16612
16613
16614
16615
16616
16617
16618
16619
16620
16621
16622
16623
16624
16625
16626
16627
16628
16629
16630
16631
16632
16633
16634
16635
16636
16637
16638
16639
16640
16641
16642
16643
16644
16645
16646
16647
16648
16649
16650
Vacuum Wavelength λ in [Å]


Fe I
Fe I
Fe I
Fe I
Fe I
H_2O
H_2O
H_2O
Fe I
Fe I
Ni I
CH_4
Fe I
Si I
H_2O
H_2O
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Al I


Rel. Flux
- H2O
- H2O
- H2O
- H2O
- H2O
- H2O
- H2O
- H2O
Al I
Fe I
Al I
Vacuum Wavelength λ in [Å]

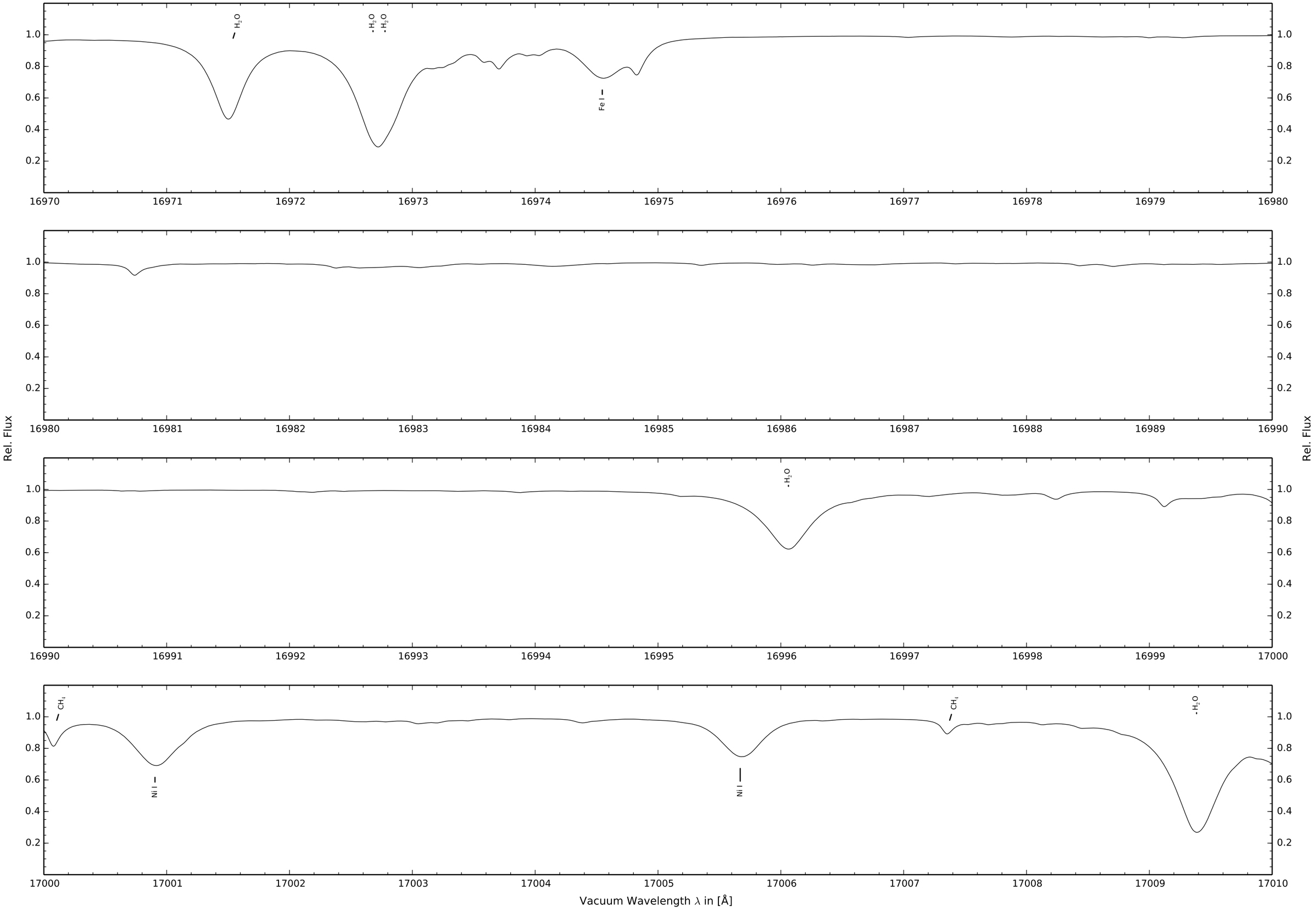

Rel. Flux
1.0
0.8
0.6
0.4
0.2
16770
16771
16772
16773
16774
16775
16776
16777
16778
16779
16780
16781
16782
16783
16784
16785
16786
16787
16788
16789
16790
16791
16792
16793
16794
16795
16796
16797
16798
16799
16800
16801
16802
16803
16804
16805
16806
16807
16808
16809
16810
Vacuum Wavelength λ in [Å]
H2O
Fe I
CH4

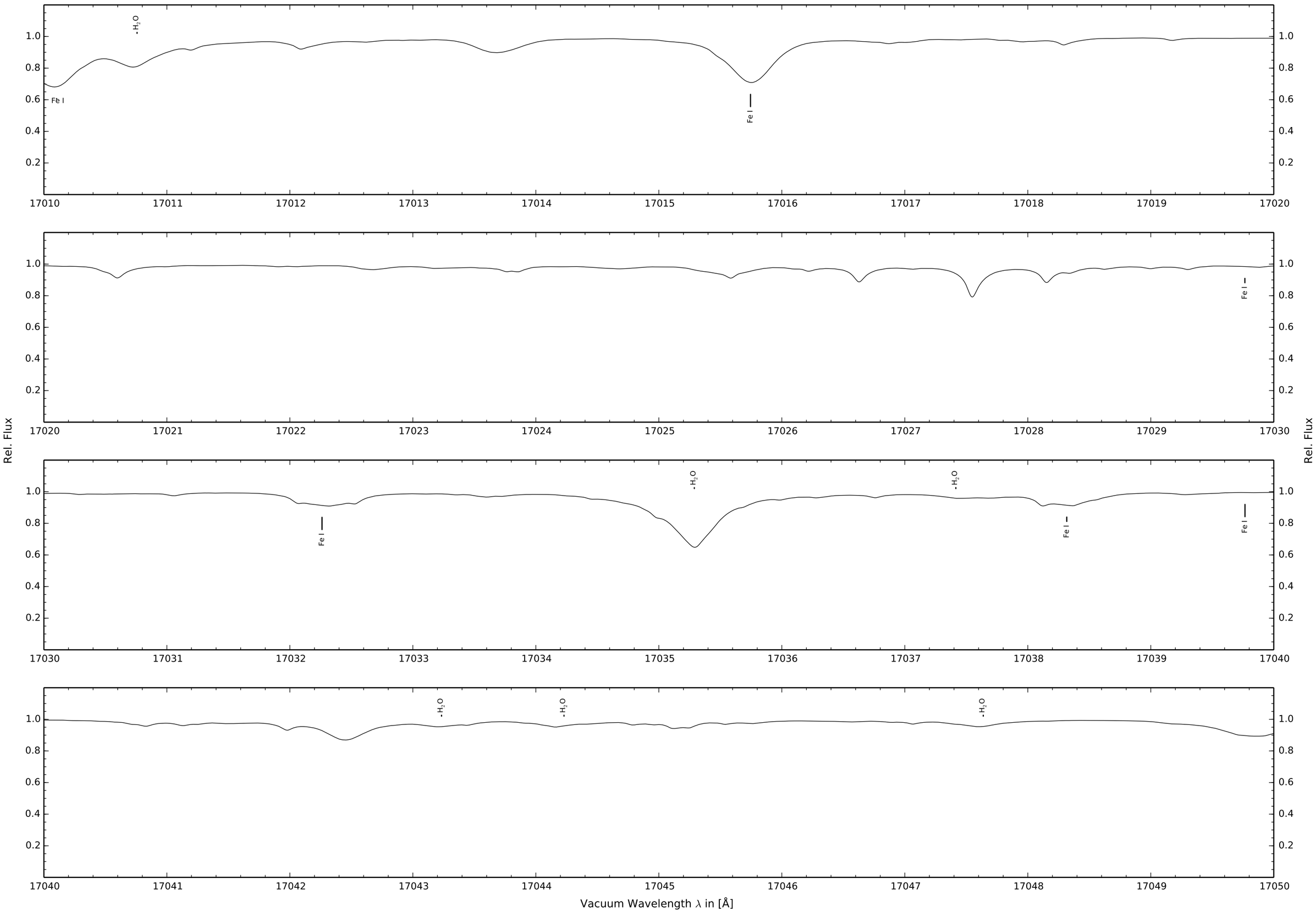

Rel. Flux
Ni I
Ni I
H2O
H2O
Si I
Fe I
CH4
CH4
CH4
CH4
CH4
H2O
Fe I
Vacuum Wavelength λ in [Å]

Rel. Flux
Fe I
Fe I
Fe I
H_2O
H_2O
Ni I
CH_4
CH_4
CH_4
CH_4
CH_4
CH_4
Fe I
Fe I
Vacuum Wavelength λ in [Å]

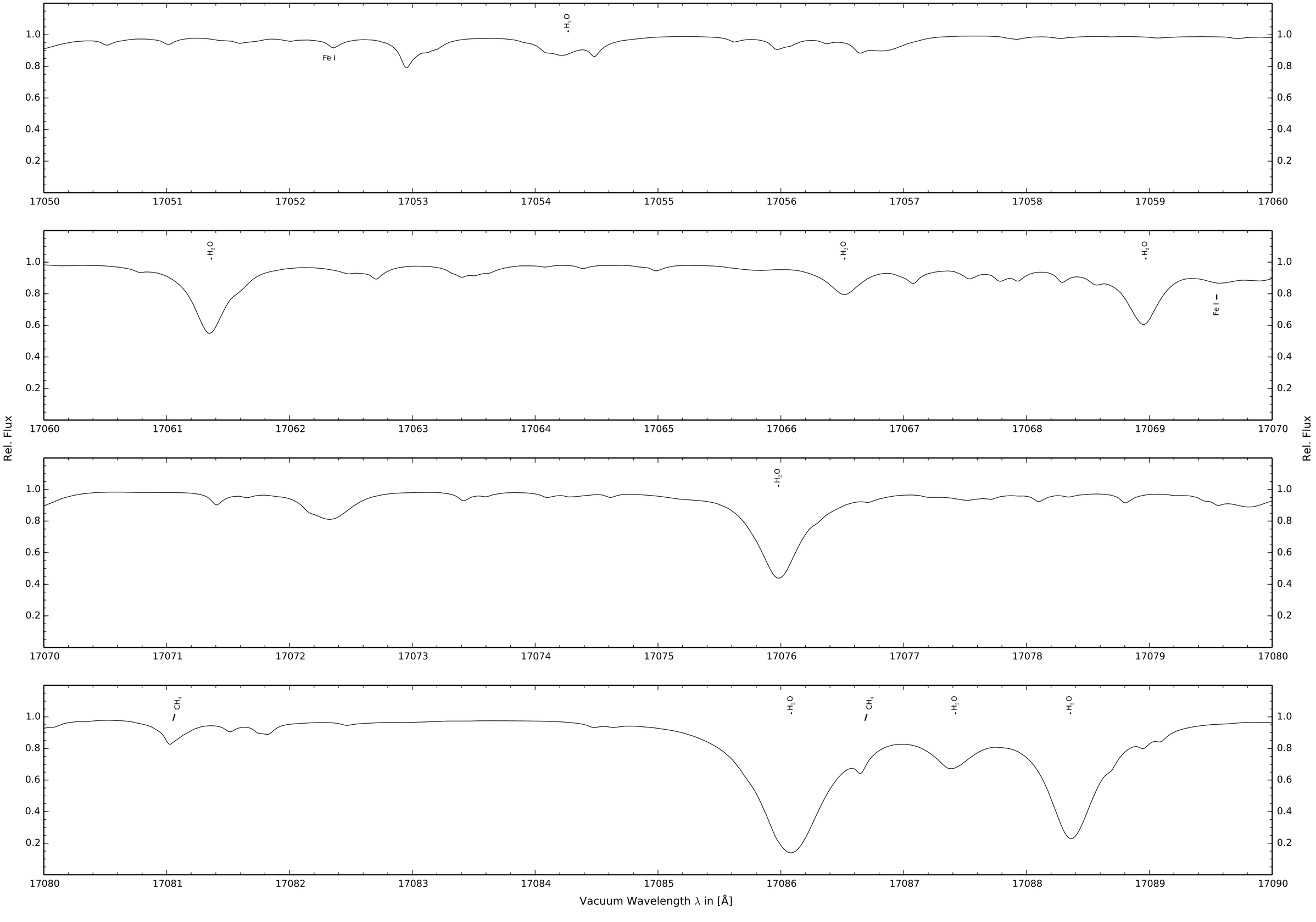
H2O
C I
Fe I
H2O
H2O
H2O
H2O
CH4
CH4
H2O
Rel. Flux
Vacuum Wavelength λ in [Å]

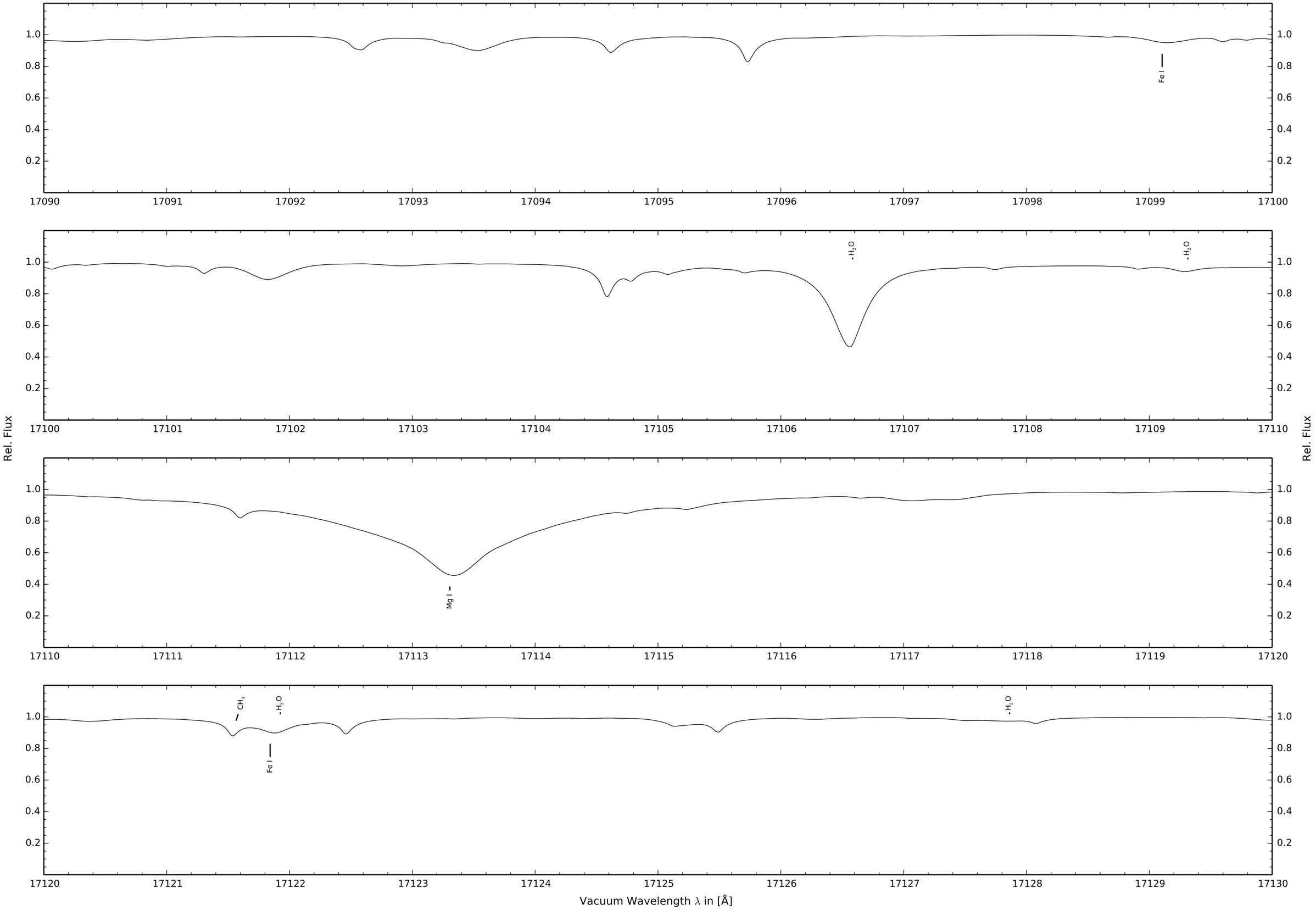
Fe I
- H_2O
- H_2O
- H_2O
- H_2O
- H_2O
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
H2O
H2O
Fe I
CH4
Ni I
Ni I
CH4
H2O

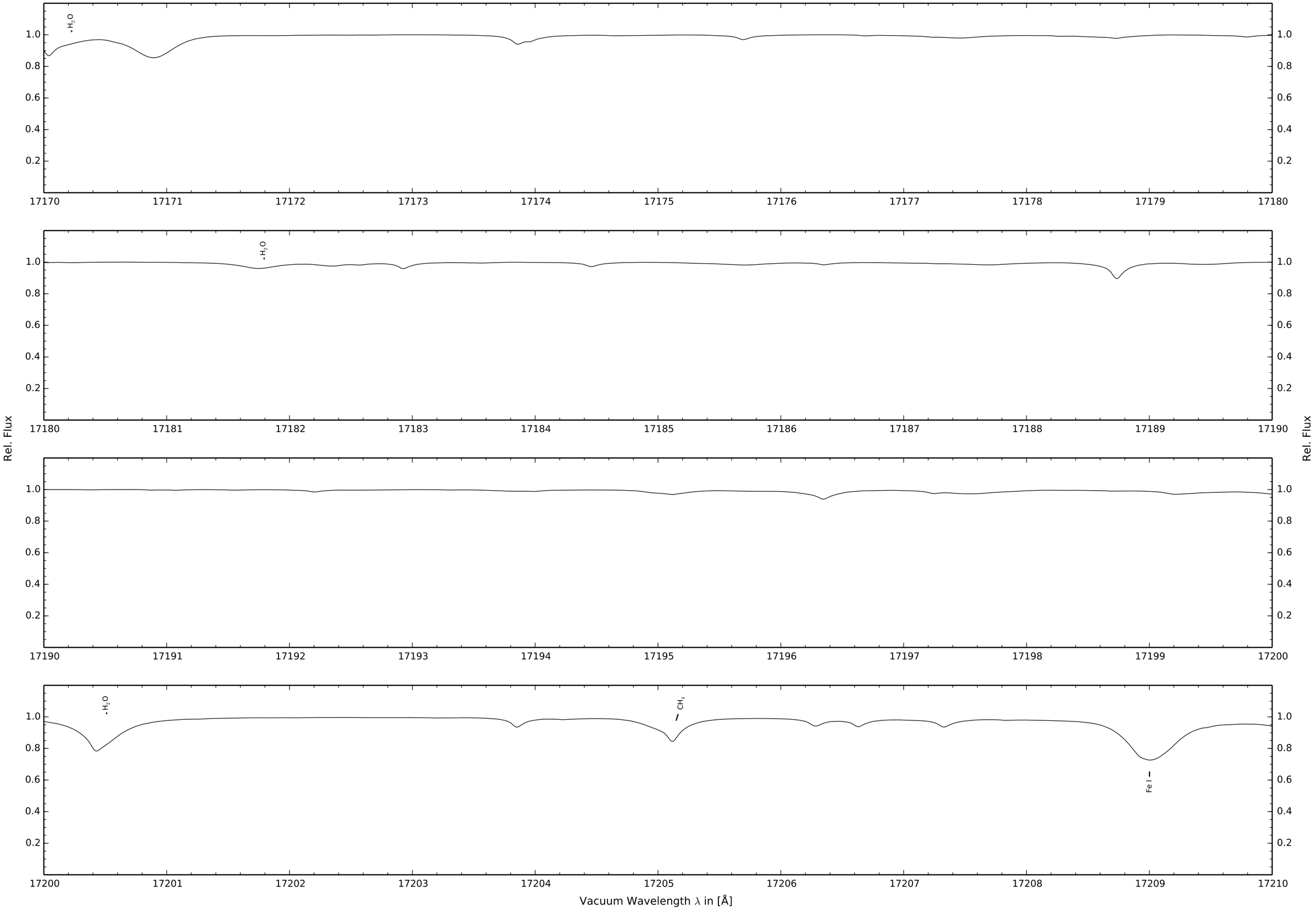


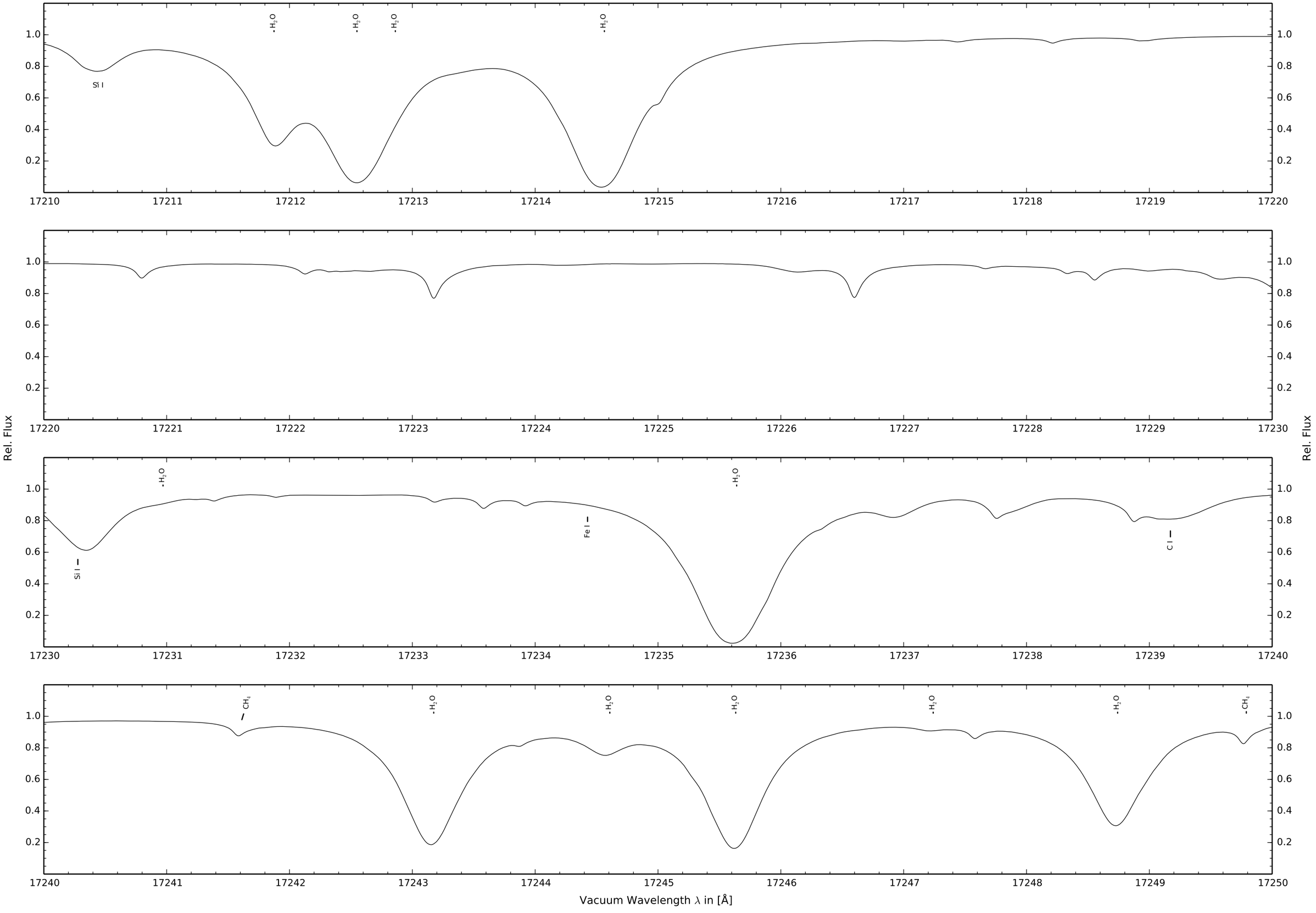
Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
H2O

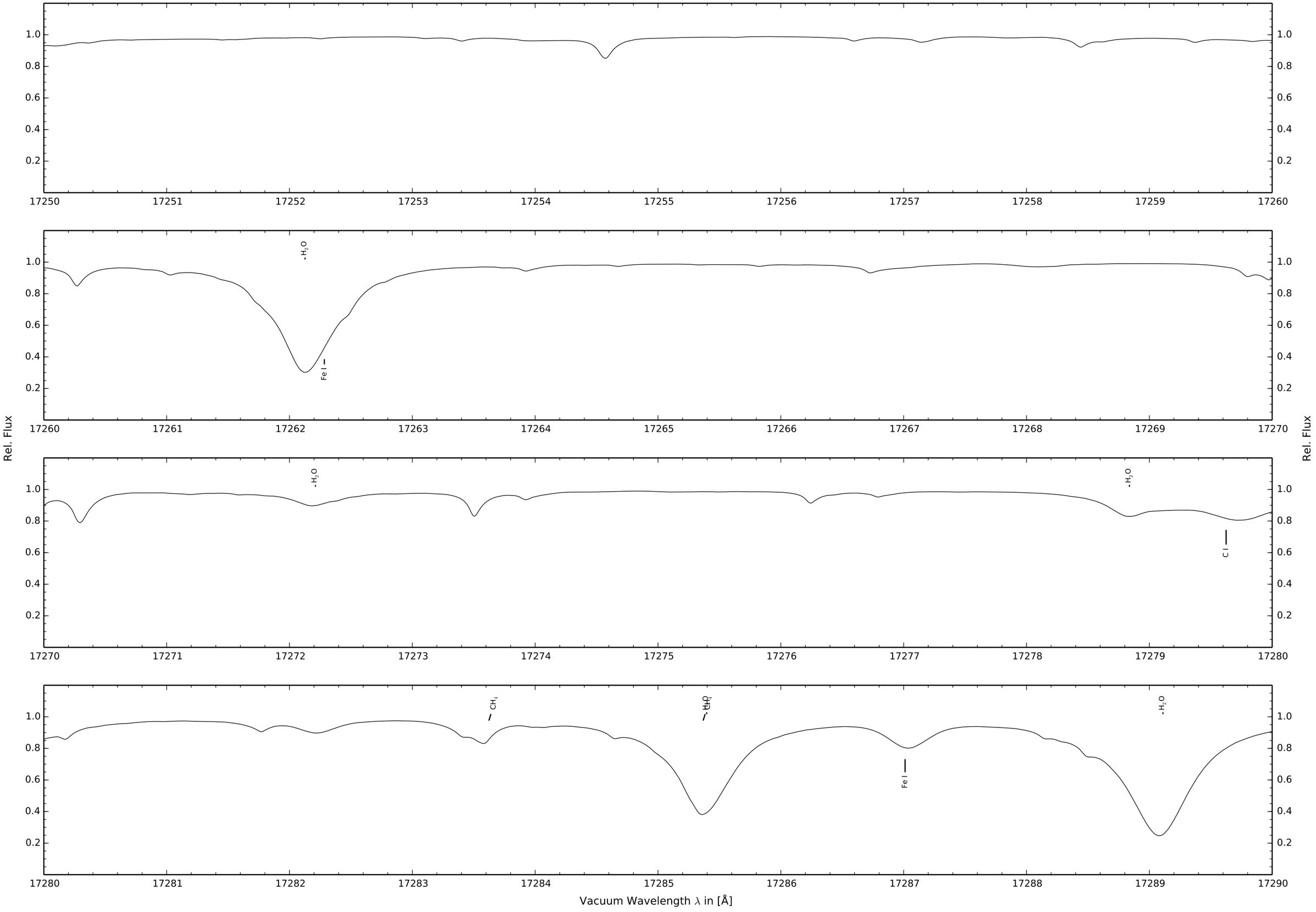

Fe I
H2O
H2O
H2O
H2O
H2O
Fe I
H2O
CH4
H2O
CH4
H2O
H2O
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]


Fe I
H2O
H2O
Mg I
CH4
Fe I
H2O
Rel. Flux
Vacuum Wavelength λ in [Å]

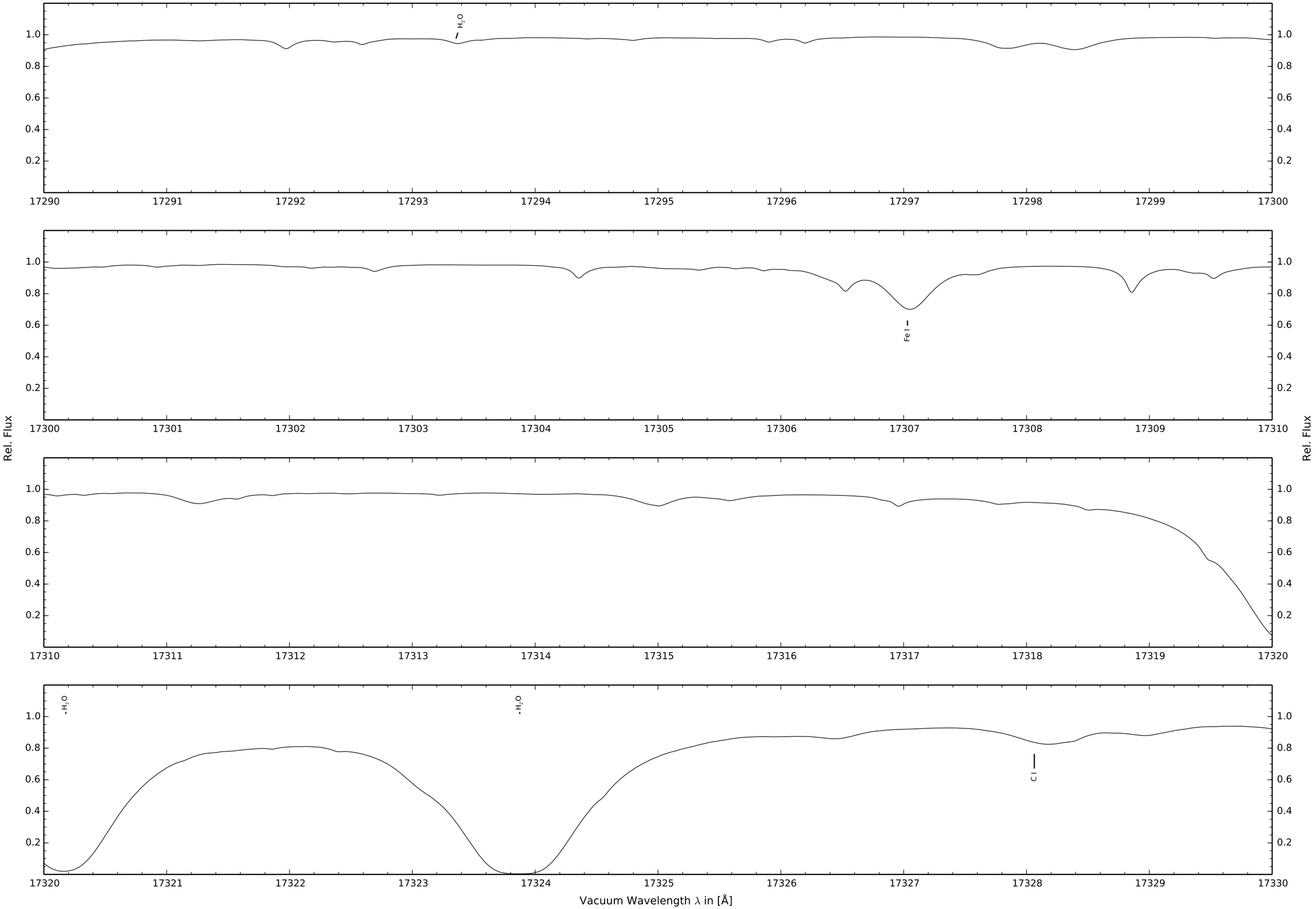
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

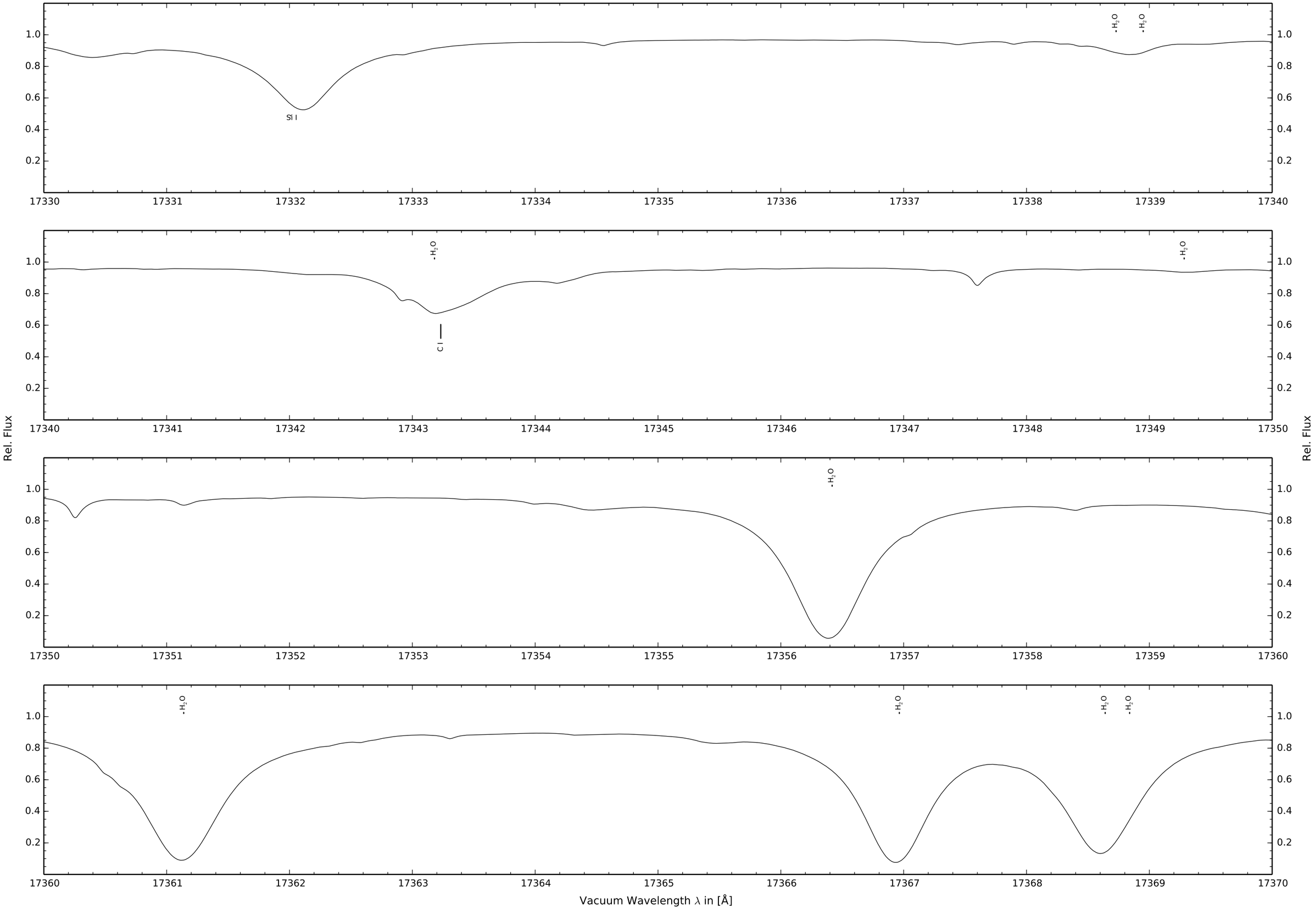

H2O
H2O
H2O
CH4
Fe I
Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]

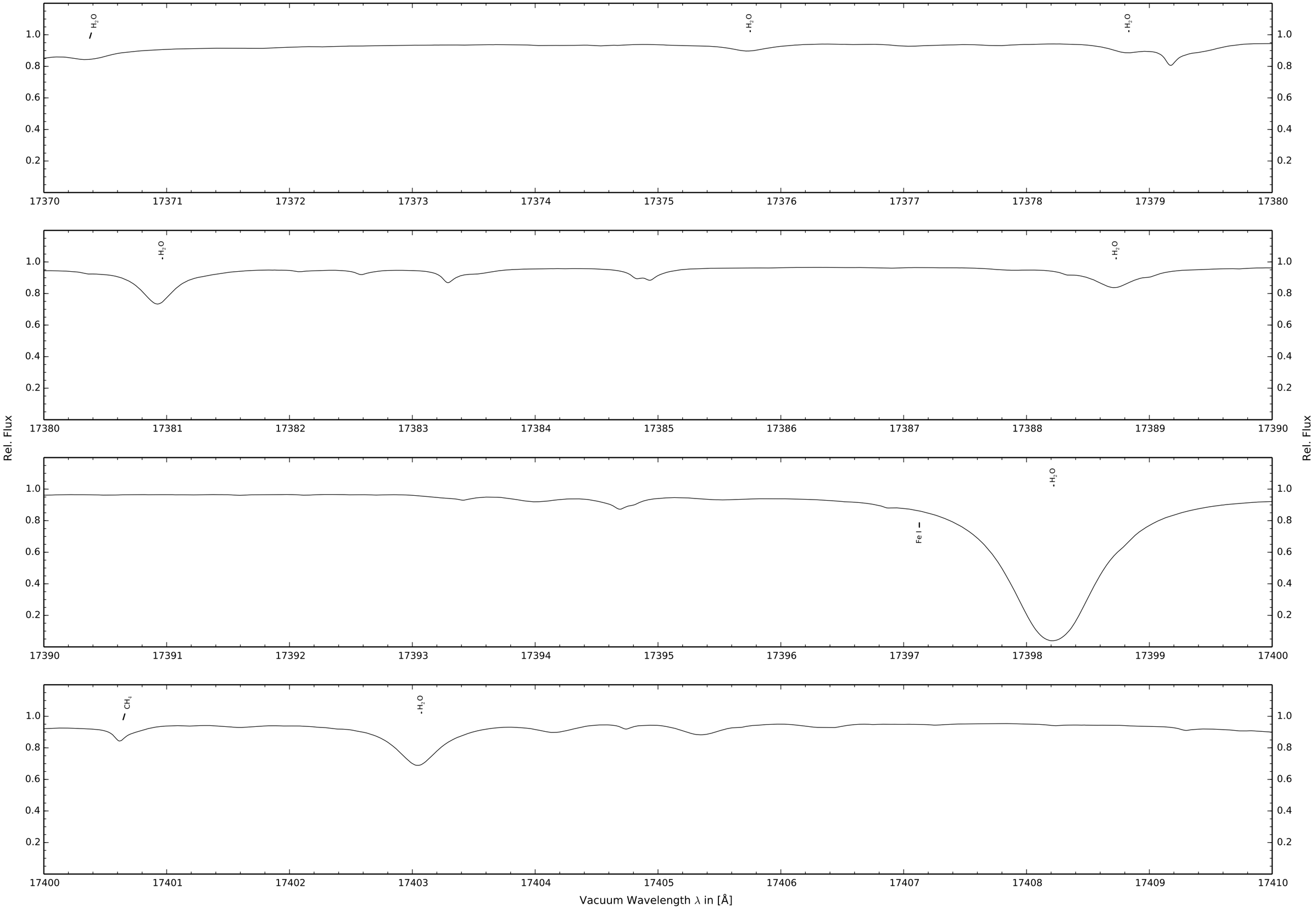

Rel. Flux
Si I
H_2O
Fe I
C I
CH_4
Vacuum Wavelength λ in [Å]

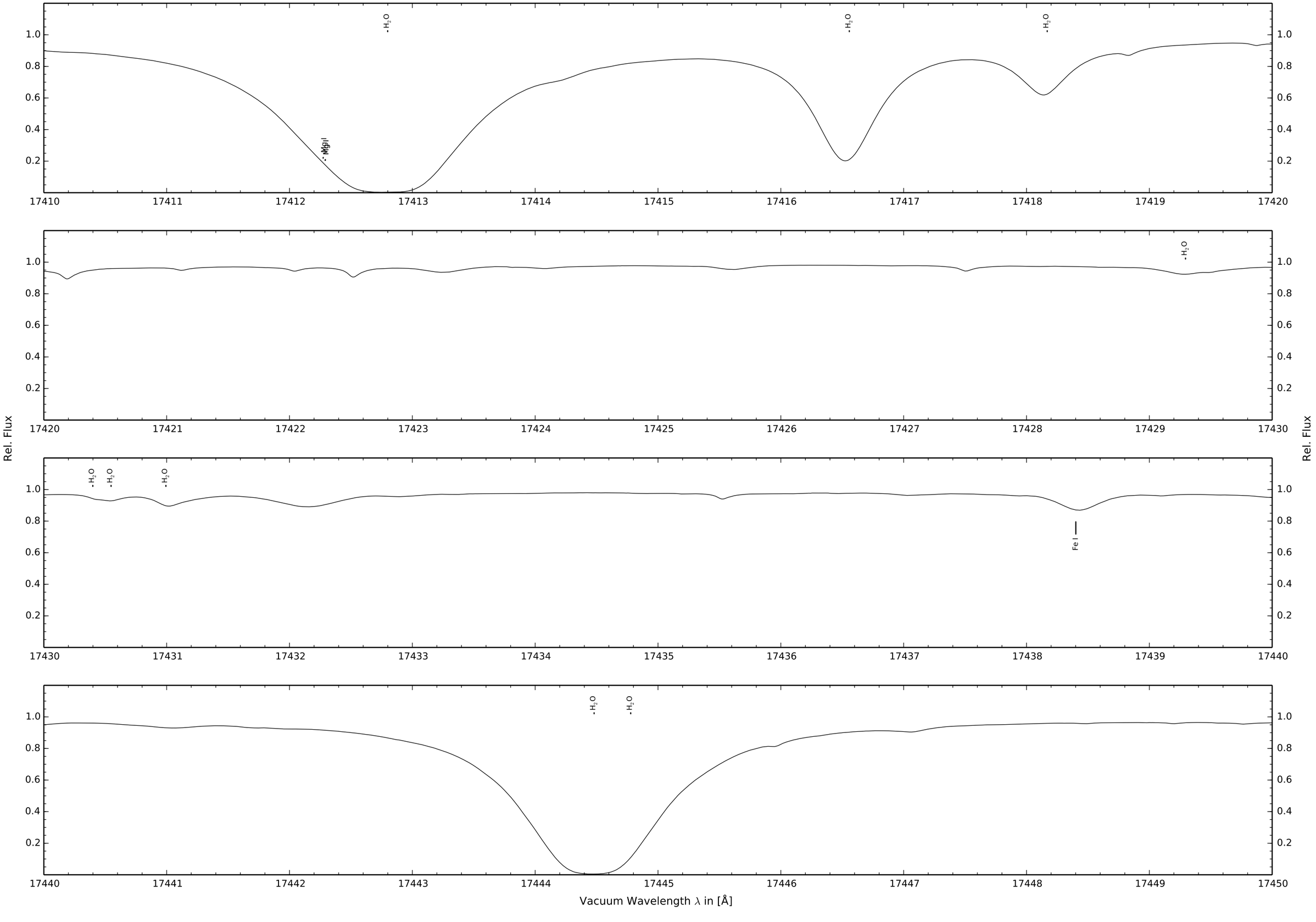


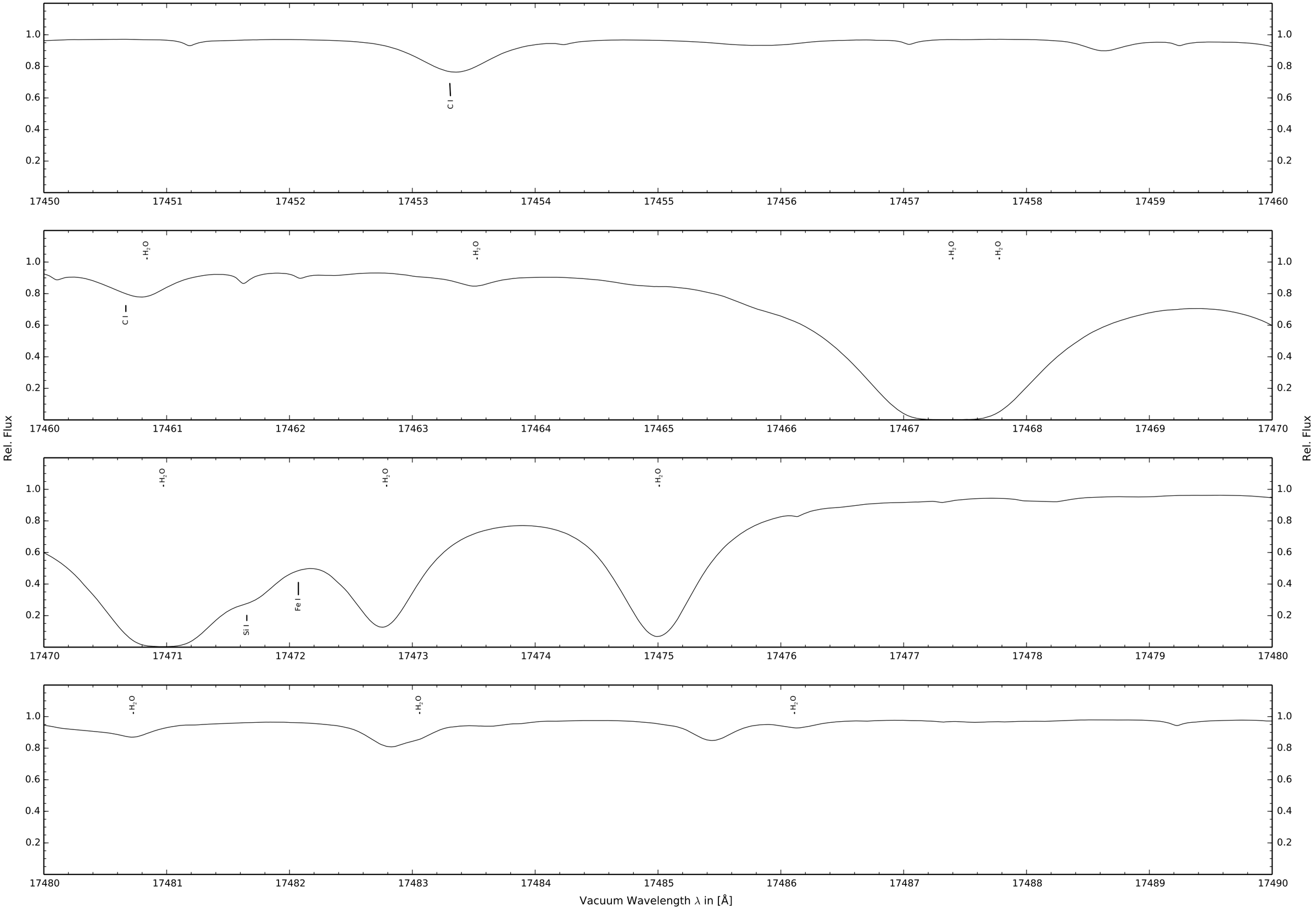
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
C I
CH4


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
H2O
H2O
C I

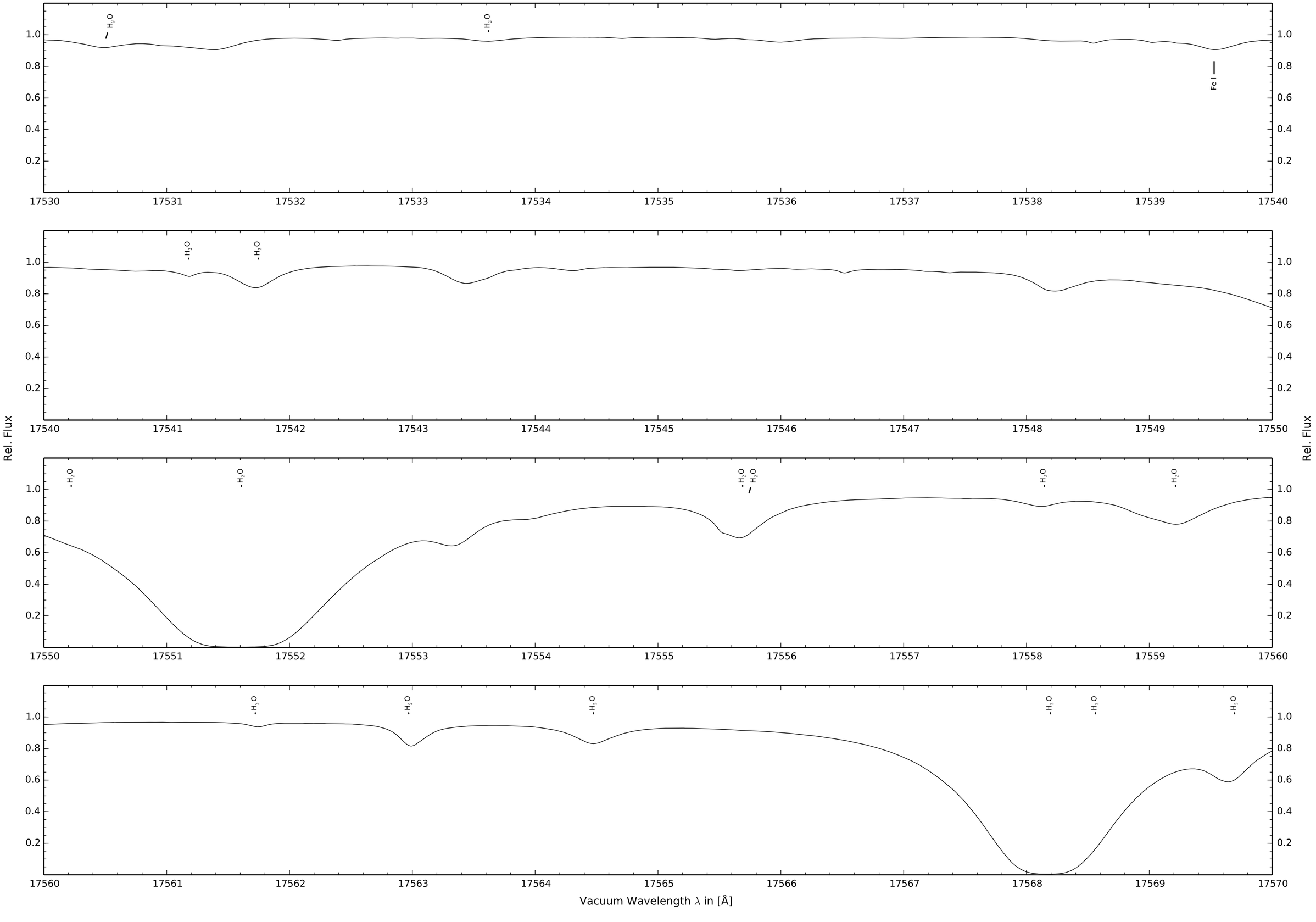

Si I
C I
- H_2O
Rel. Flux
Vacuum Wavelength λ in [Å]

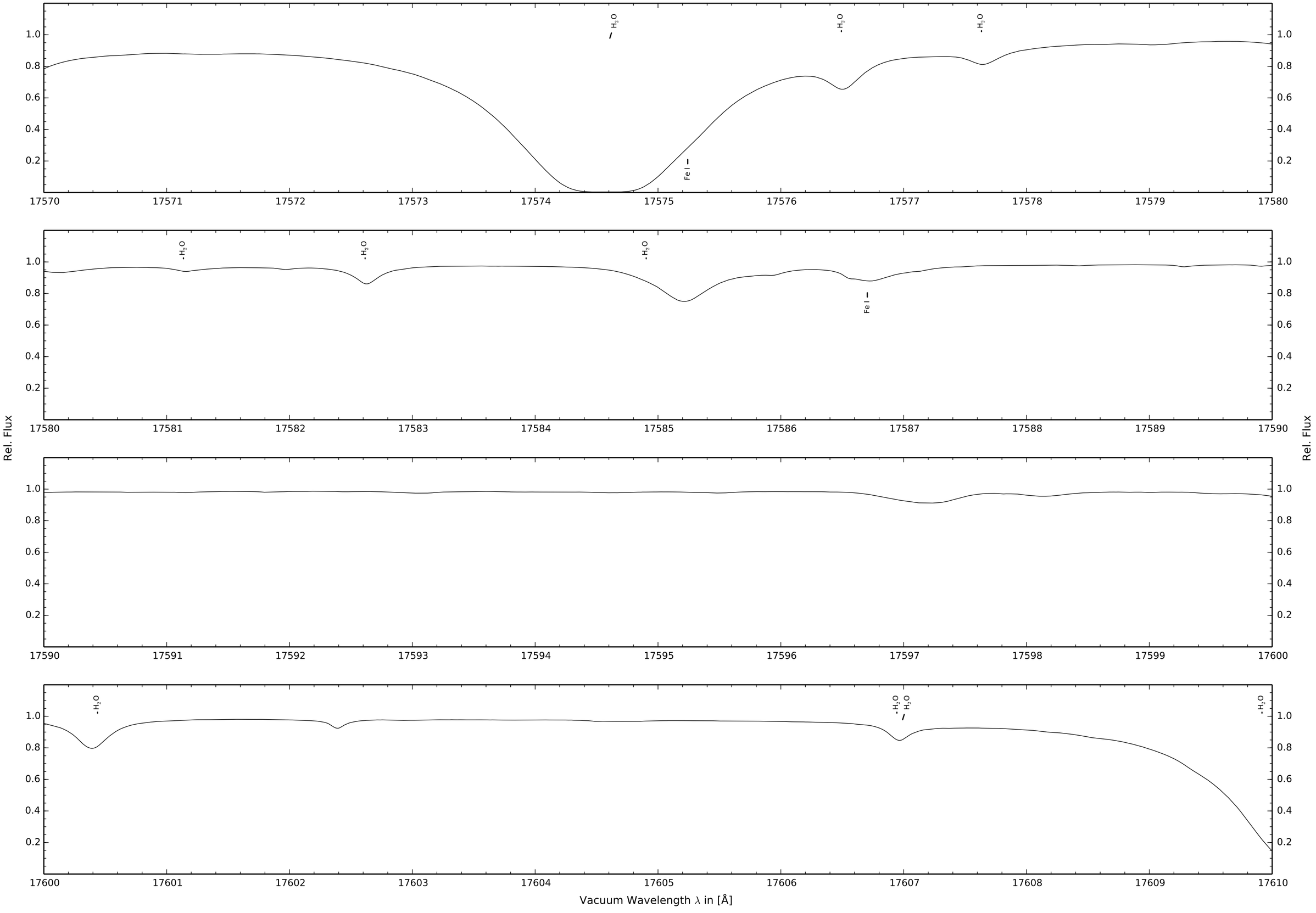

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
H2O
H2O
H2O
H2O
H2O
Fe I
CH4
H2O

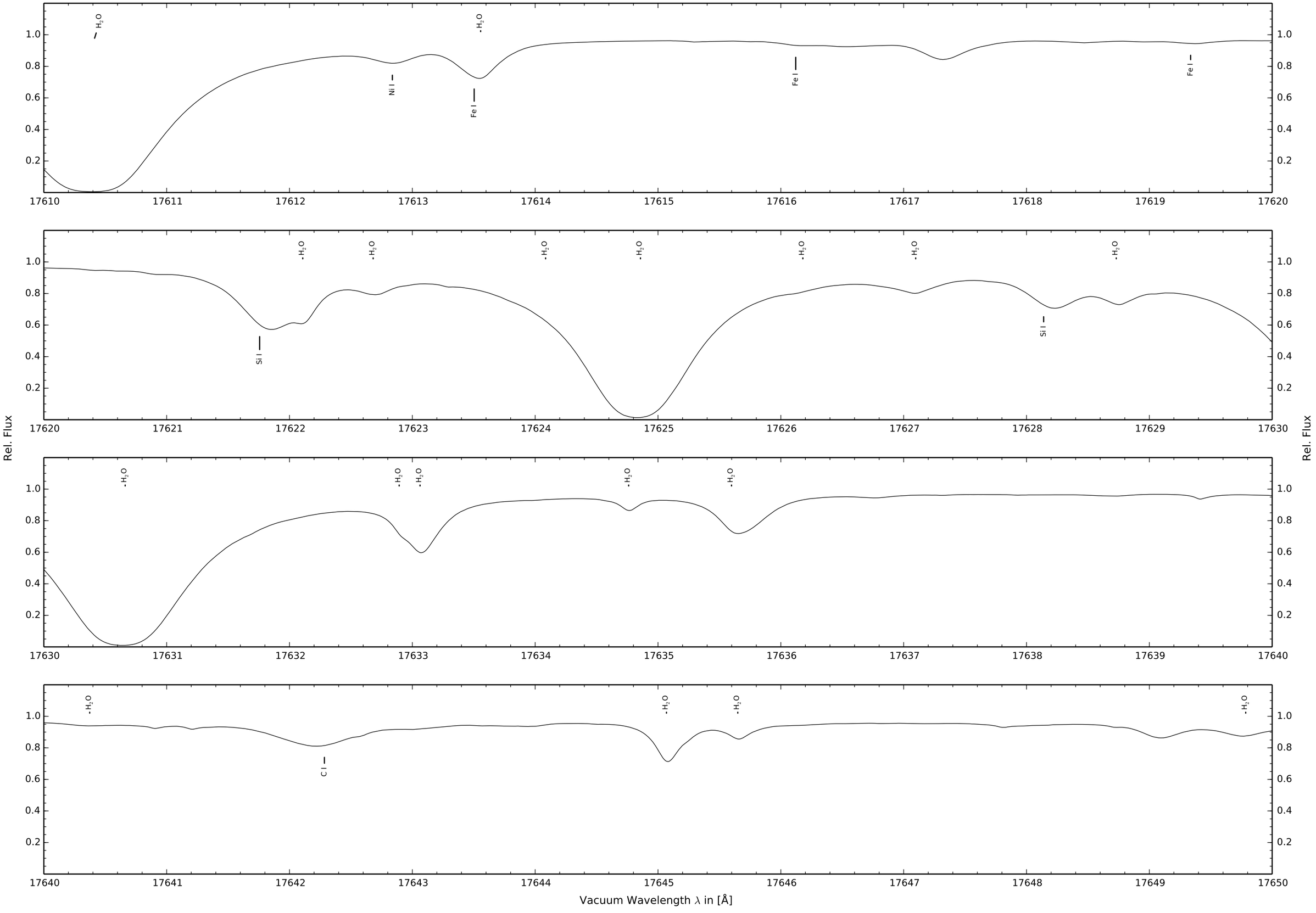

Rel. Flux
$-H_2O$
$-H_2O$
$-H_2O$
$-H_2O$
$-H_2O$
$-H_2O$
$-H_2O$
$-H_2O$
$-H_2O$
Mg I
Fe I
Vacuum Wavelength λ in [Å]

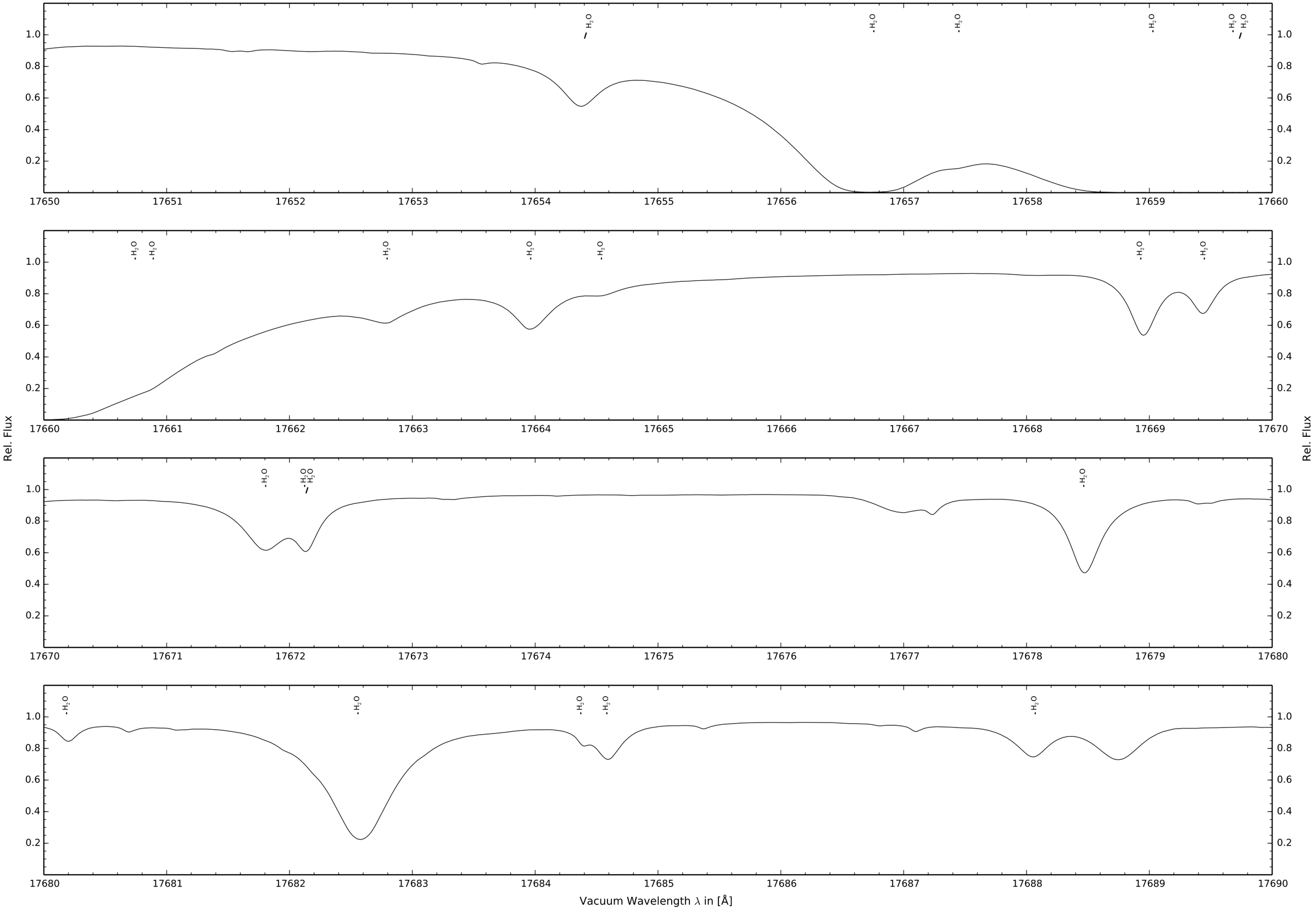

Rel. Flux
Vacuum Wavelength λ in [Å]
C I
Si I
Fe I
-H2O

Rel. Flux
Fe I
C I
H_2O
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

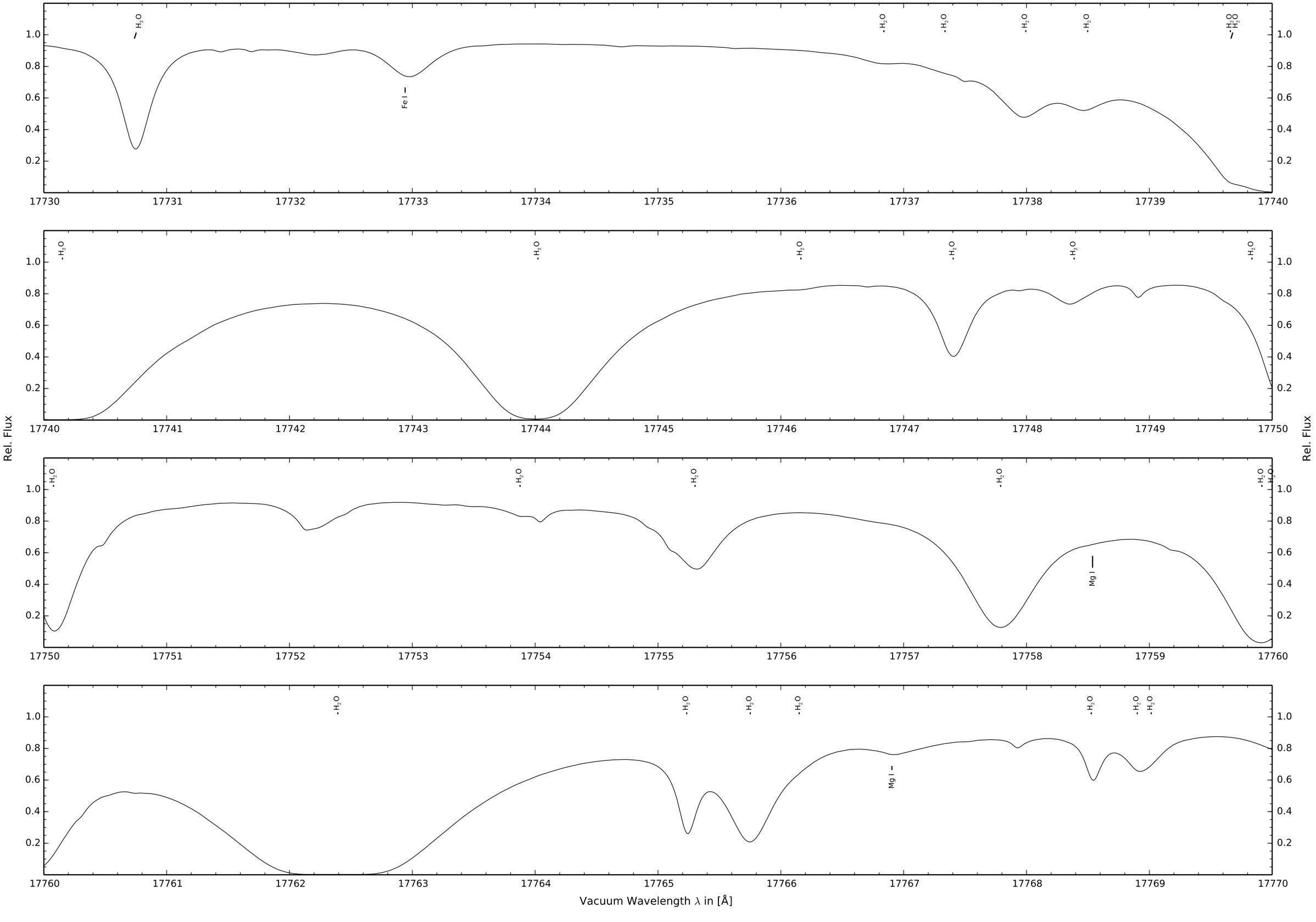

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

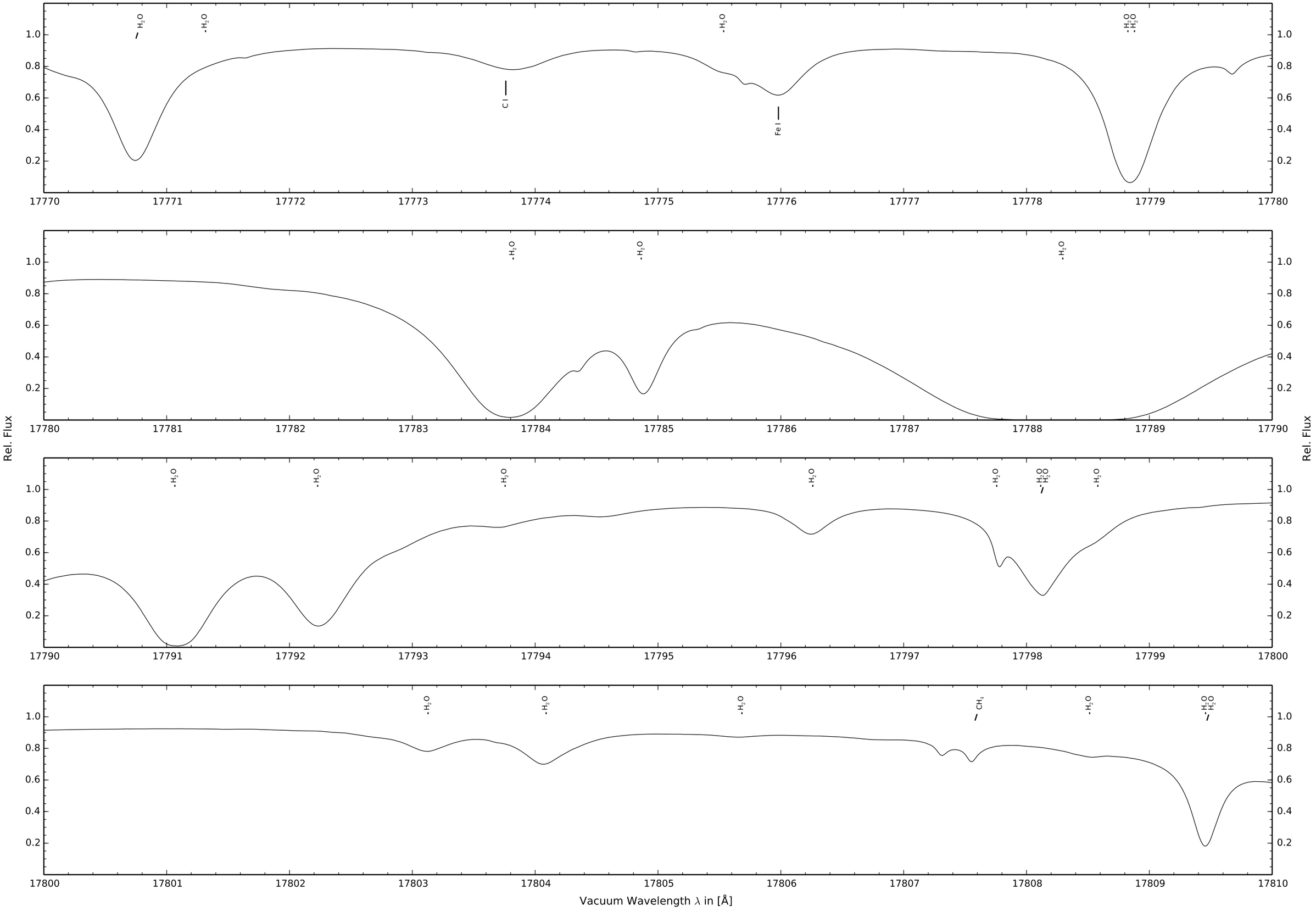

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ni I
Fe I
Si I
C I

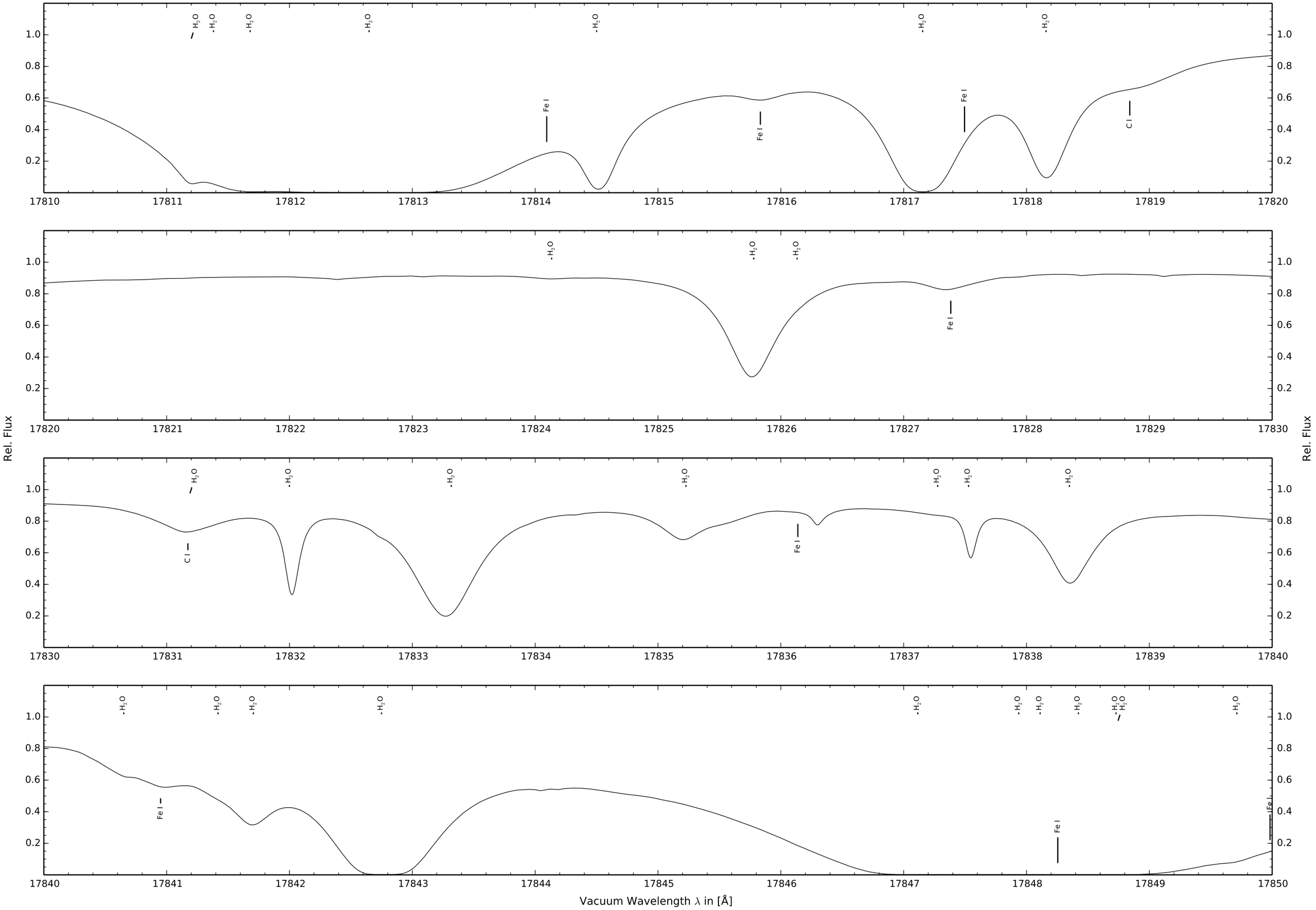

Rel. Flux
Vacuum Wavelength λ in [Å]
17650
17651
17652
17653
17654
17655
17656
17657
17658
17659
17660
17661
17662
17663
17664
17665
17666
17667
17668
17669
17670
17671
17672
17673
17674
17675
17676
17677
17678
17679
17680
17681
17682
17683
17684
17685
17686
17687
17688
17689
17690
0.2
0.4
0.6
0.8
1.0
H2O

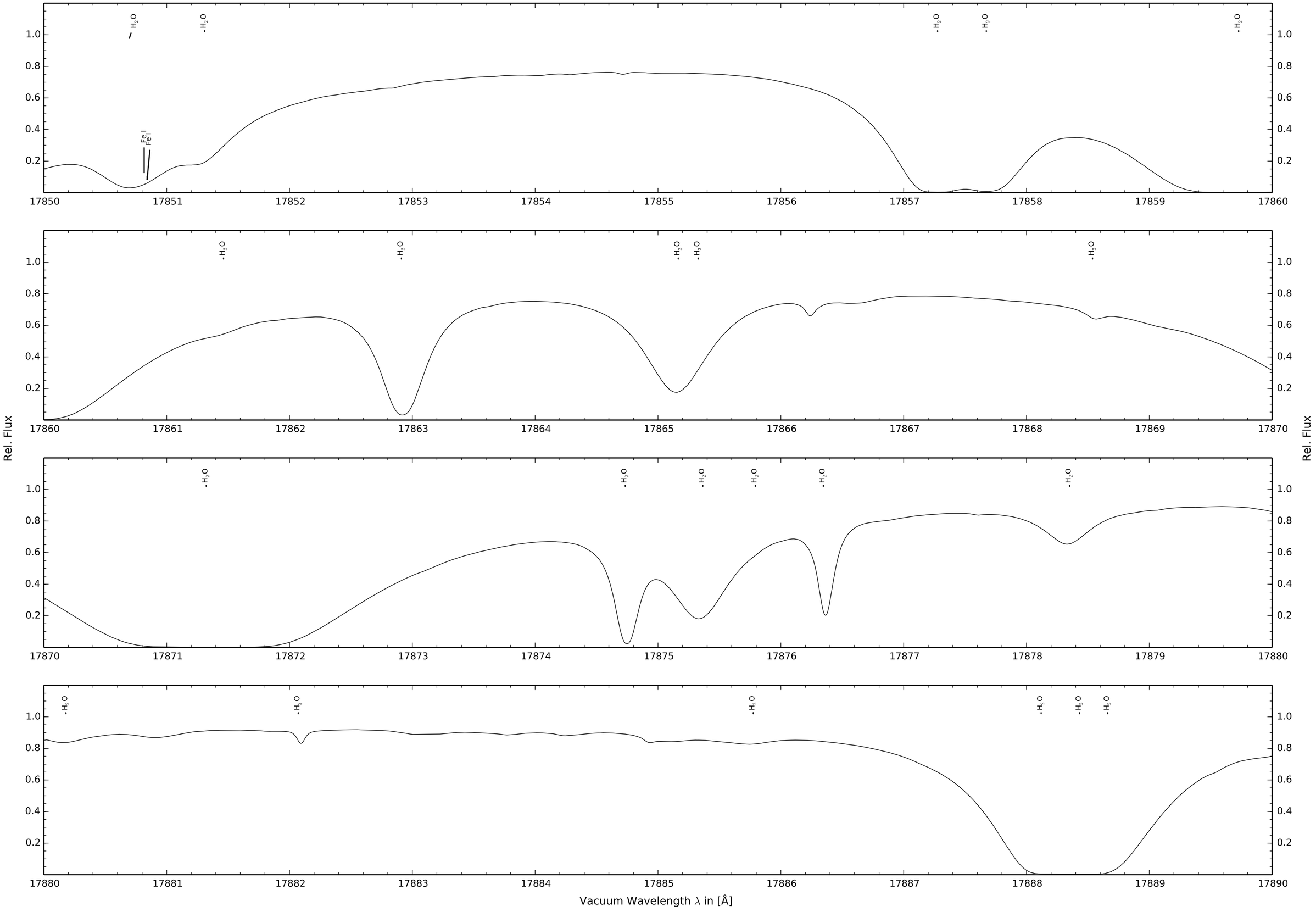
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Mg I

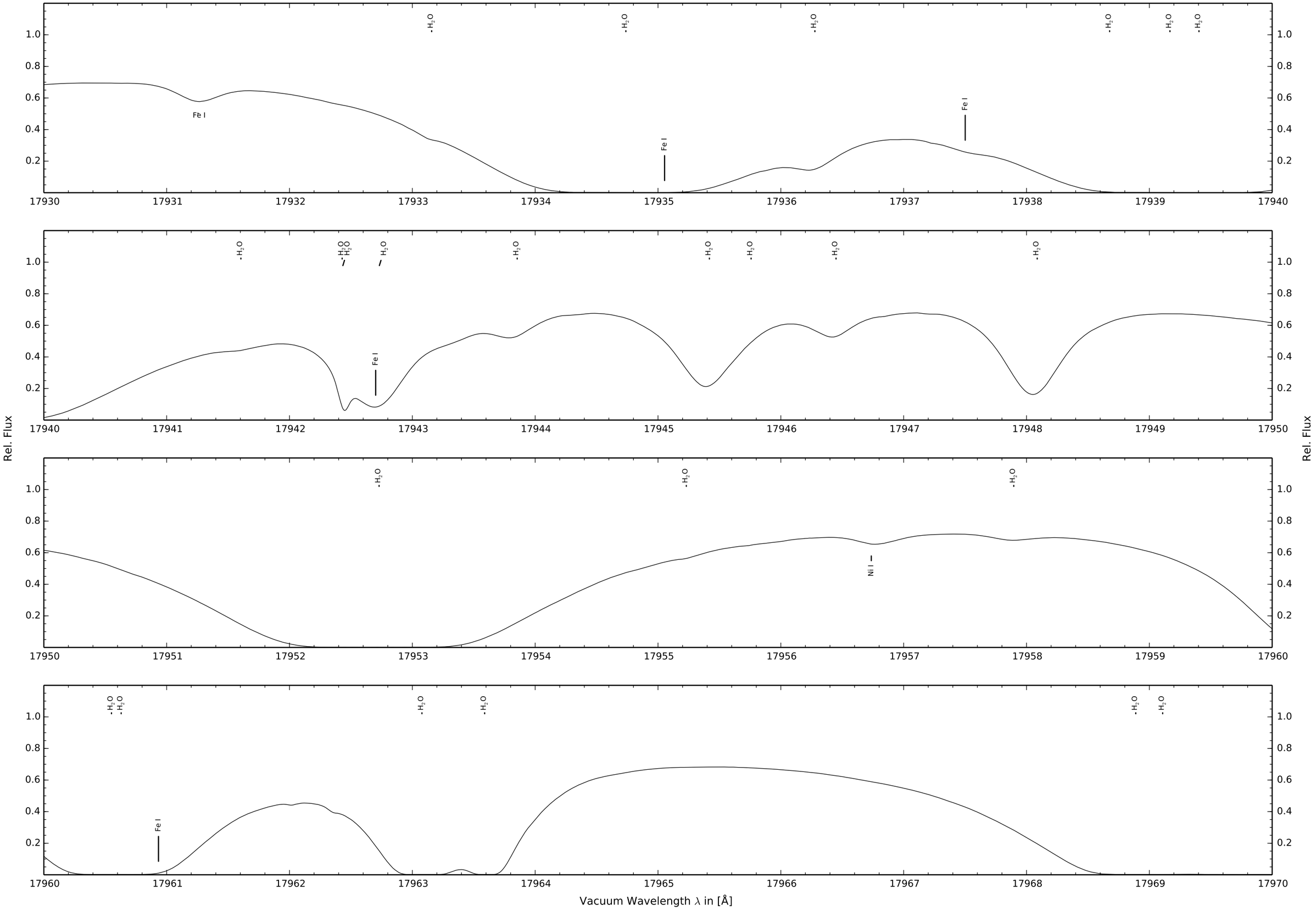

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
C I
Fe I
CH4

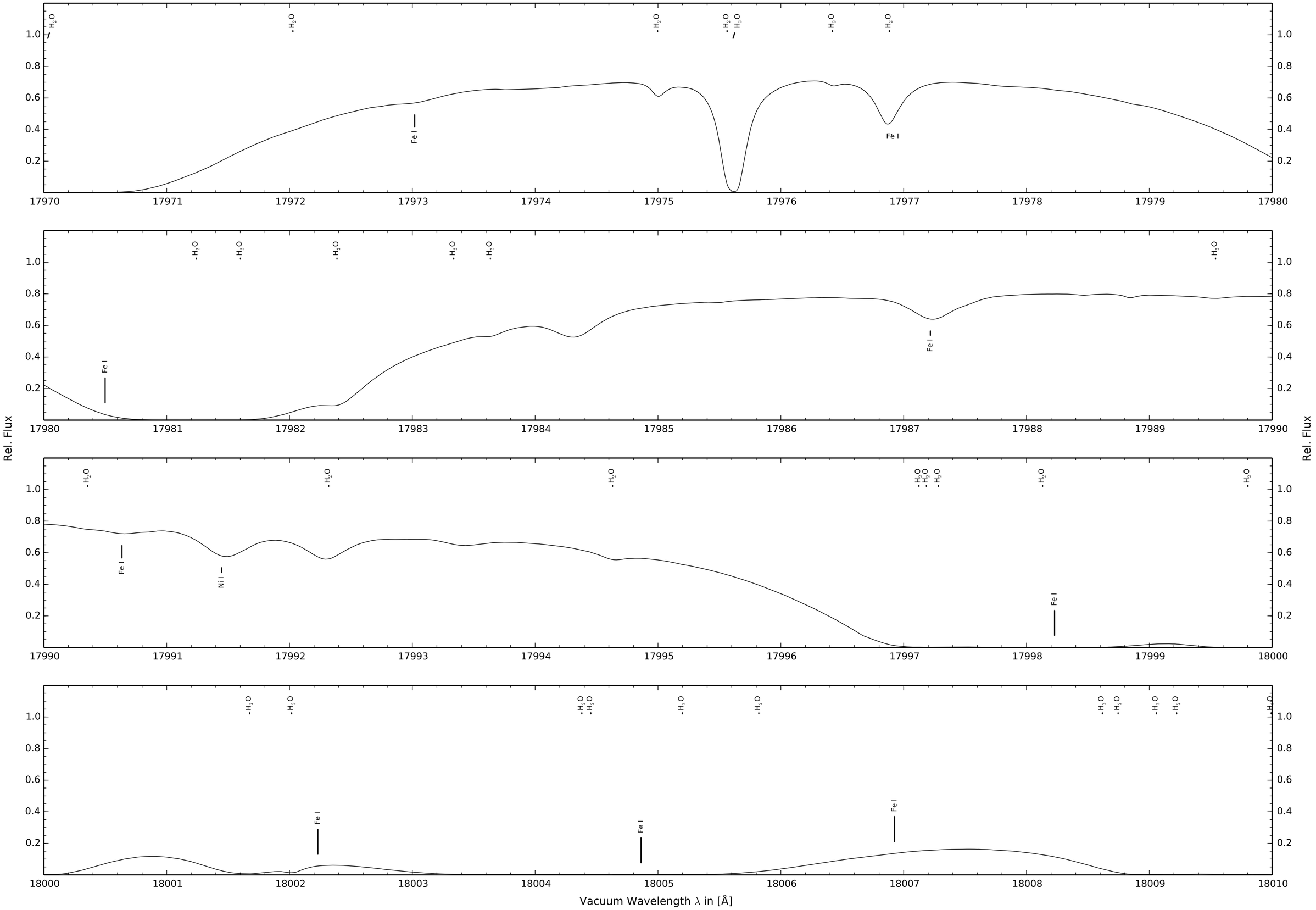

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
C I

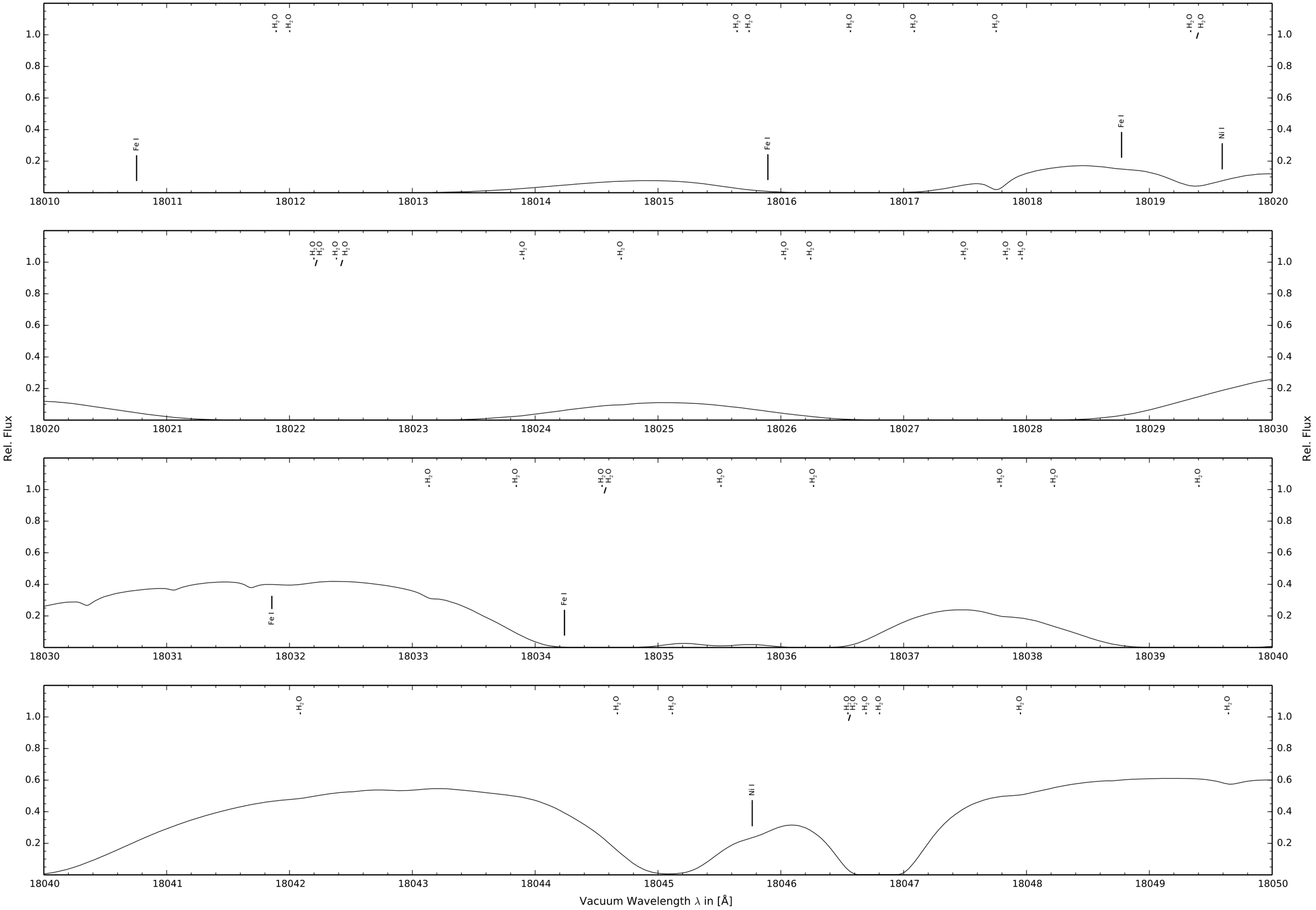

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Fe I

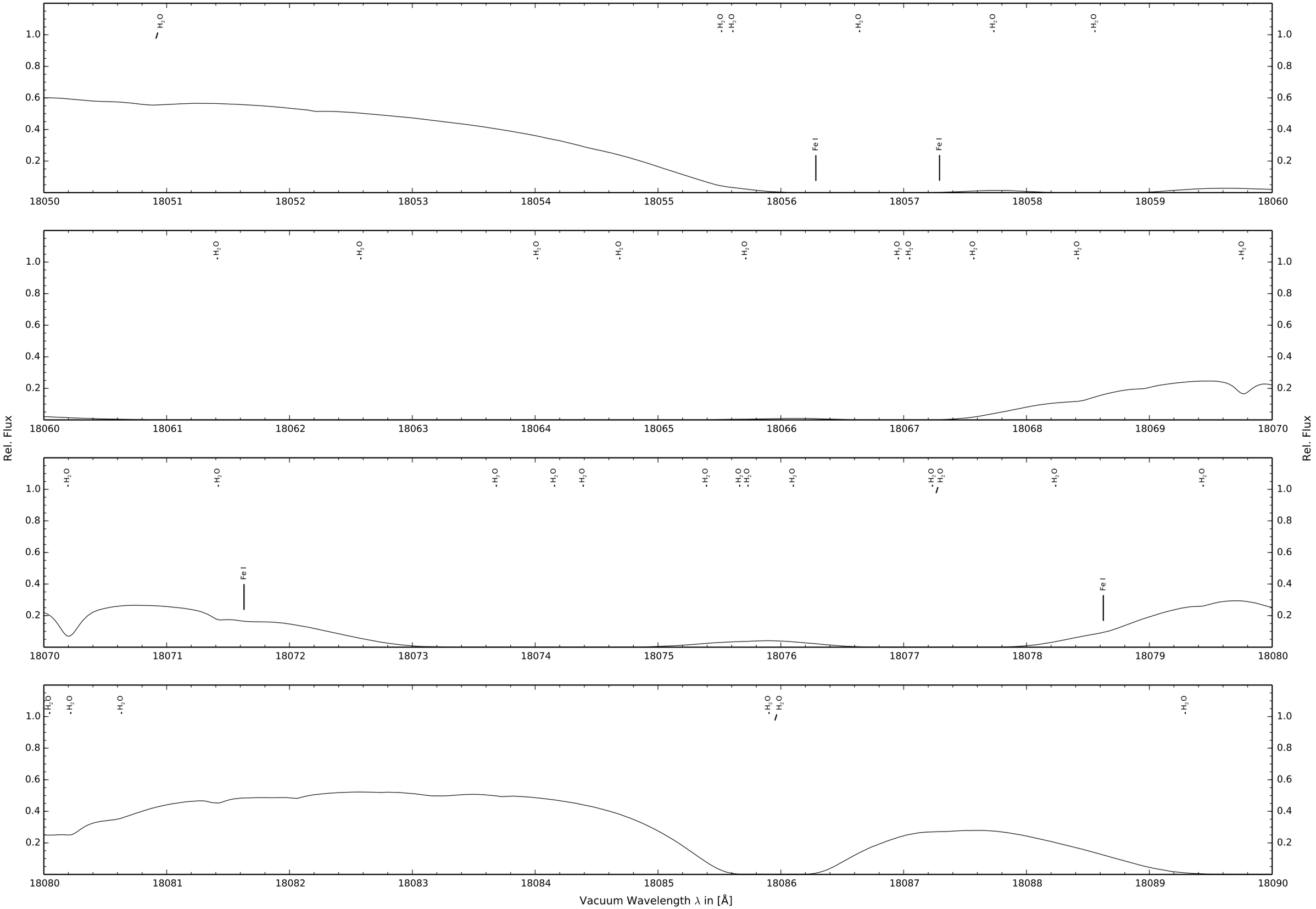
Rel. Flux

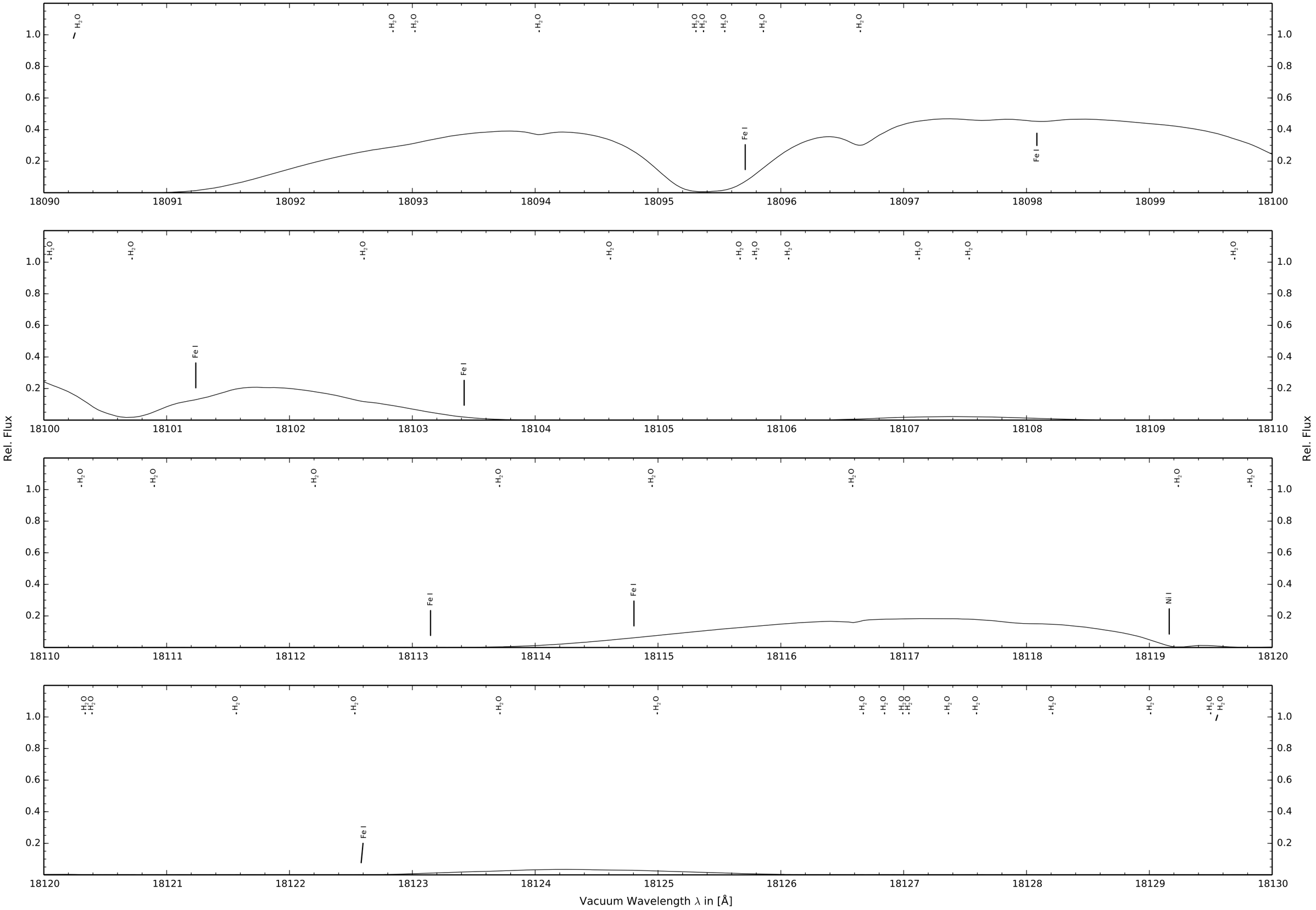
Vacuum Wavelength λ in [Å]


Rel. Flux
Fe I
Fe I
Fe I
Fe I
Fe I
Ni I
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ni I


Rel. Flux
Fe I
Fe I
Fe I
Ni I
Fe I
Ni I
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ni I

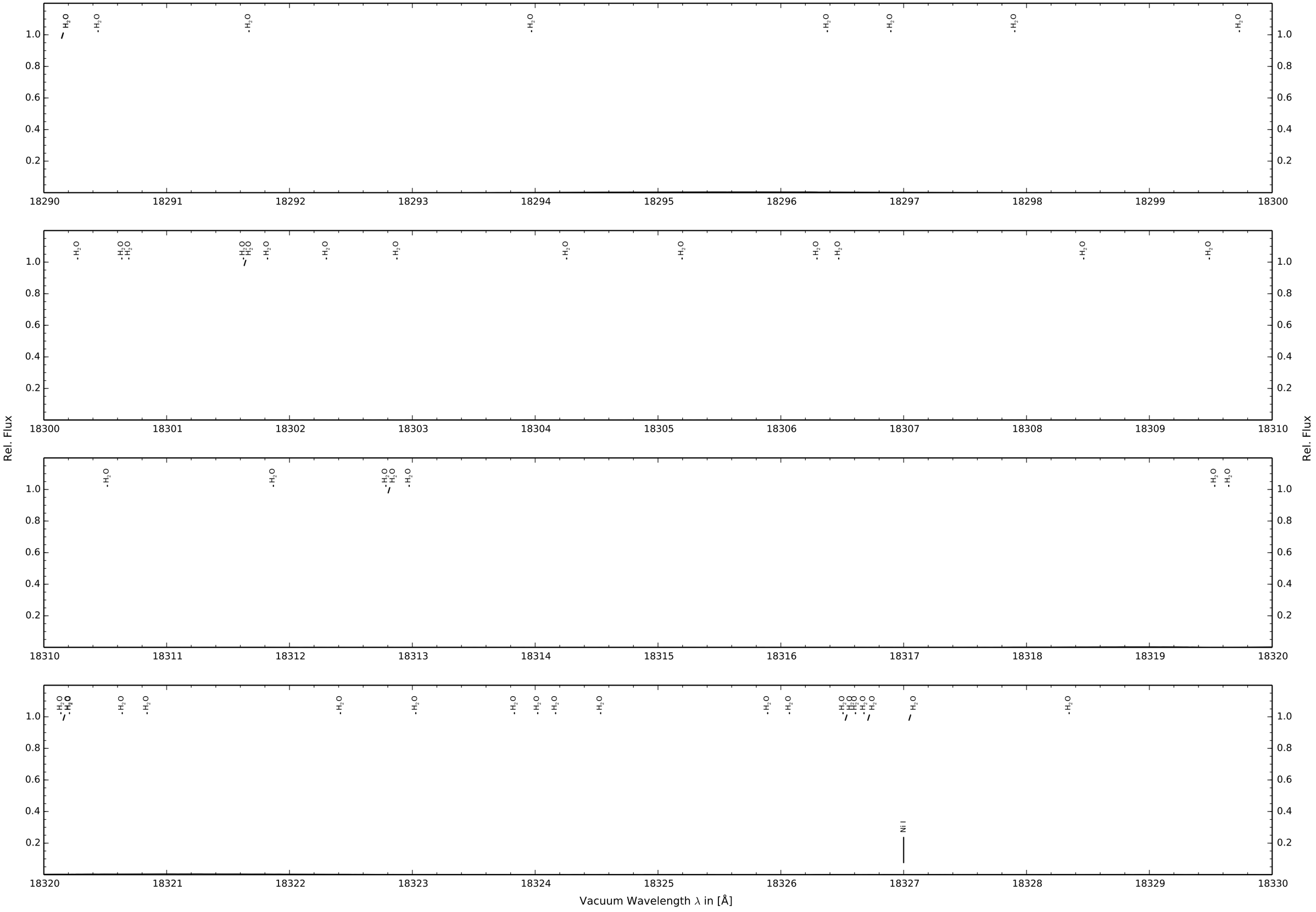
Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
-H2O

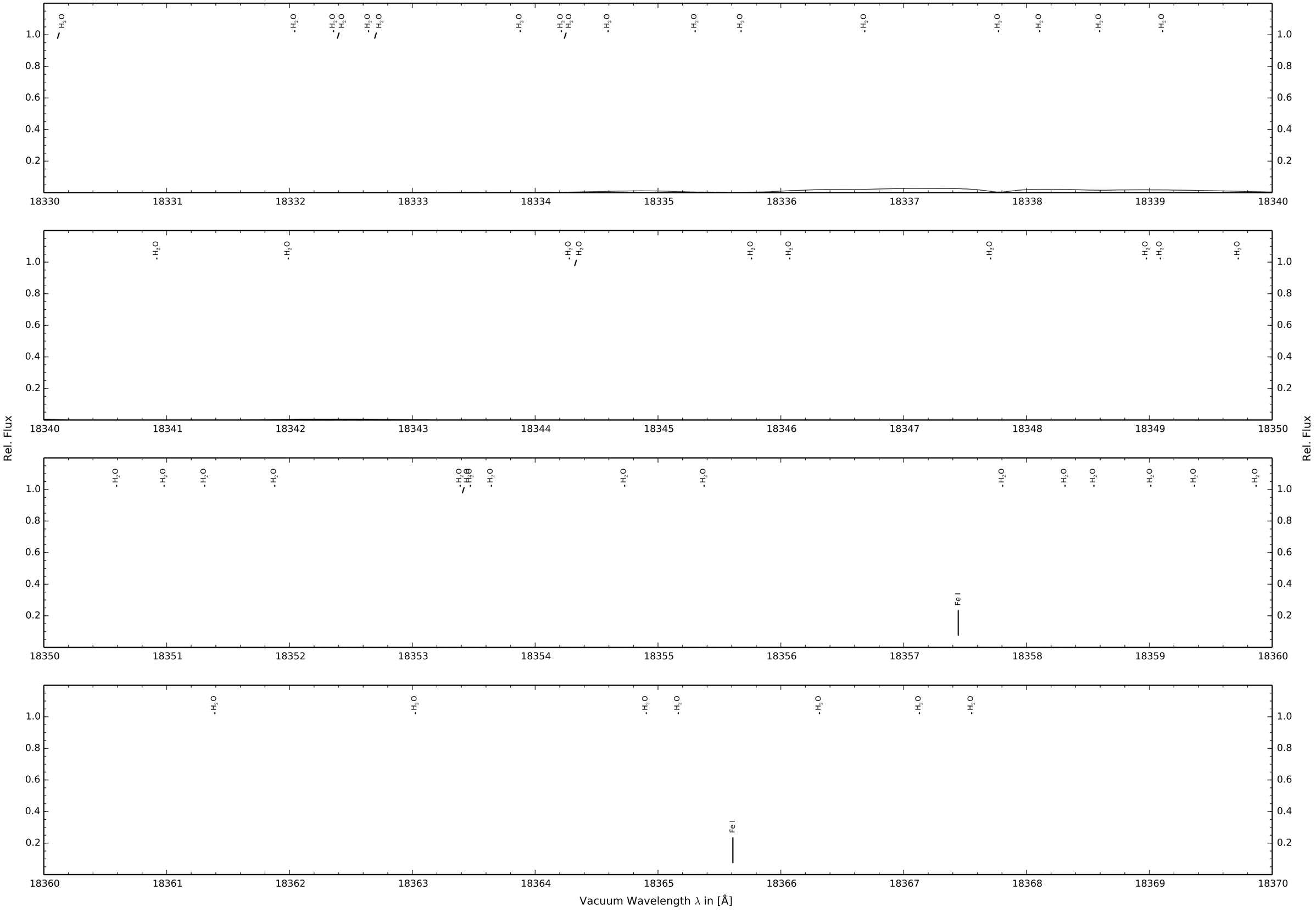
Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I

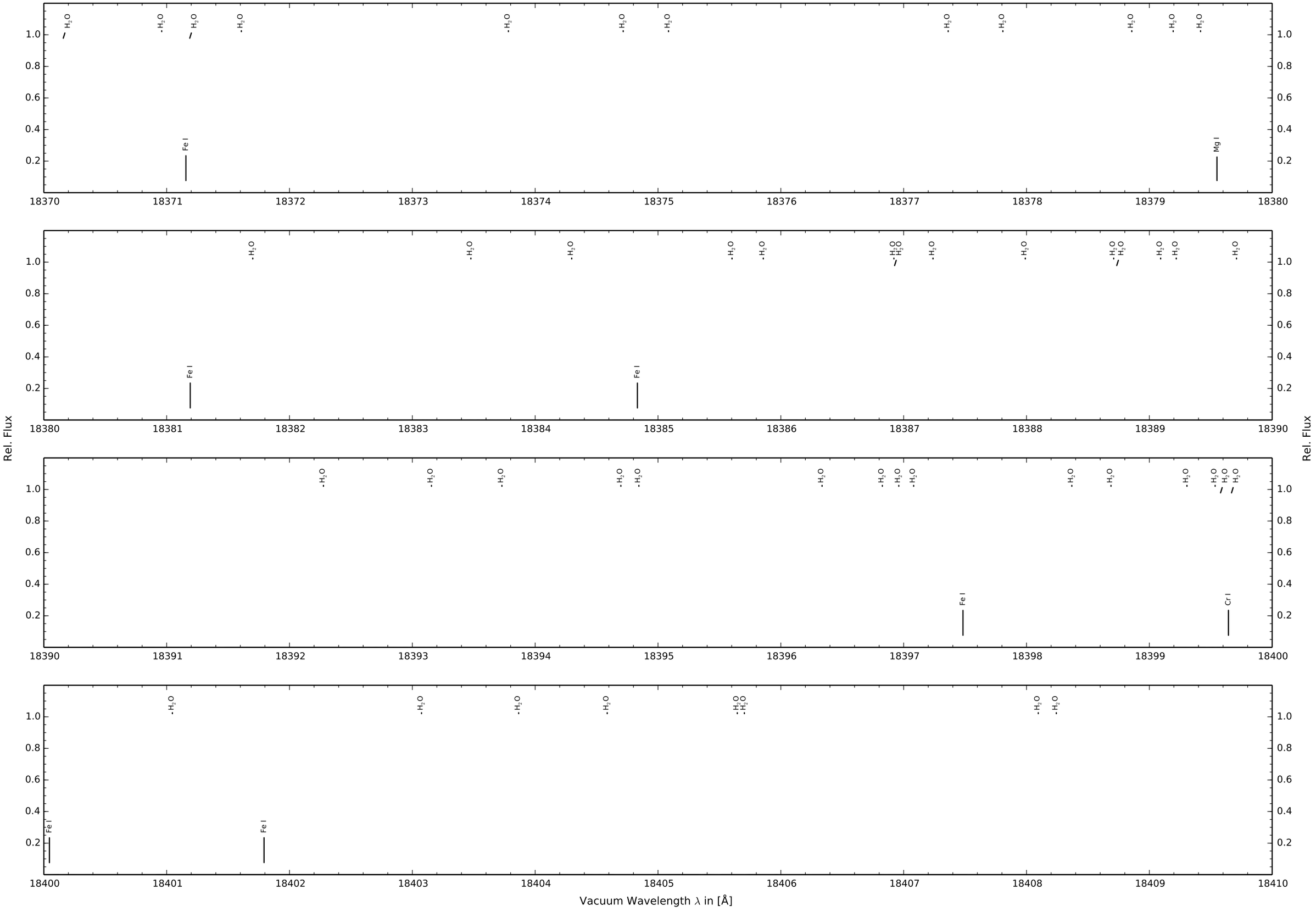
Rel. Flux

Vacuum Wavelength λ in [Å]

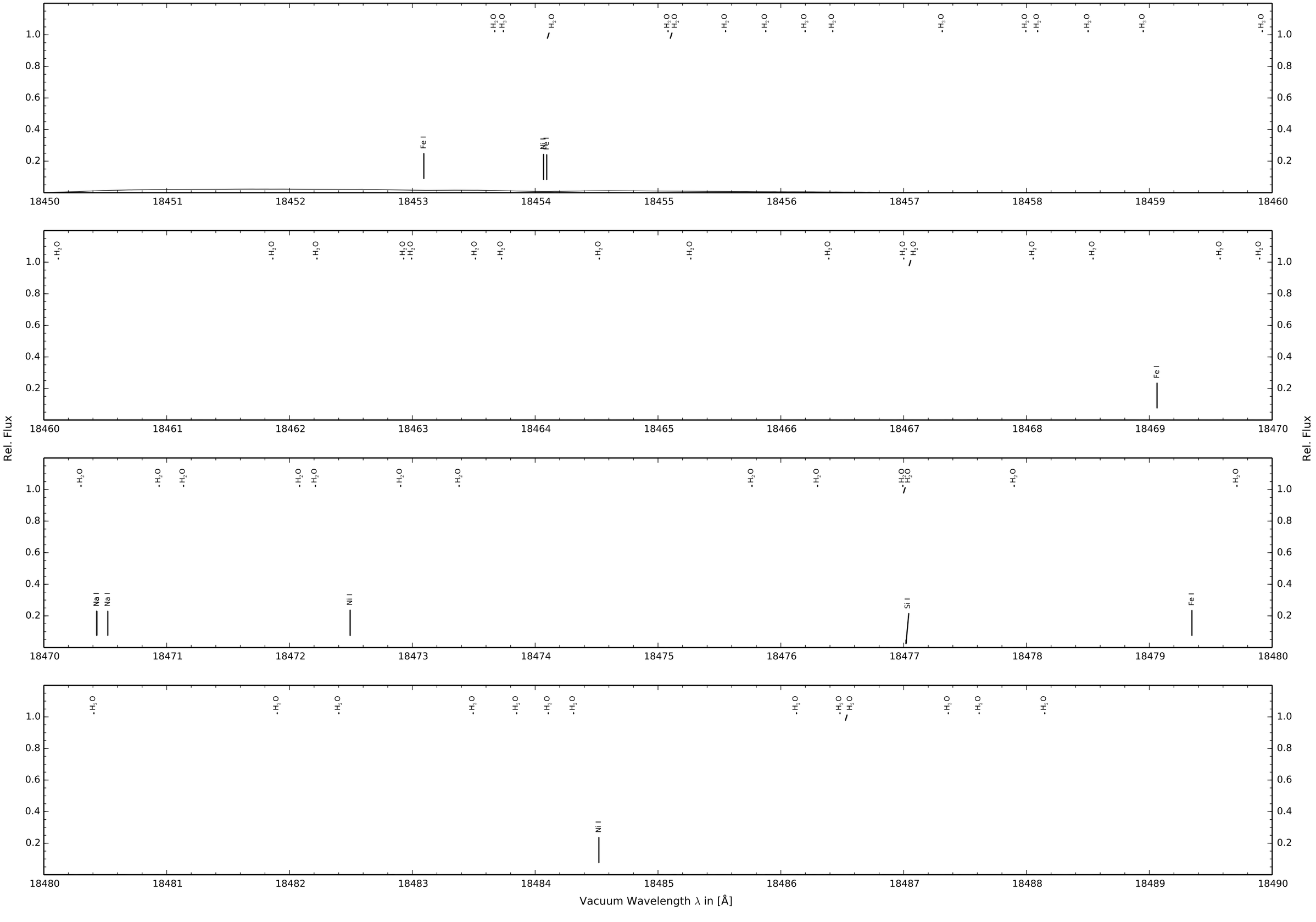
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Ni I
Fe I
Si I


Rel. Flux
Vacuum Wavelength λ in [Å]
Ni I

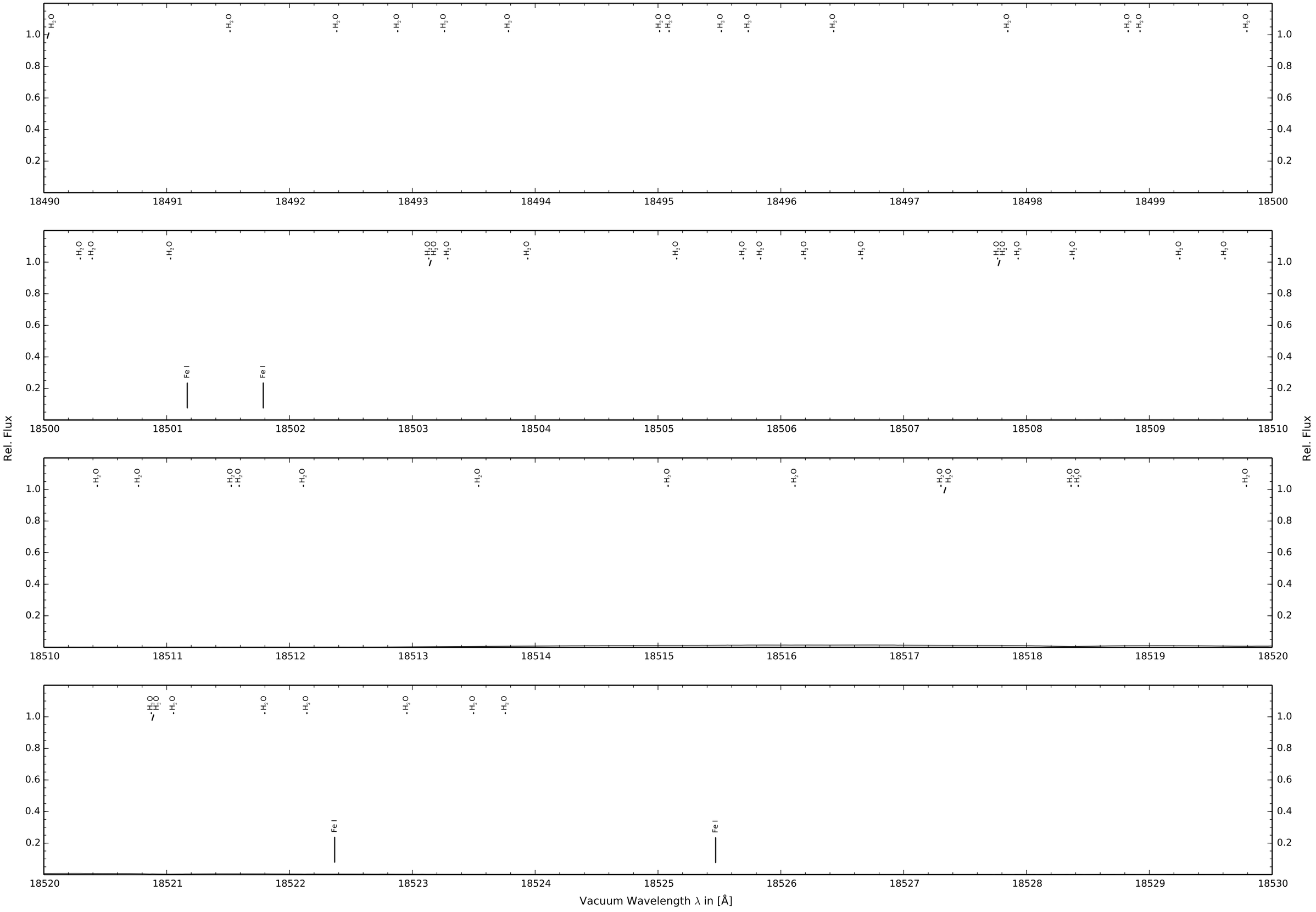

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Mg I
Cr I
H2O

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Ni I
Si I

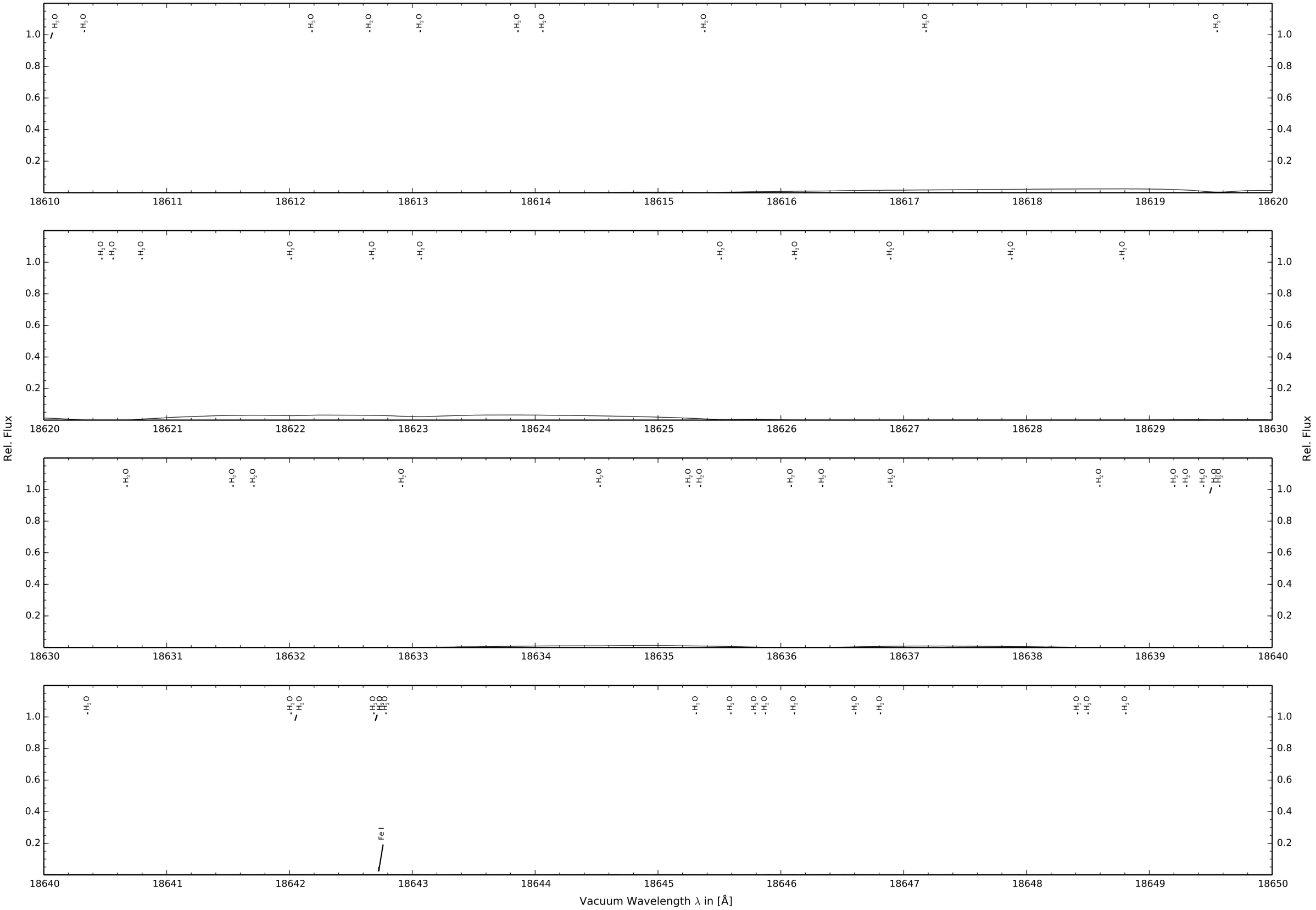


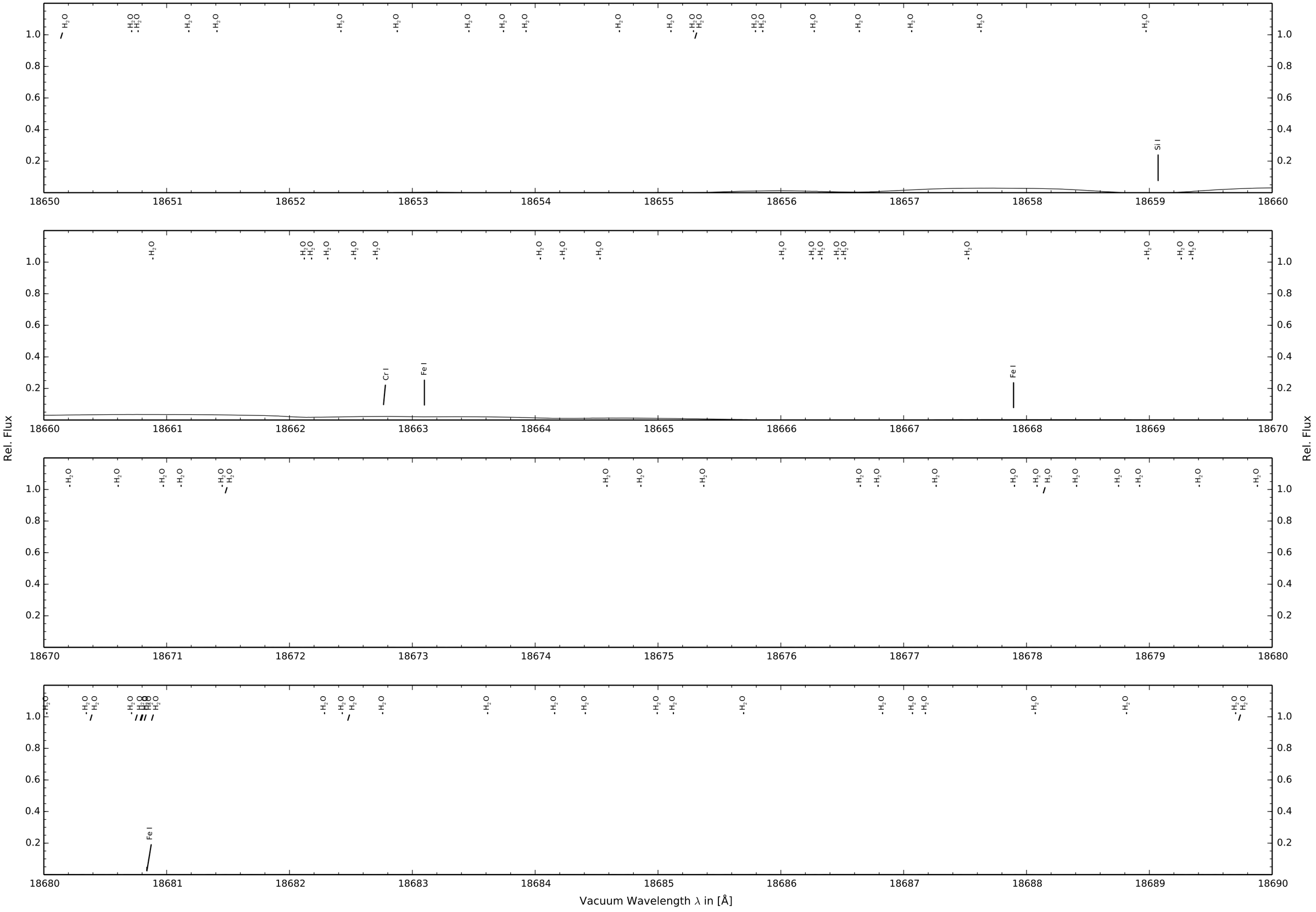
Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Ni I
Na I
Si I
H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Fe I
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Si I
H2O

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I
Fe I
Cr I

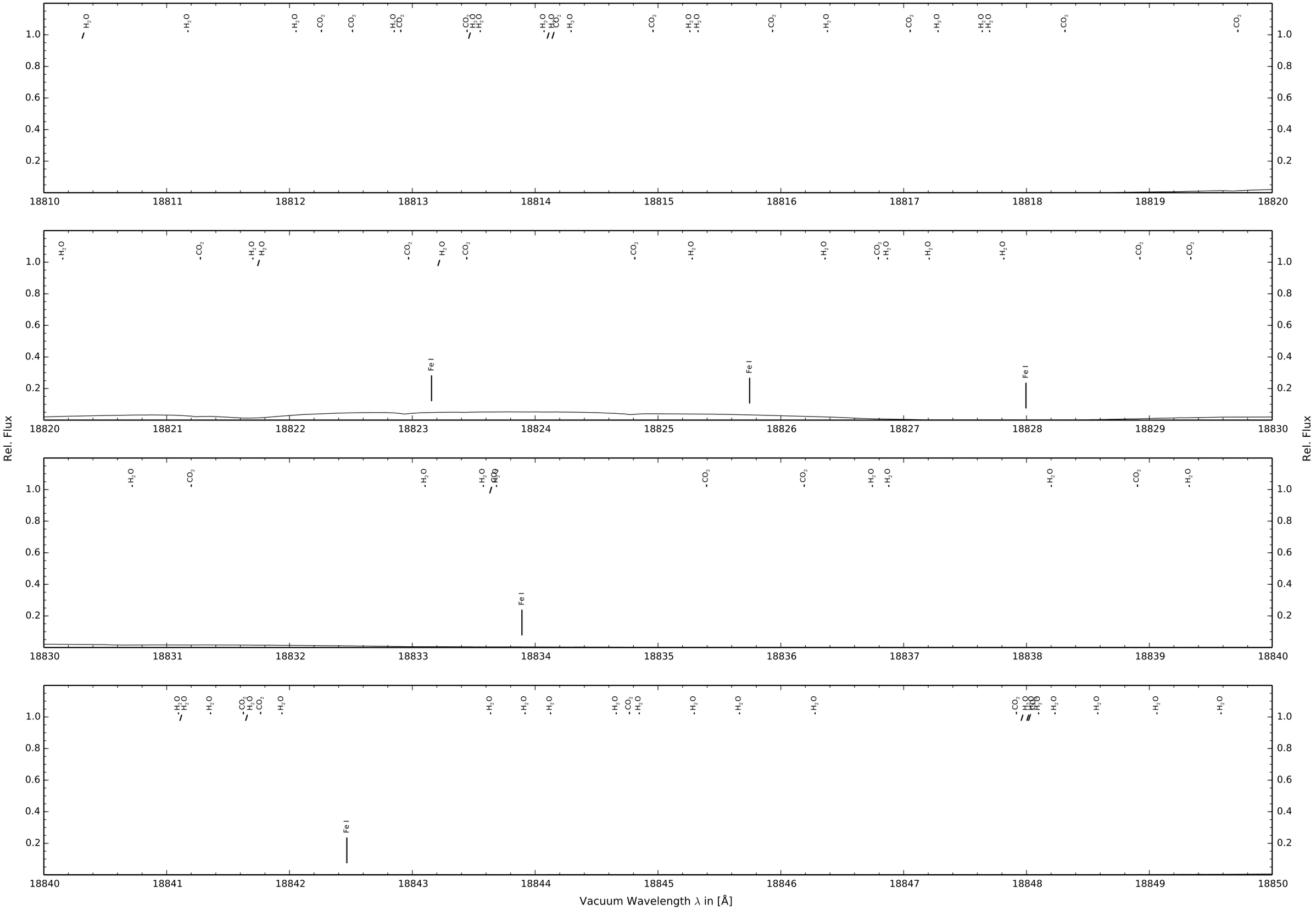

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

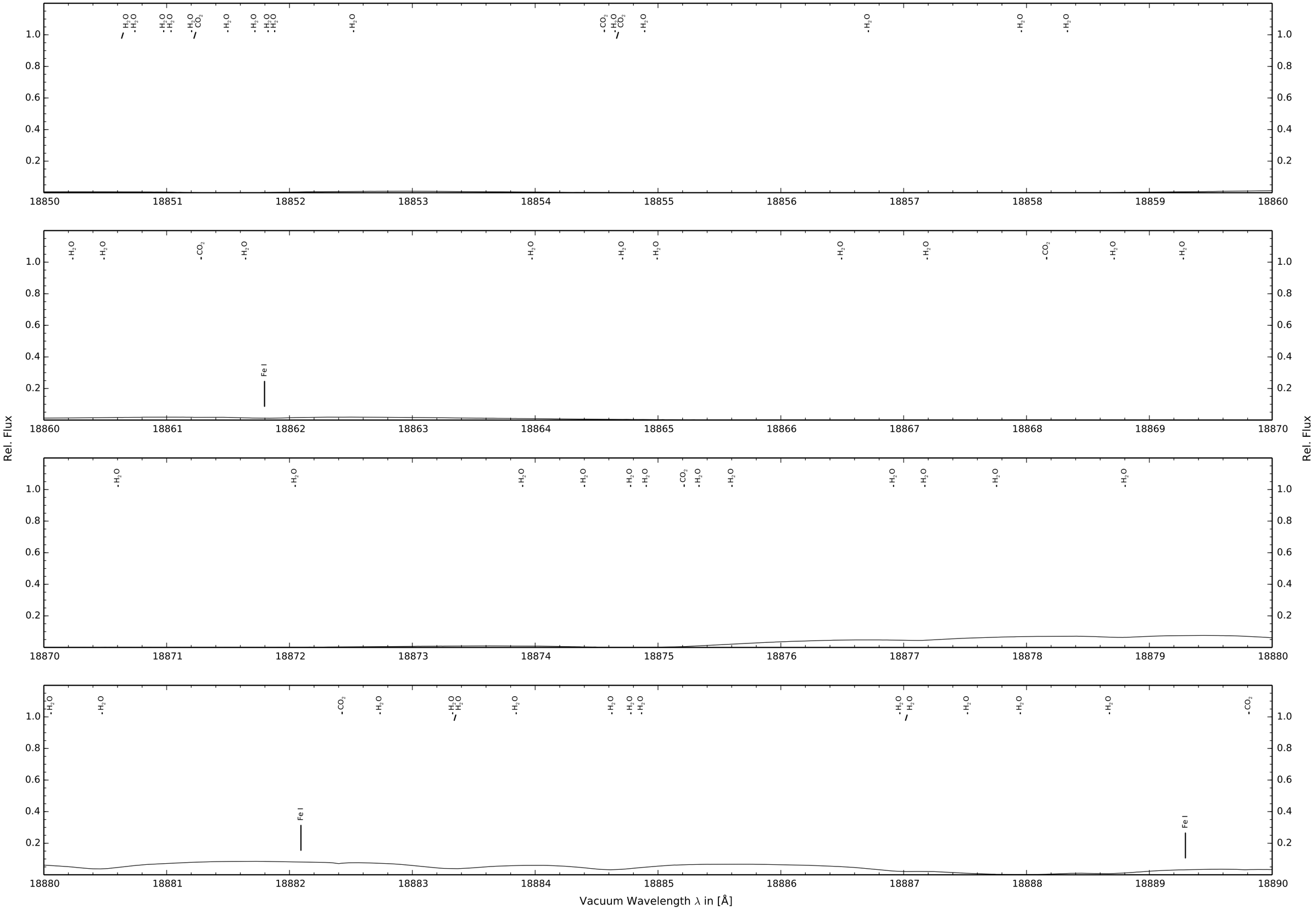

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Cr I
Fe I
Fe I
Fe I
H2O

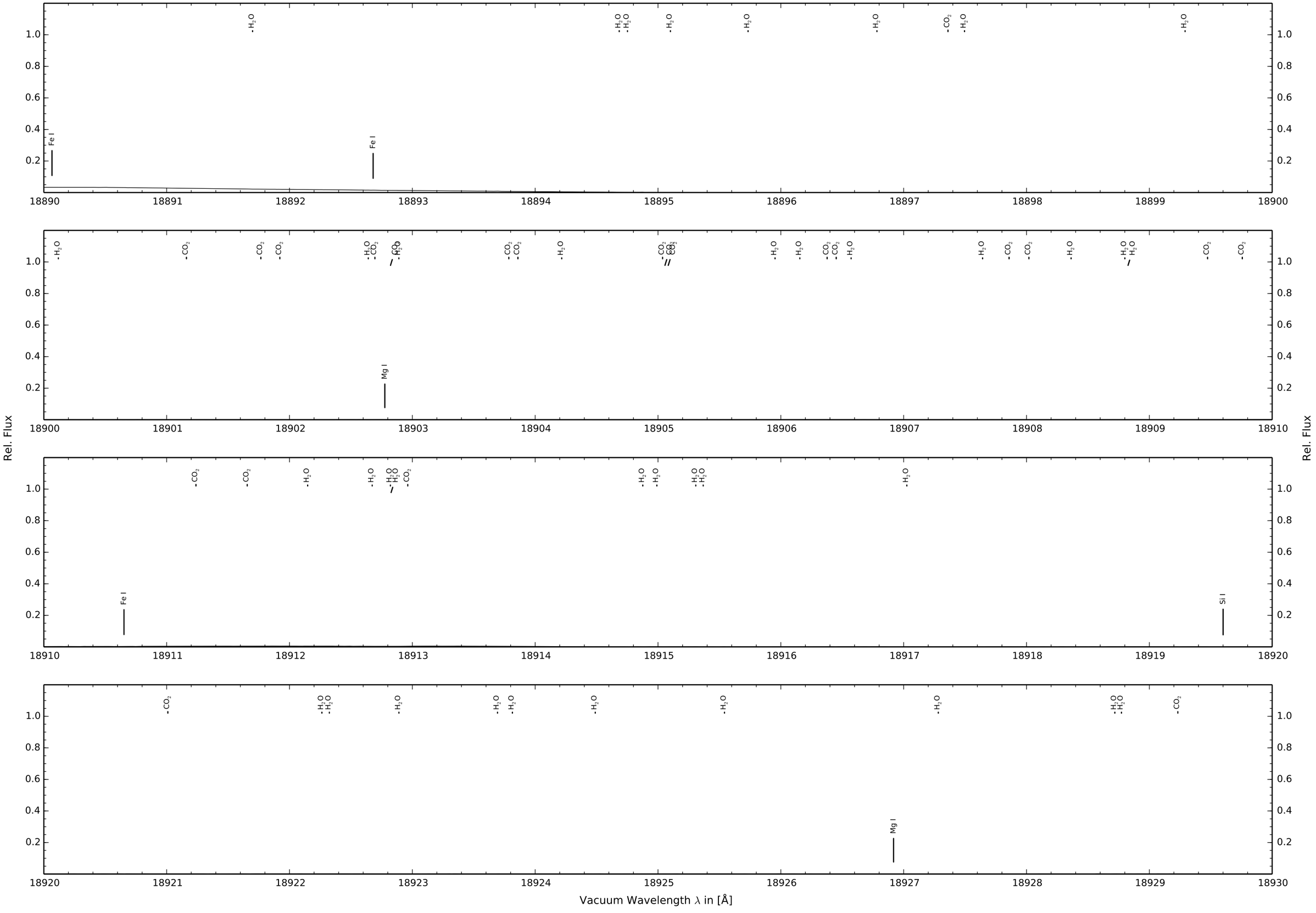
Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Cr I
Si I
CO2

Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
H I
H_2O
CO_2

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I


Rel. Flux
Fe I
Fe I
Mg I
Fe I
Si I
Mg I
Vacuum Wavelength λ in [Å]

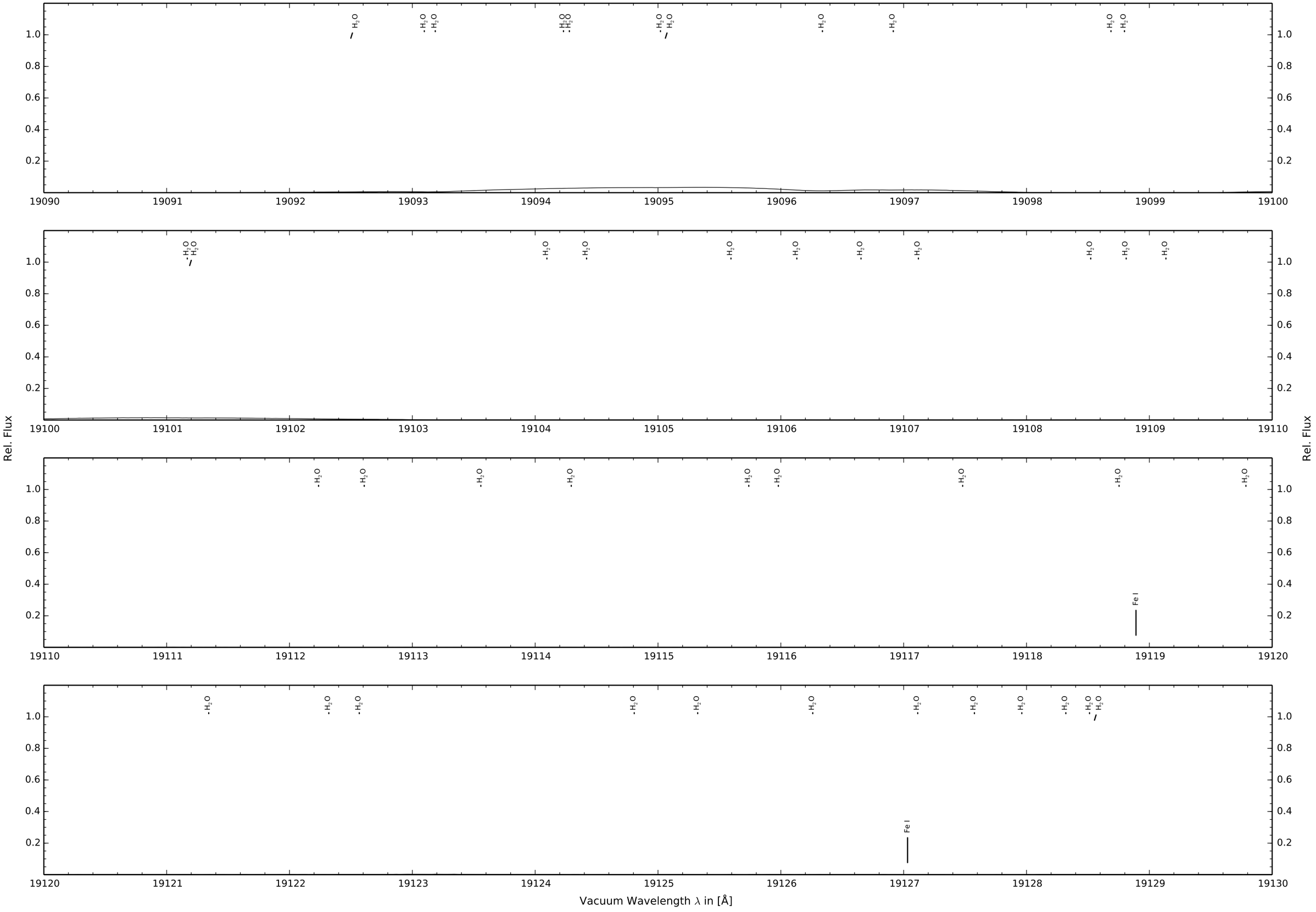
Rel. Flux
Vacuum Wavelength λ in [Å]
Ca I
S I
Fe I
Mg I
H_2O
CO_2

Rel. Flux

Vacuum Wavelength λ in [Å]

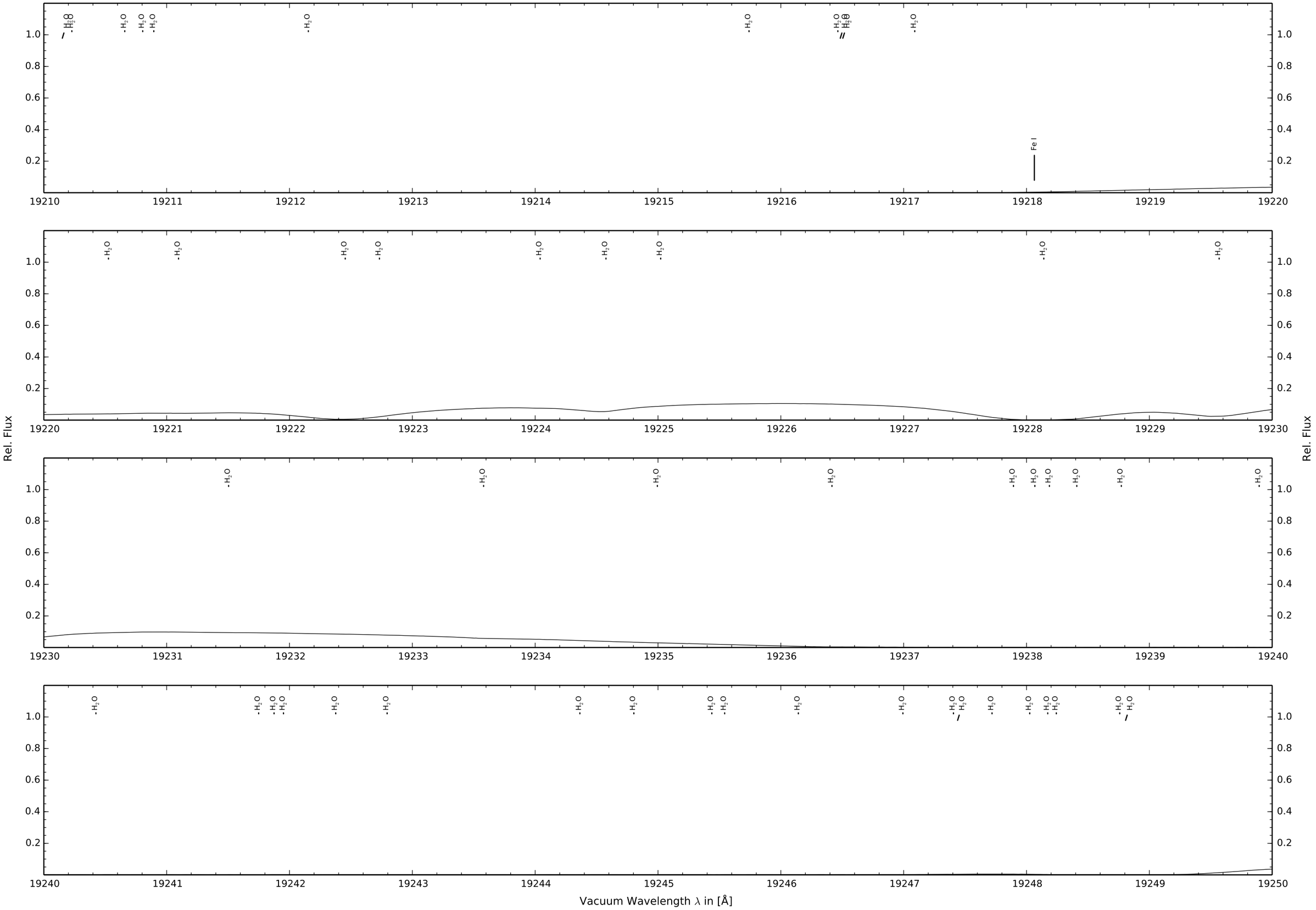
Rel. Flux
Vacuum Wavelength λ in [Å]
Si I

Rel. Flux
Ca I
-H2O
1.0
0.8
0.6
0.4
0.2
19050
19051
19052
19053
19054
19055
19056
19057
19058
19059
19060
19061
19062
19063
19064
19065
19066
19067
19068
19069
19070
19071
19072
19073
19074
19075
19076
19077
19078
19079
19080
19081
19082
19083
19084
19085
19086
19087
19088
19089
19090
Vacuum Wavelength λ in [Å]

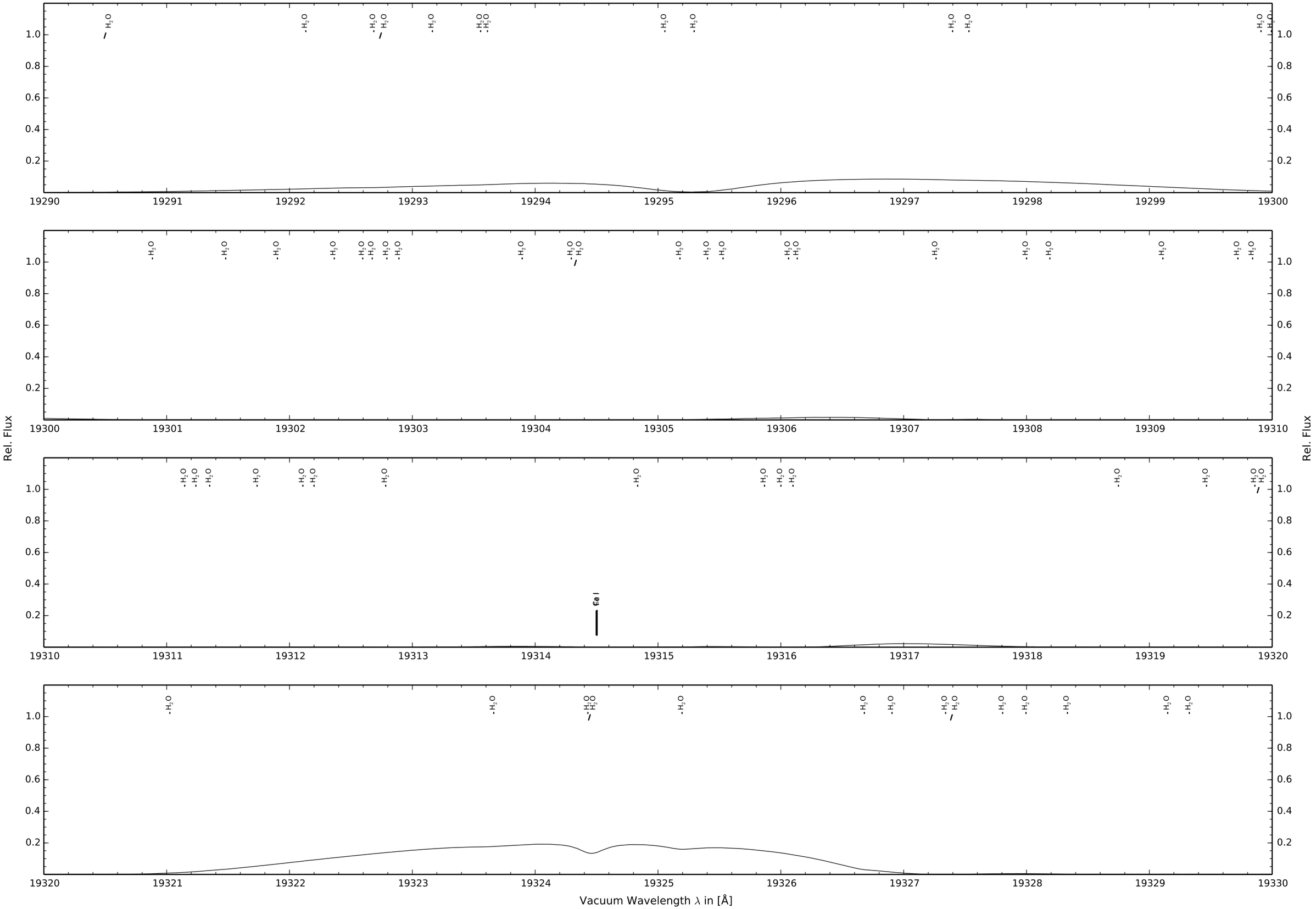

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Mg I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Fe I
Si I


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I

Rel. Flux
Fe I
Fe I
Fe I
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

Rel. Flux

Mg I

Mg I

Si I

Vacuum Wavelength λ in [Å]

Rel. Flux
Vacuum Wavelength λ in [Å]
H I
Ca I
Fe I
Fe I
H2O
CO2

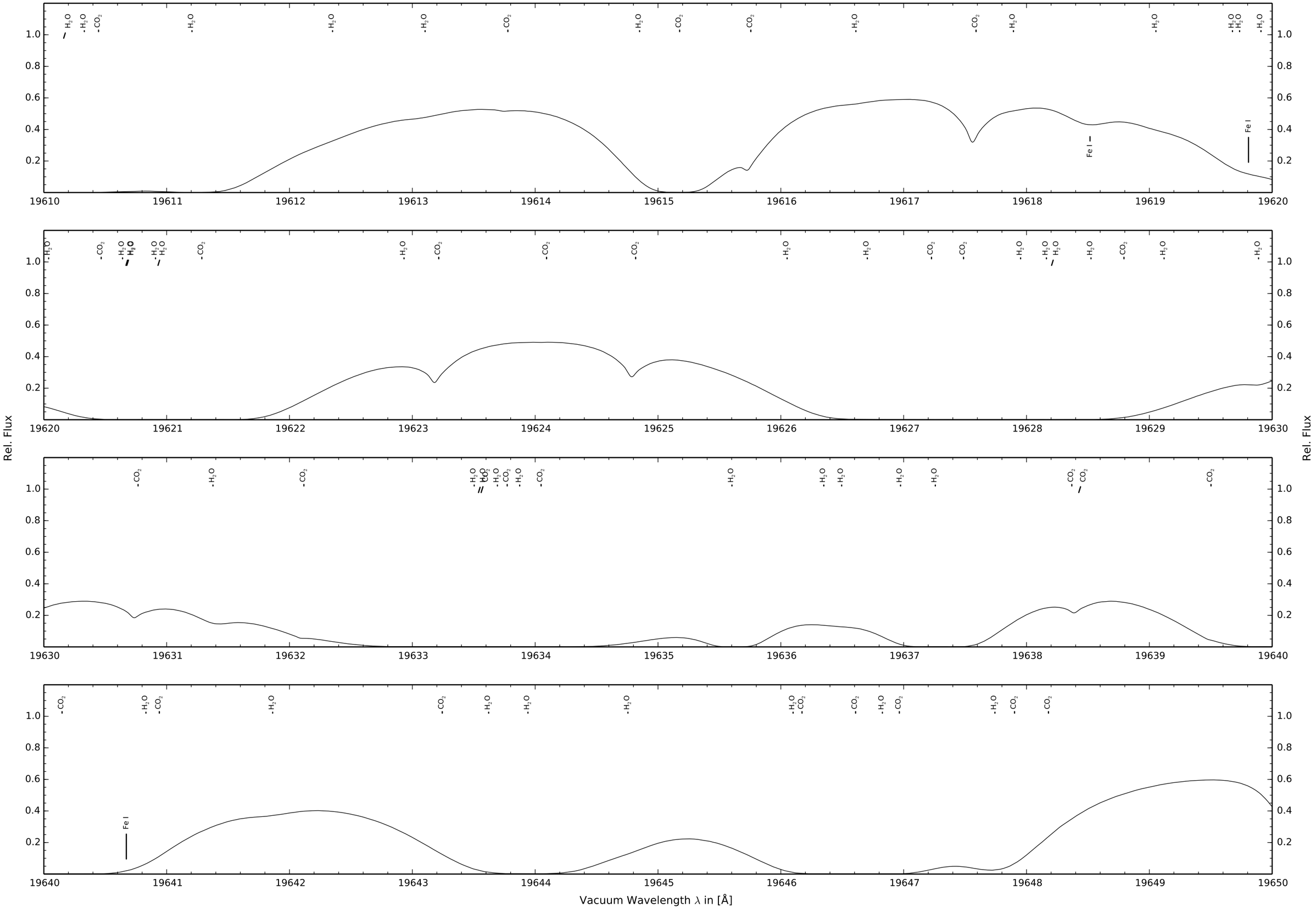
Rel. Flux

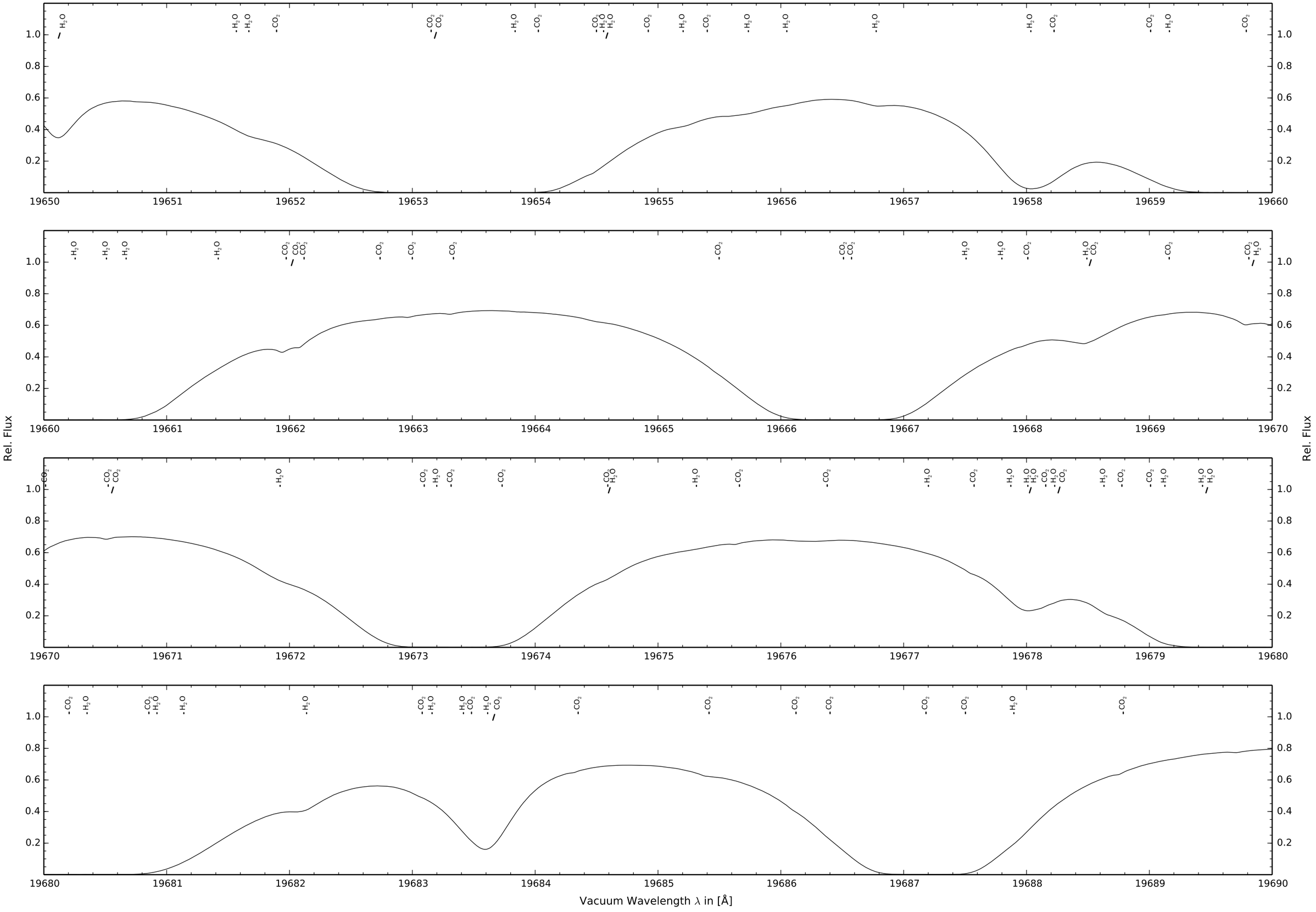
Vacuum Wavelength λ in [Å]

Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Fe I

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Fe I
Fe I
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]

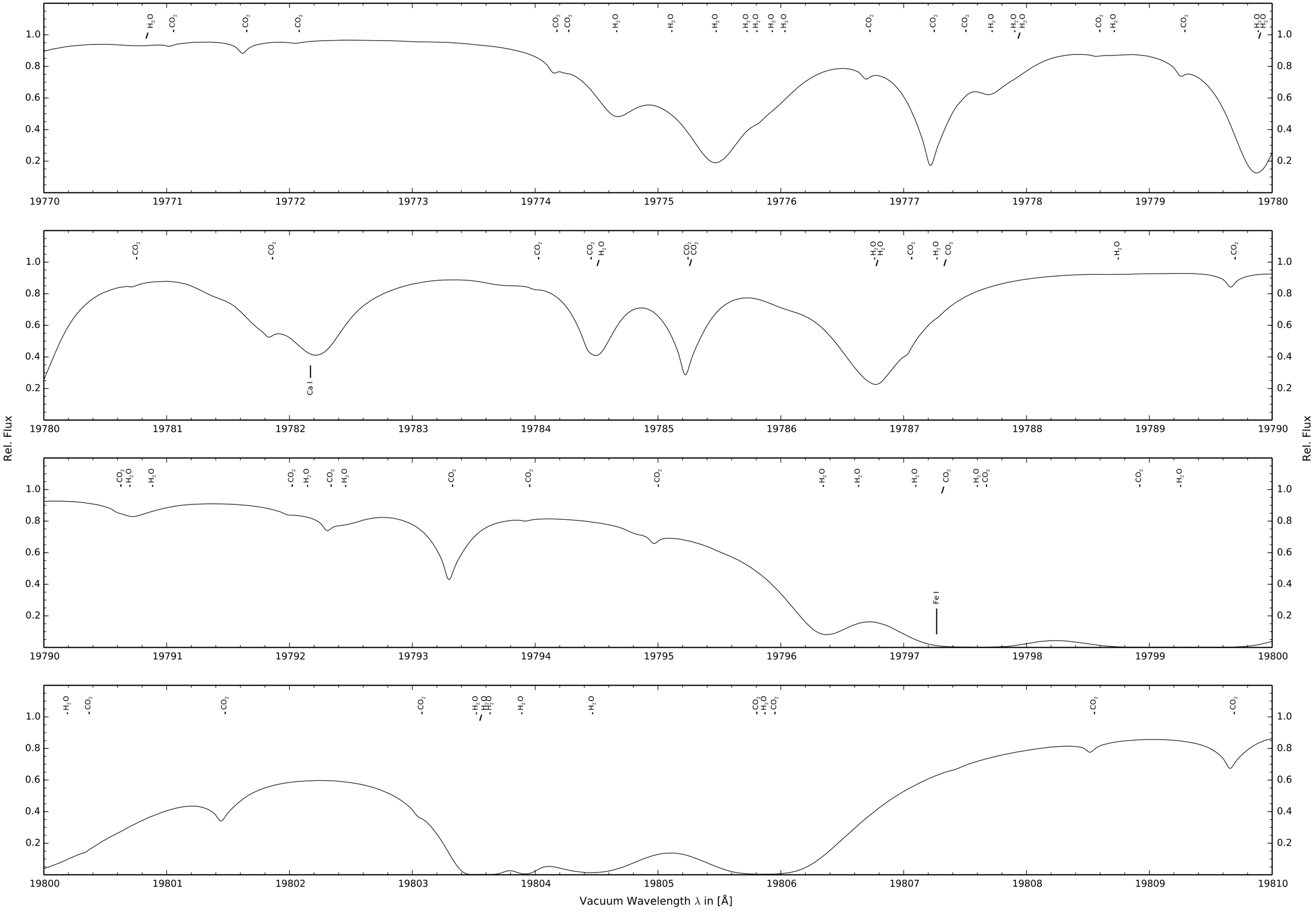
Rel. Flux

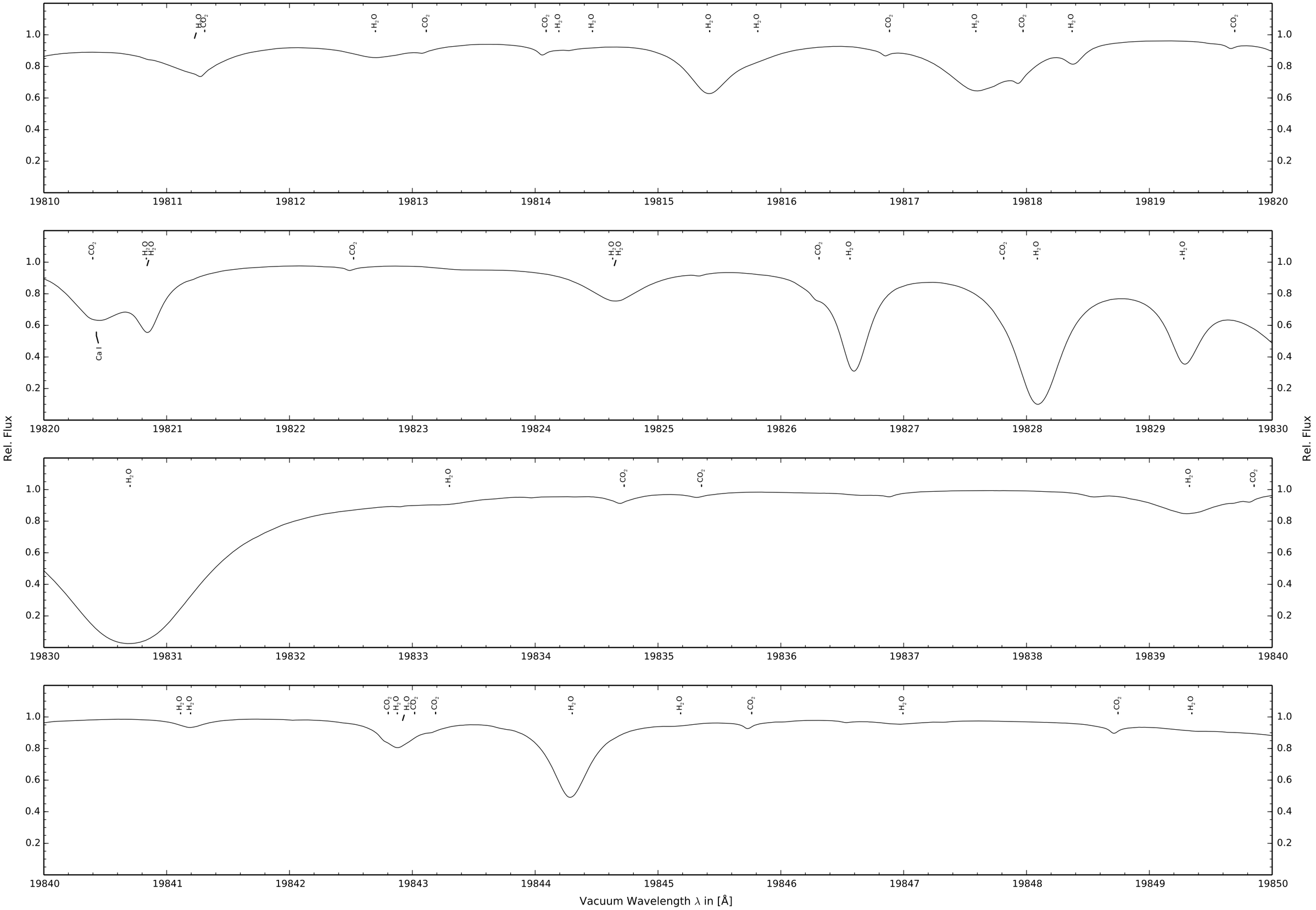
Vacuum Wavelength λ in [Å]

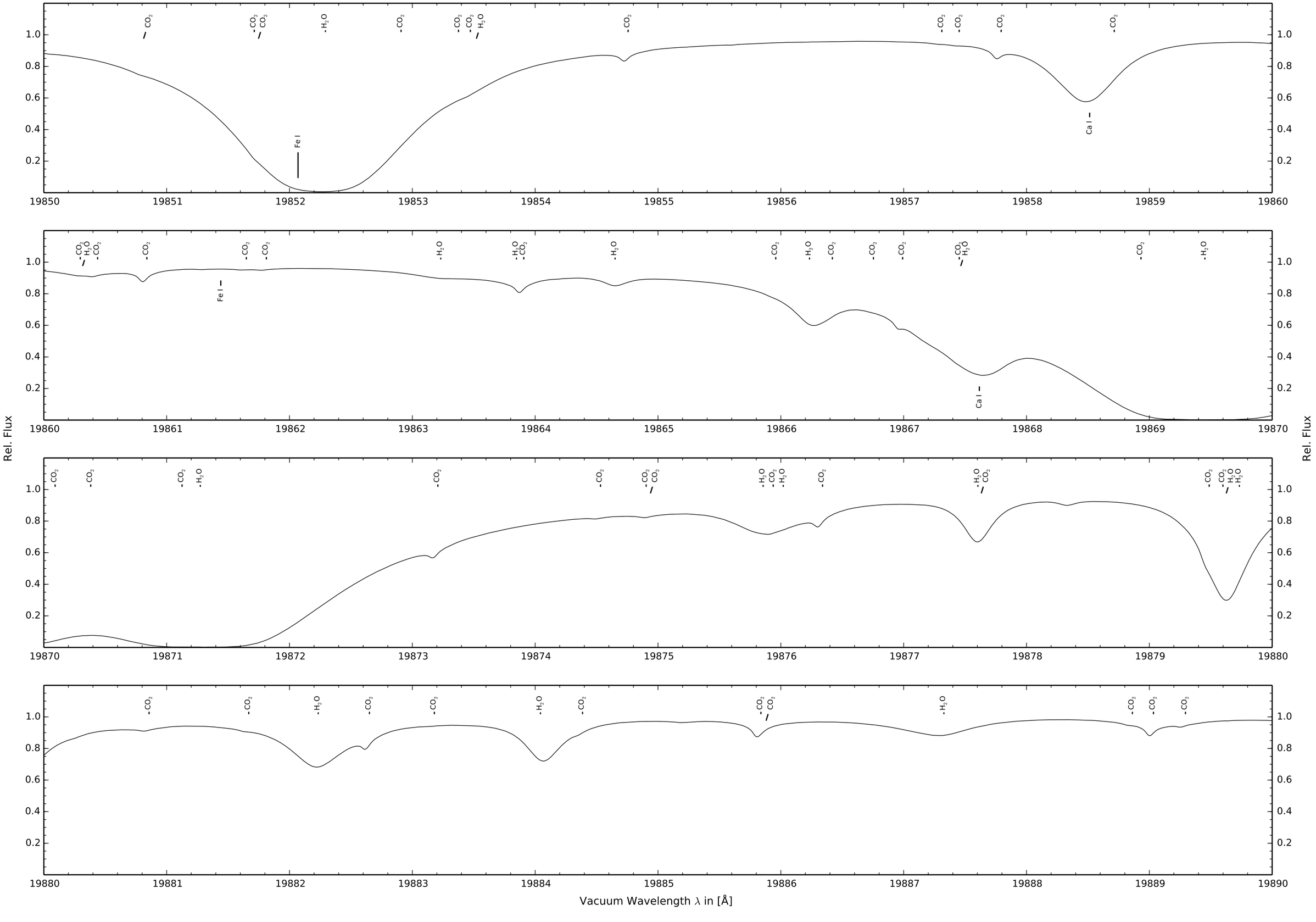
Si I

Mg I

Rel. Flux
Vacuum Wavelength λ in [Å]
Mg I


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Ca I
Fe I


Rel. Flux
Ca I
H_2O
CO_2
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
Ca I

Rel. Flux

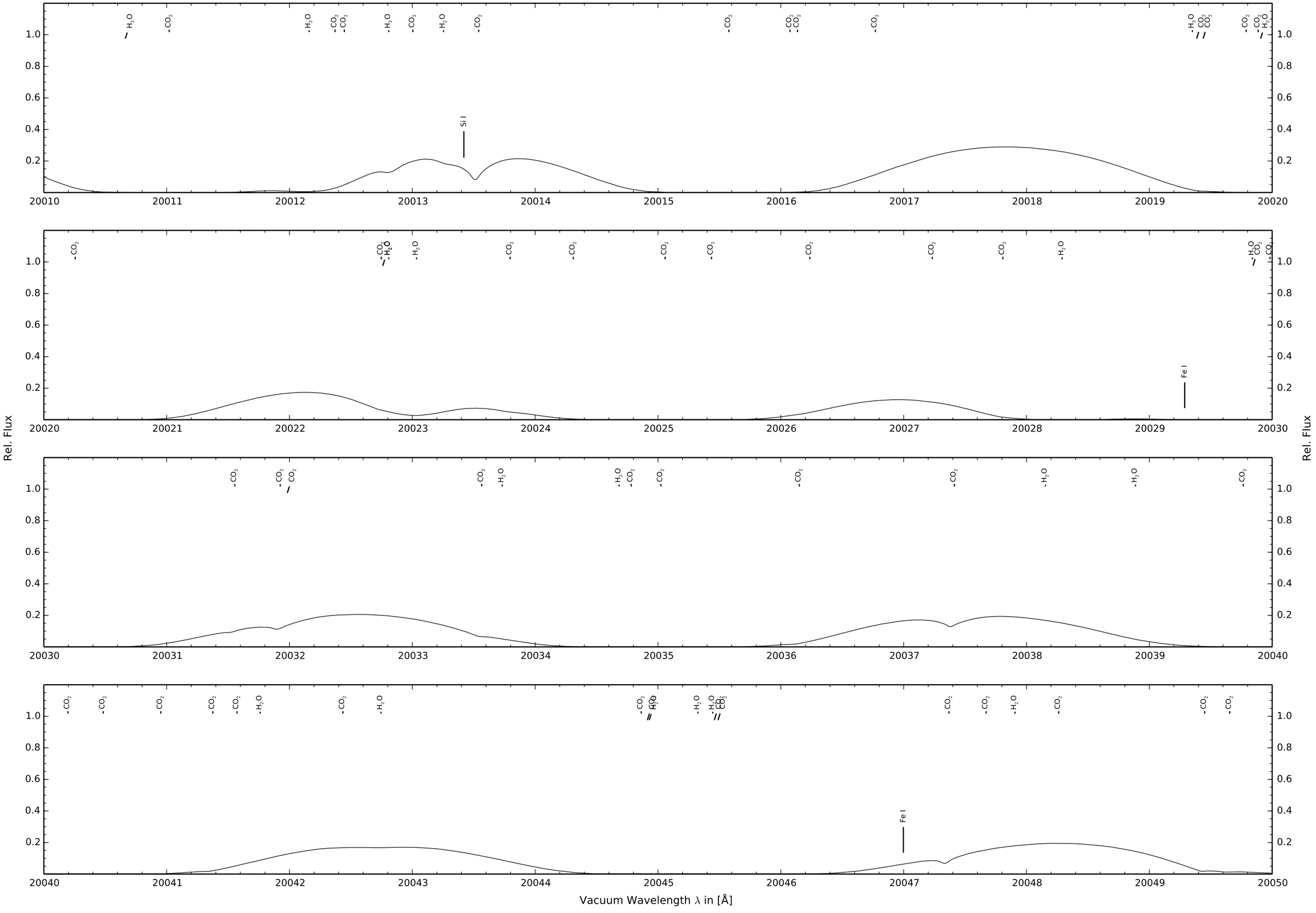
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

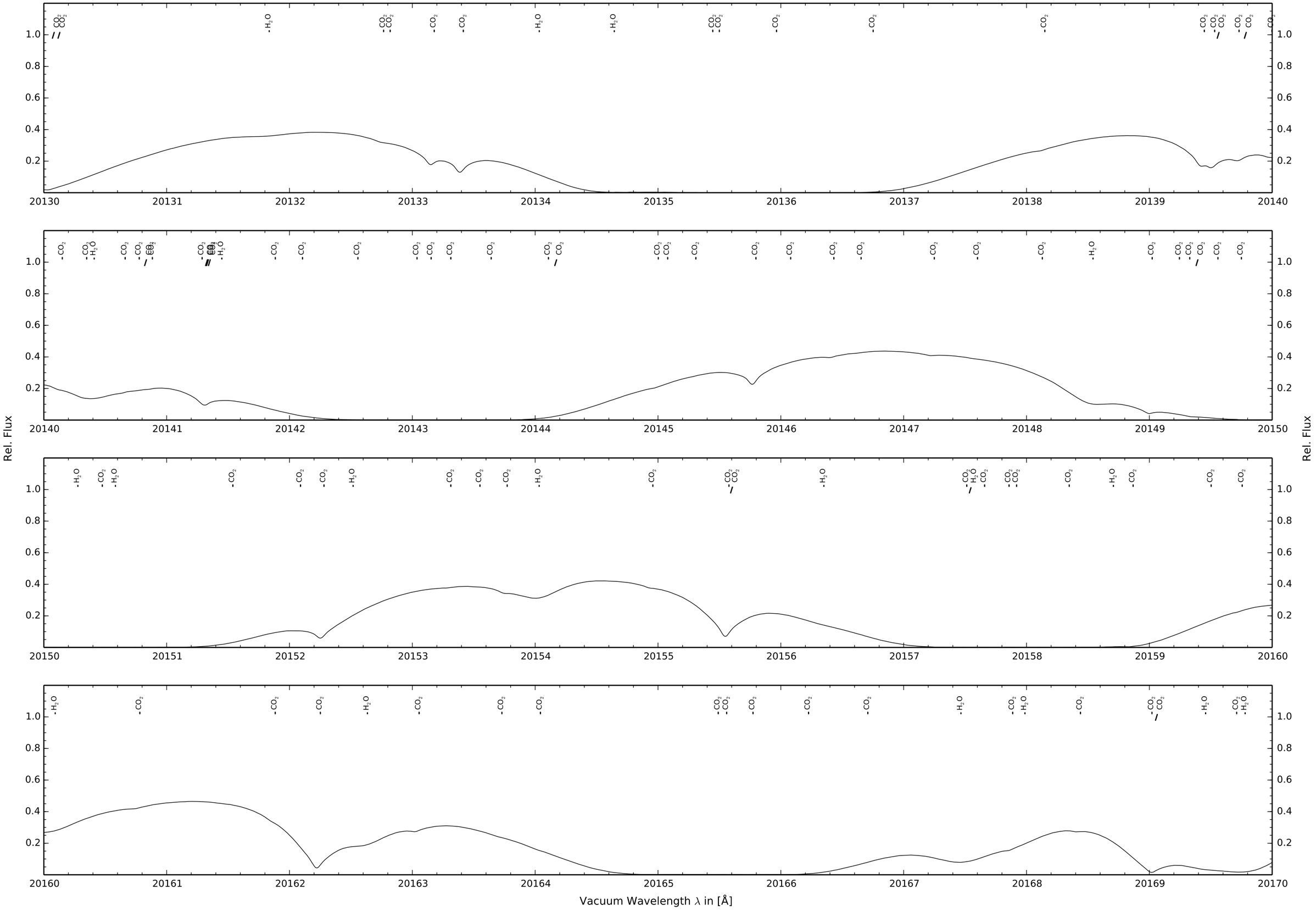
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
Si I
Fe I
H2O
CO2
CO

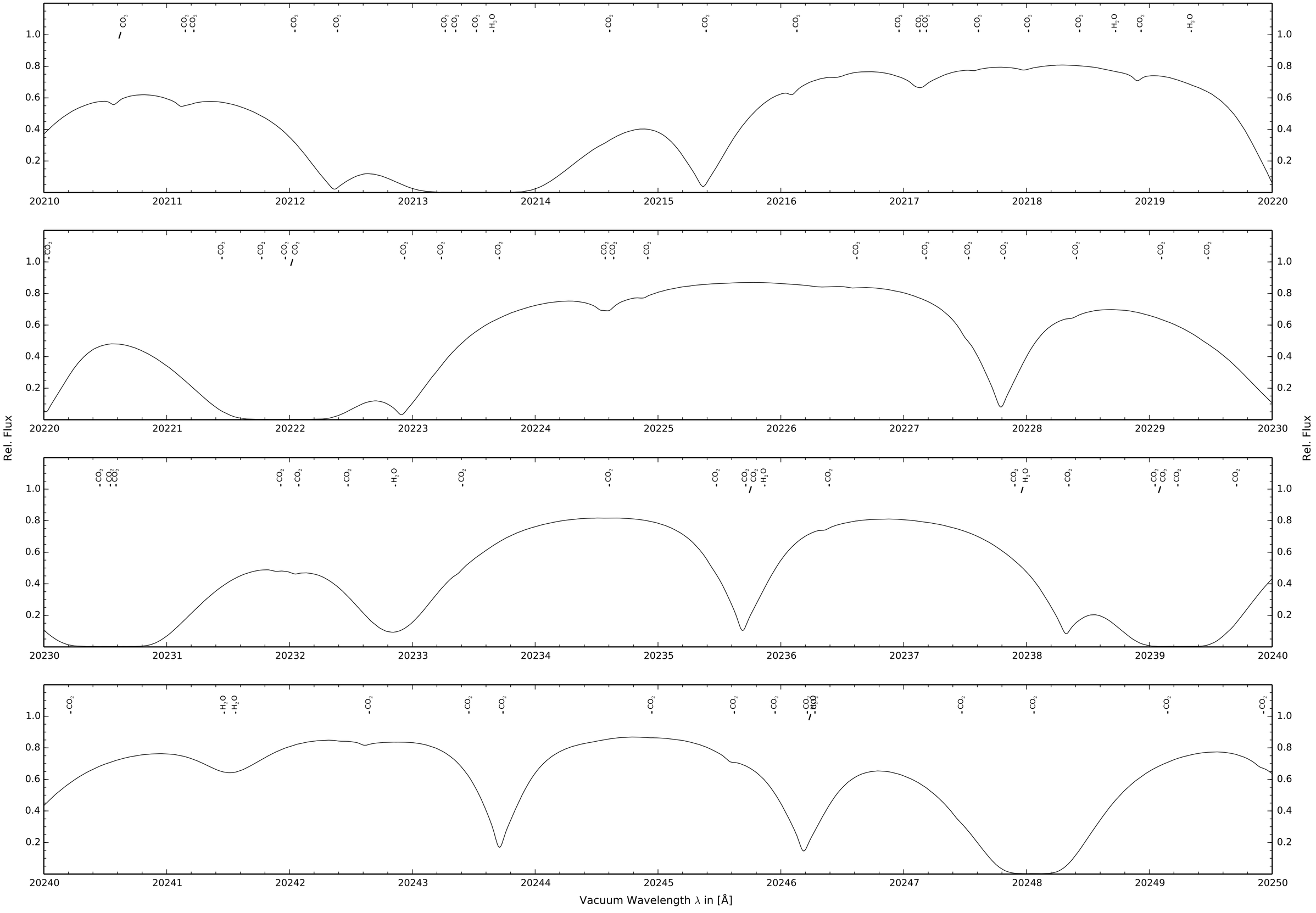
Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Si I
Fe I

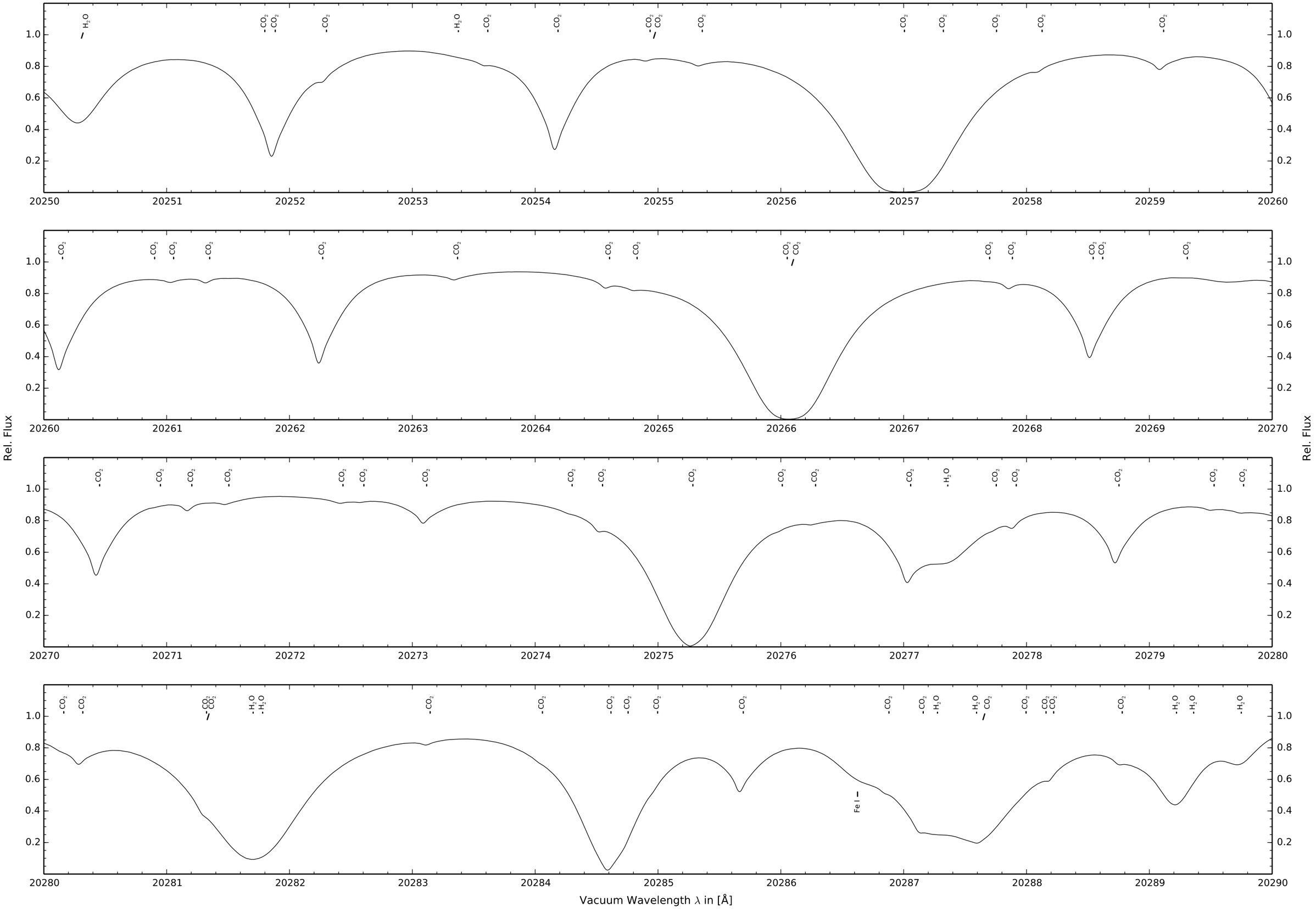
Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I


Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]

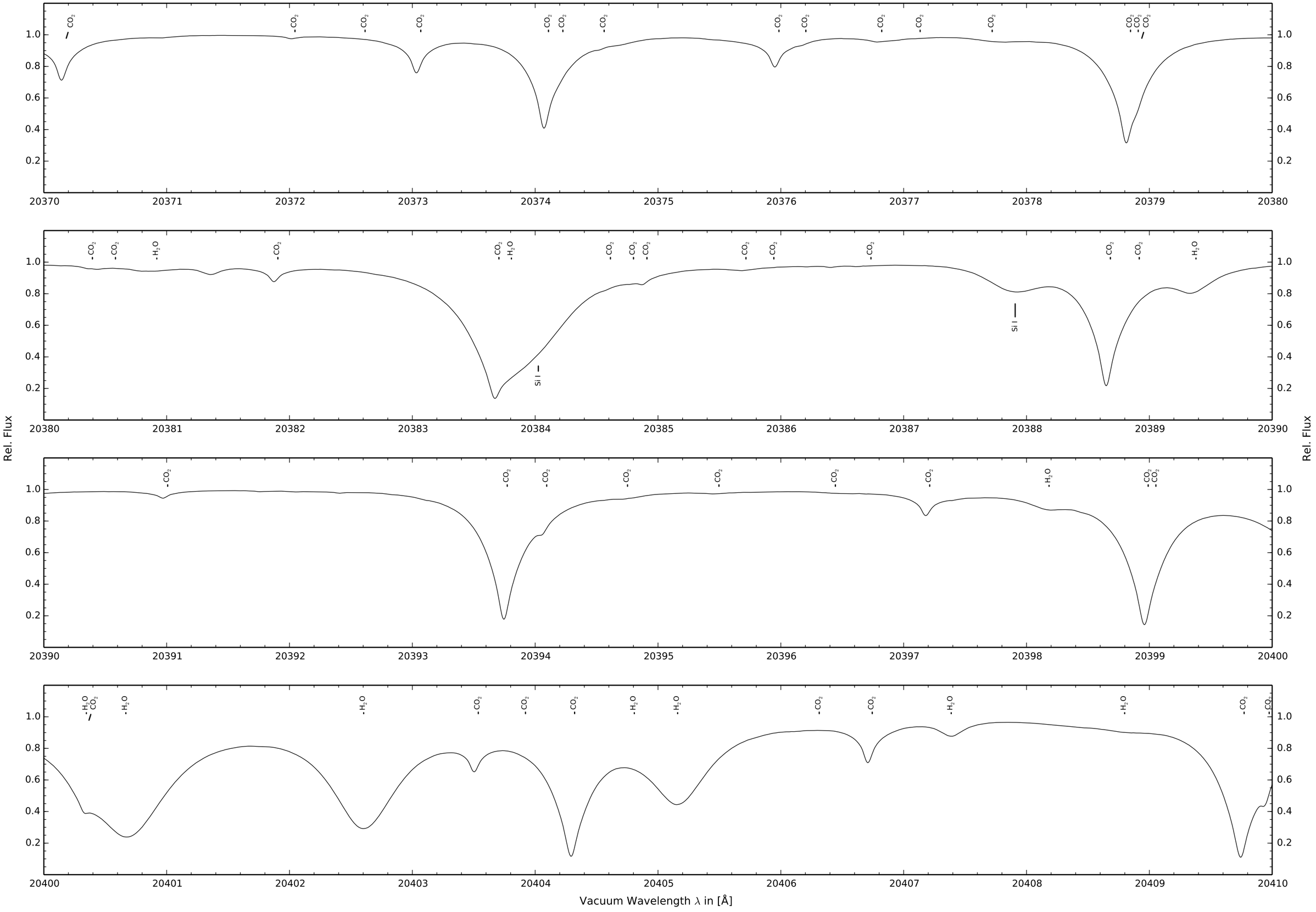

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
CO2
Fe I

Rel. Flux

Vacuum Wavelength λ in [Å]

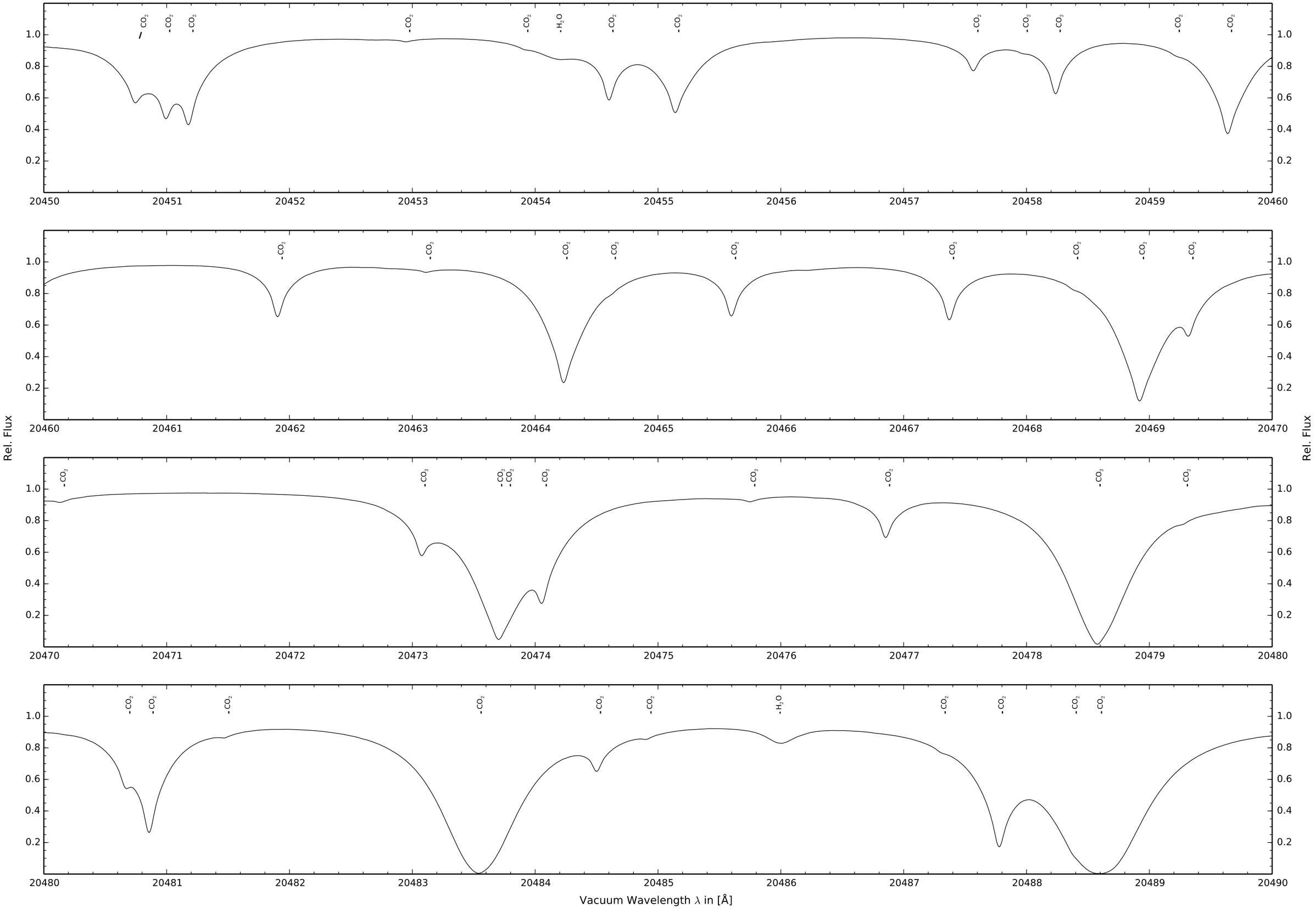
Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Si I

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
20450
20451
20452
20453
20454
20455
20456
20457
20458
20459
20460
20461
20462
20463
20464
20465
20466
20467
20468
20469
20470
20471
20472
20473
20474
20475
20476
20477
20478
20479
20480
20481
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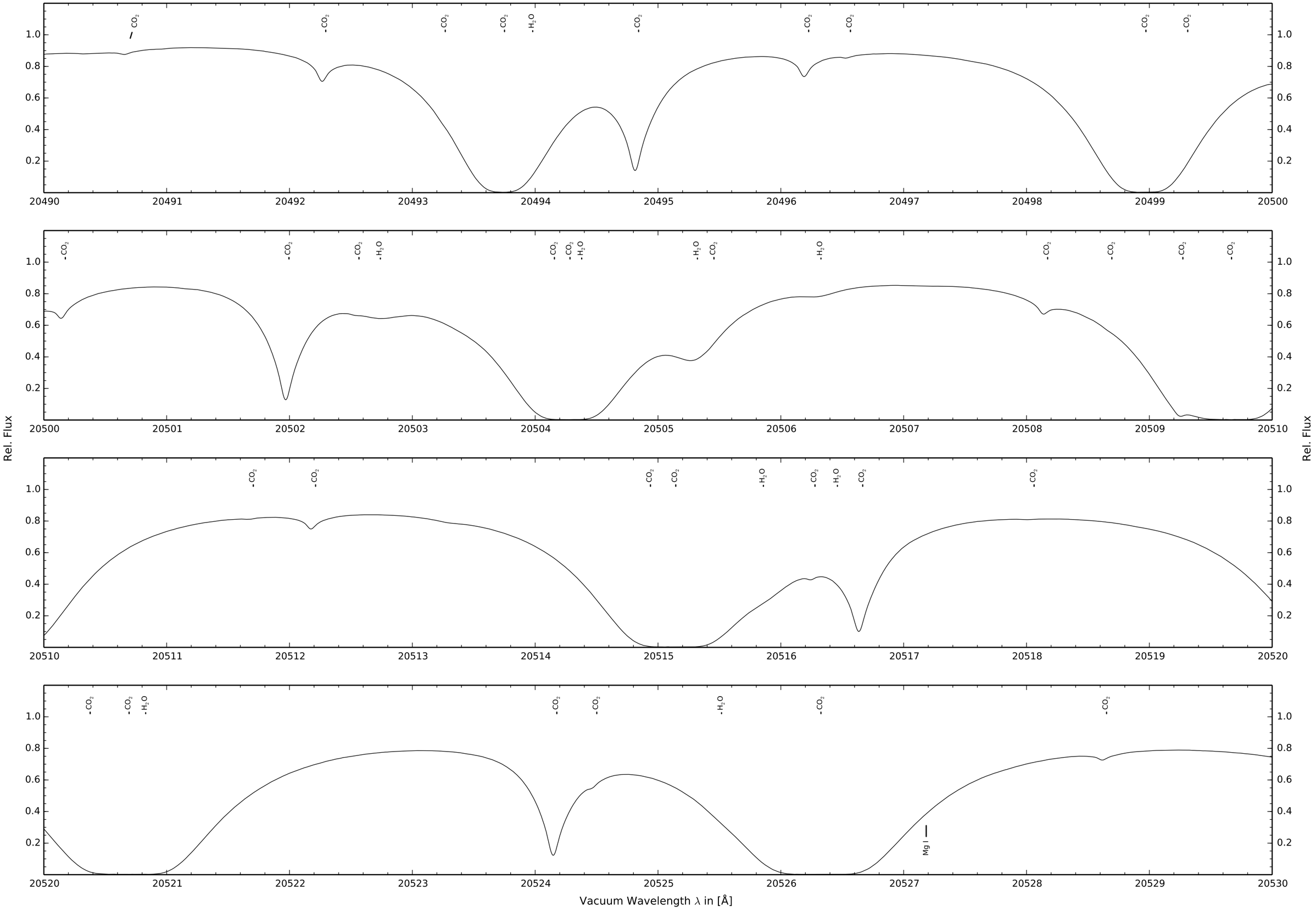
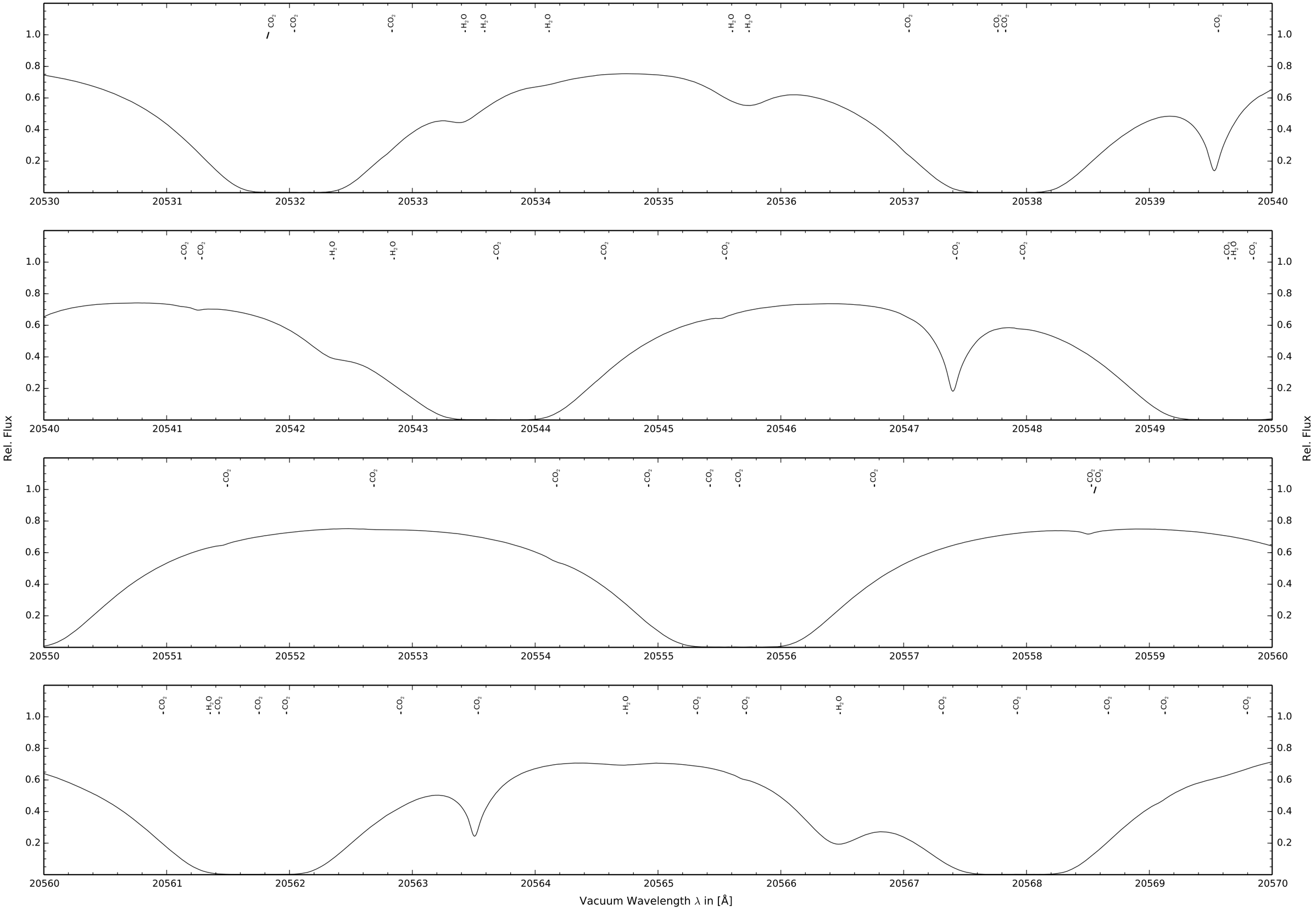
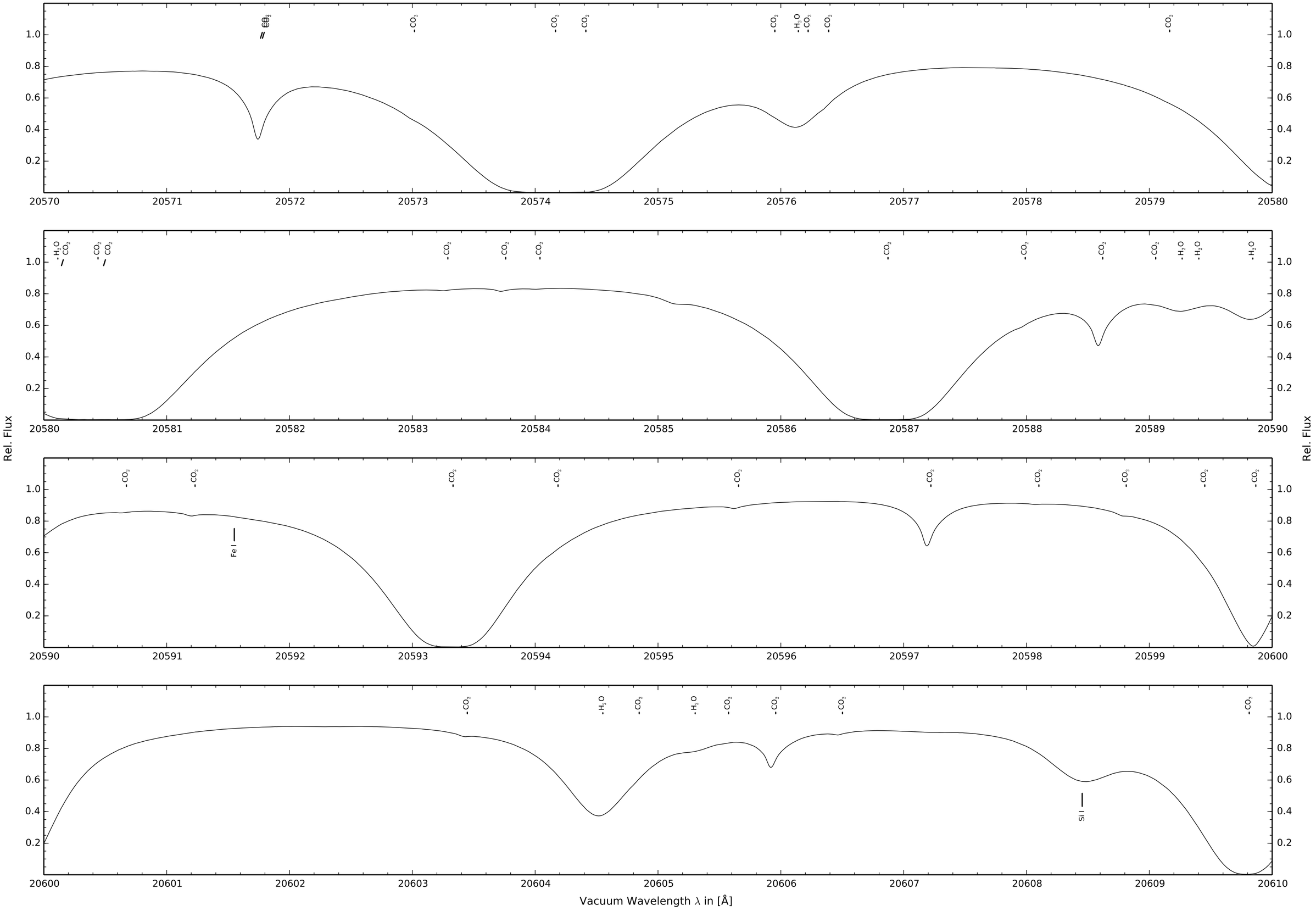
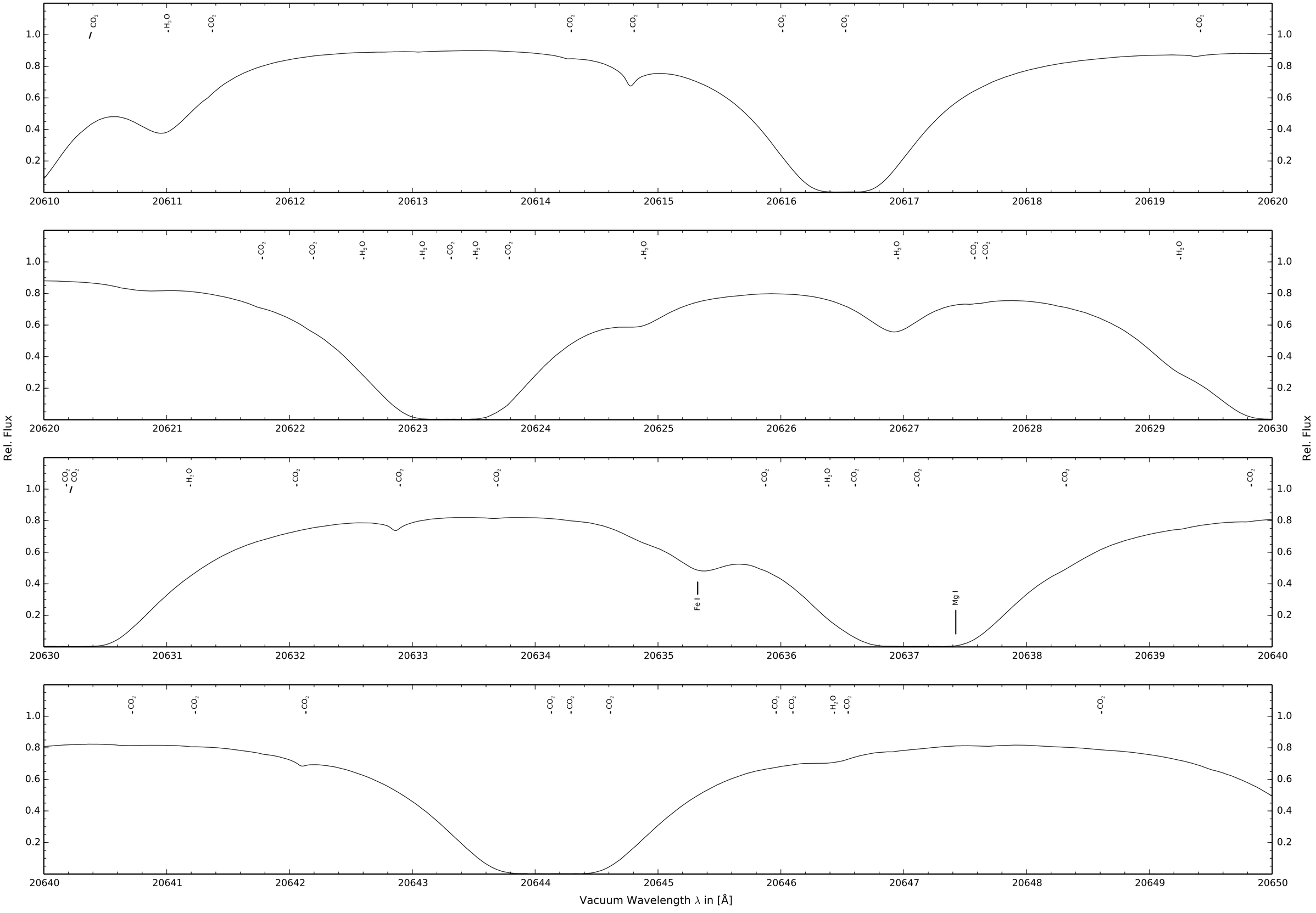
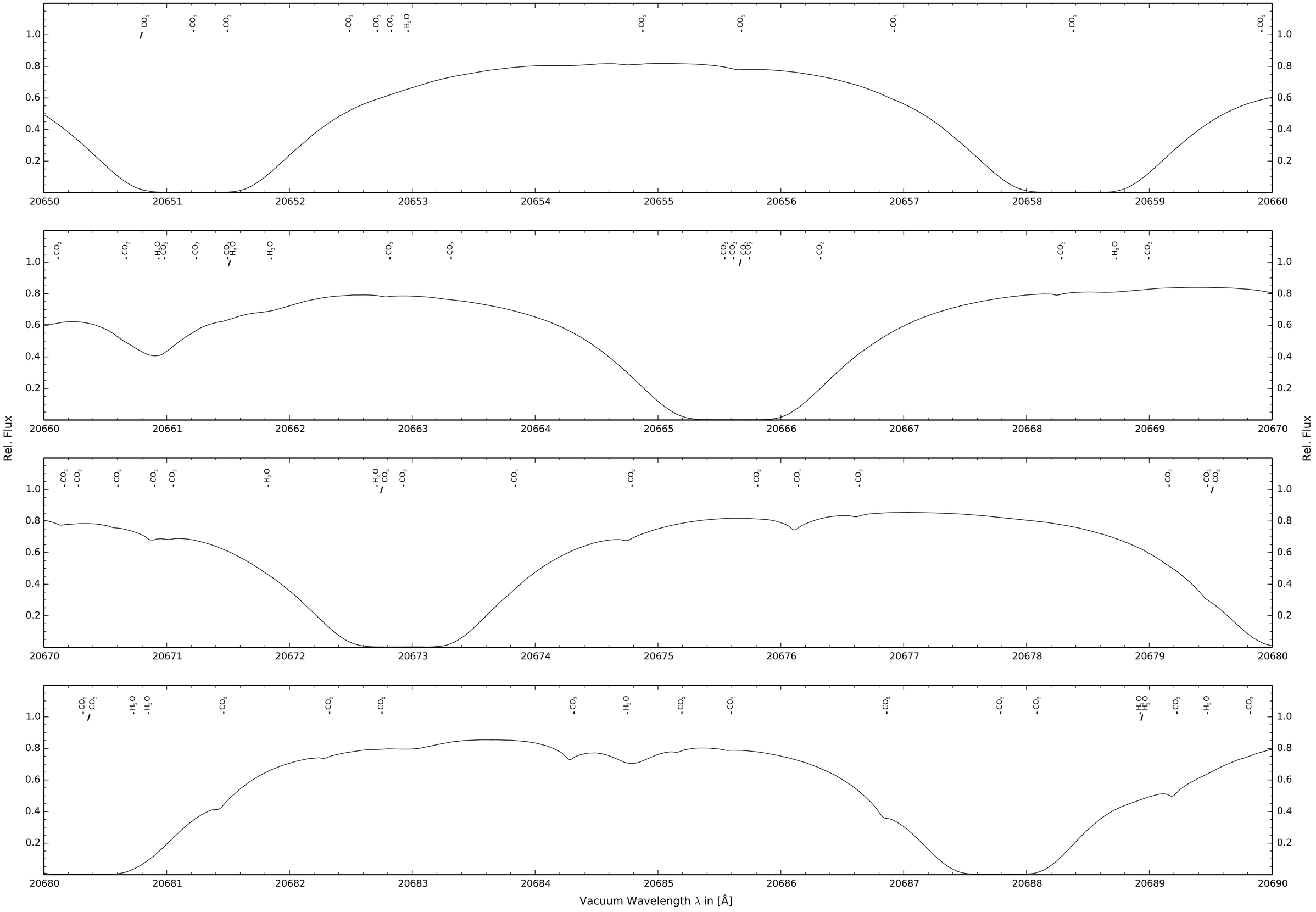
0.6
0.8
1.0

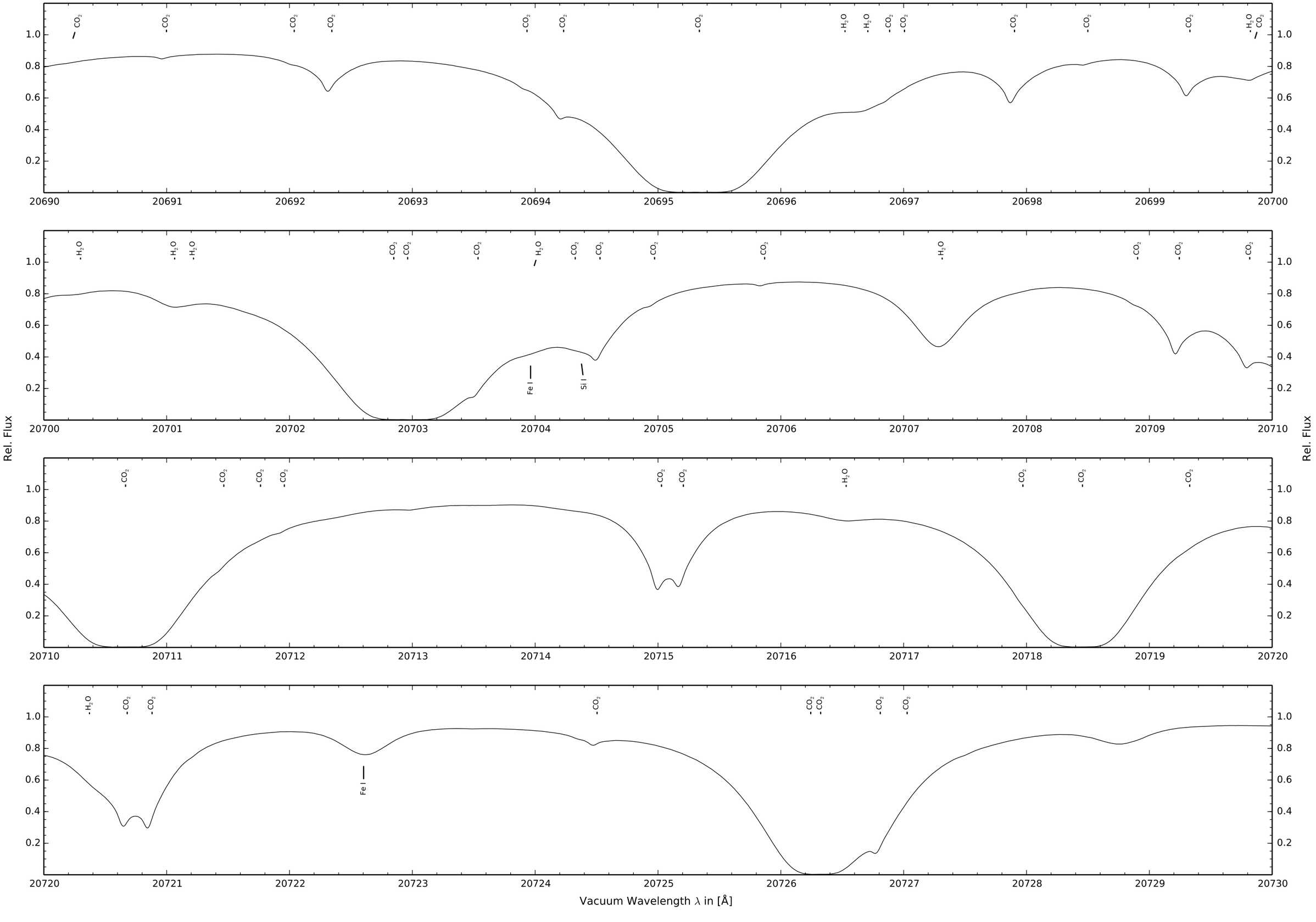

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Mg I


Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
Si I

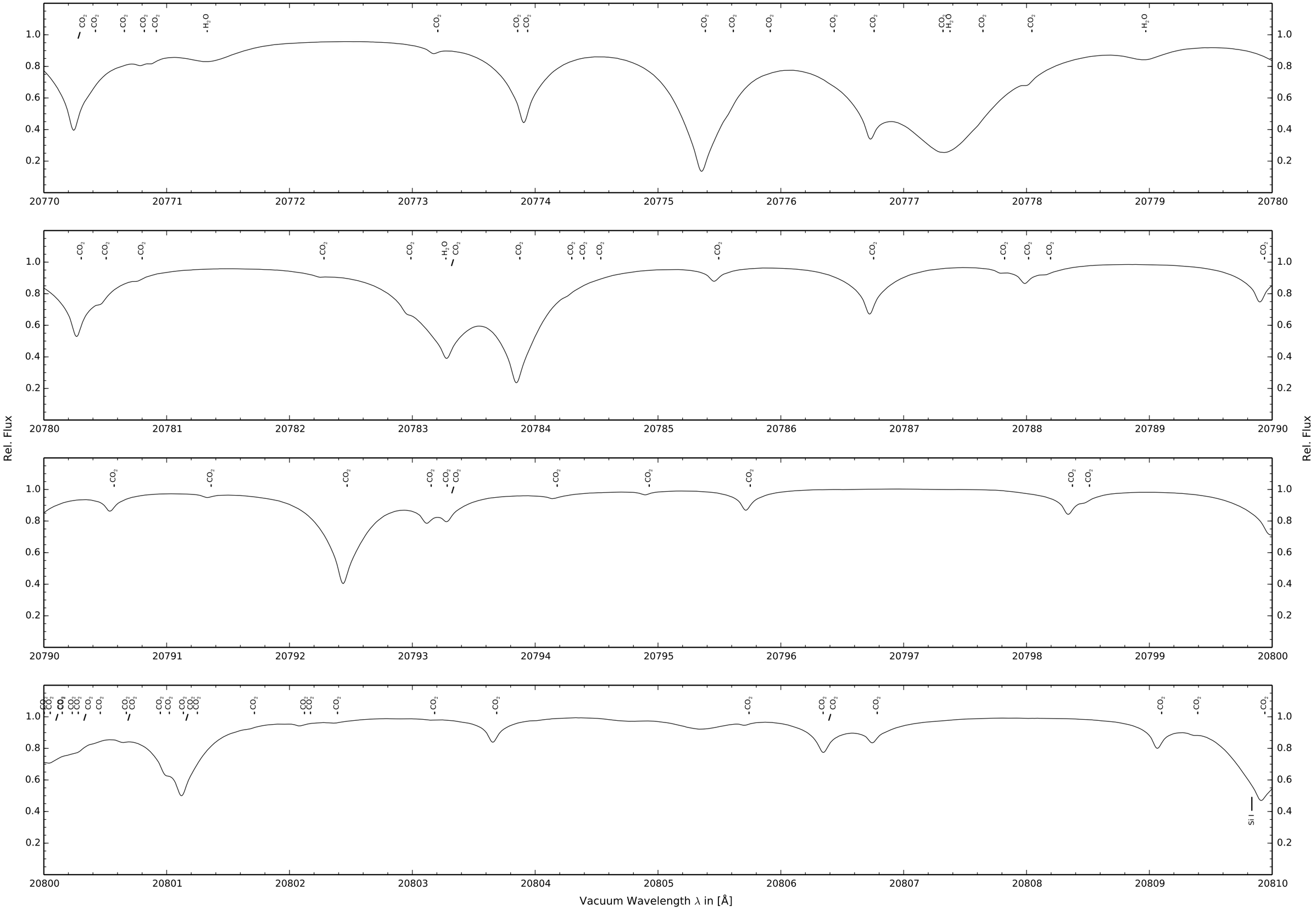

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
Mg I

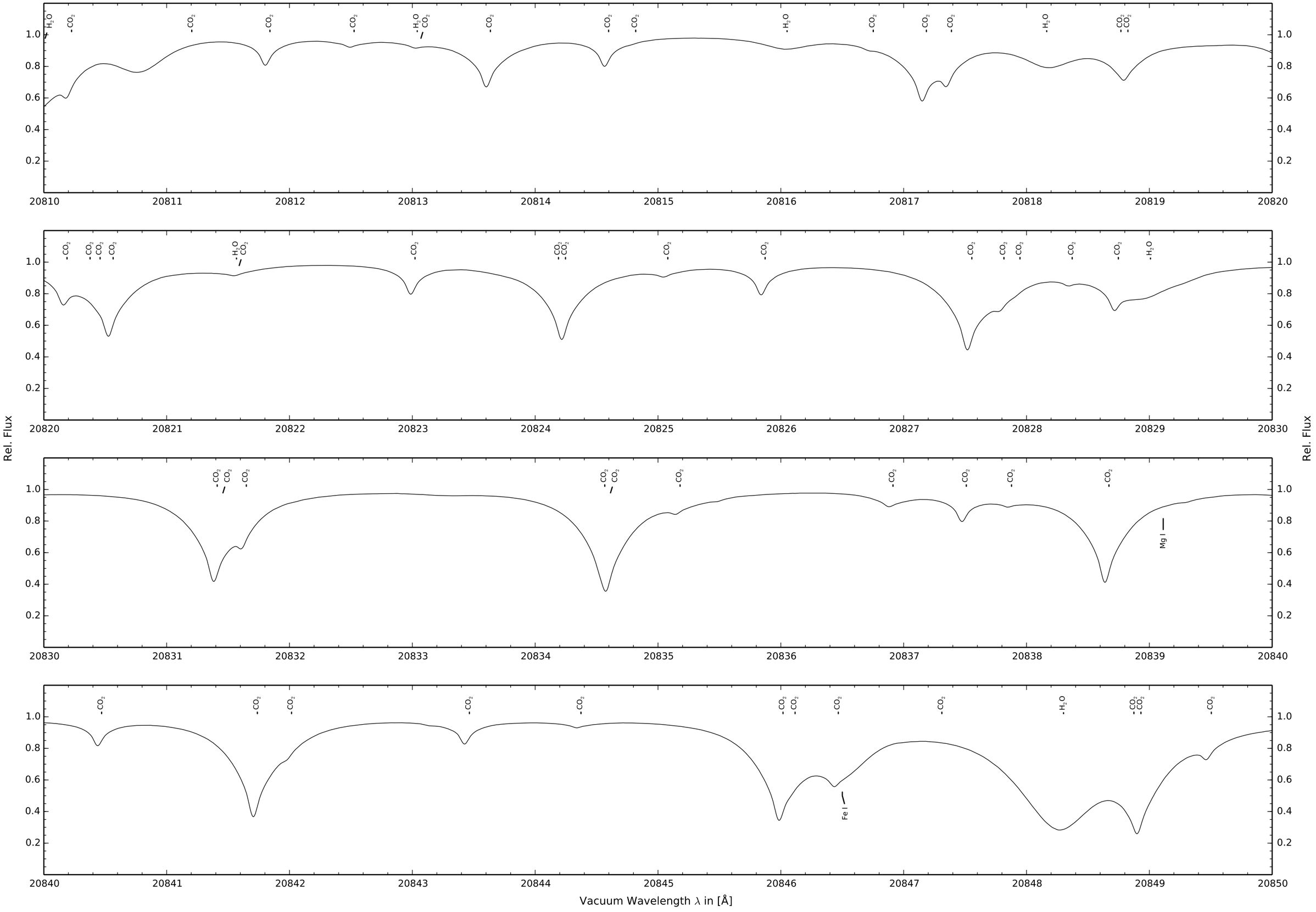

Rel. Flux
Vacuum Wavelength λ in [Å]

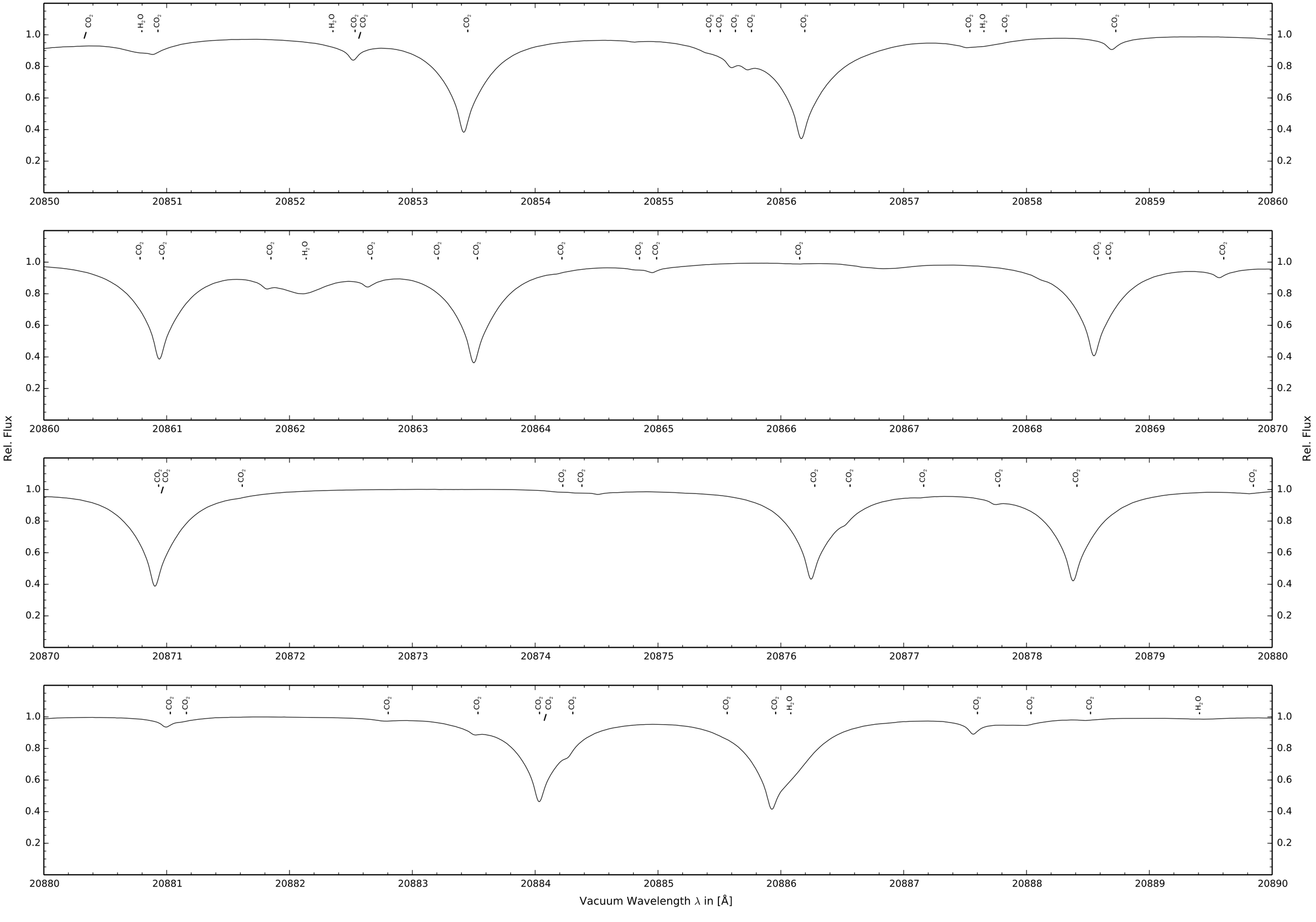

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Fe I
Si I

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Si I

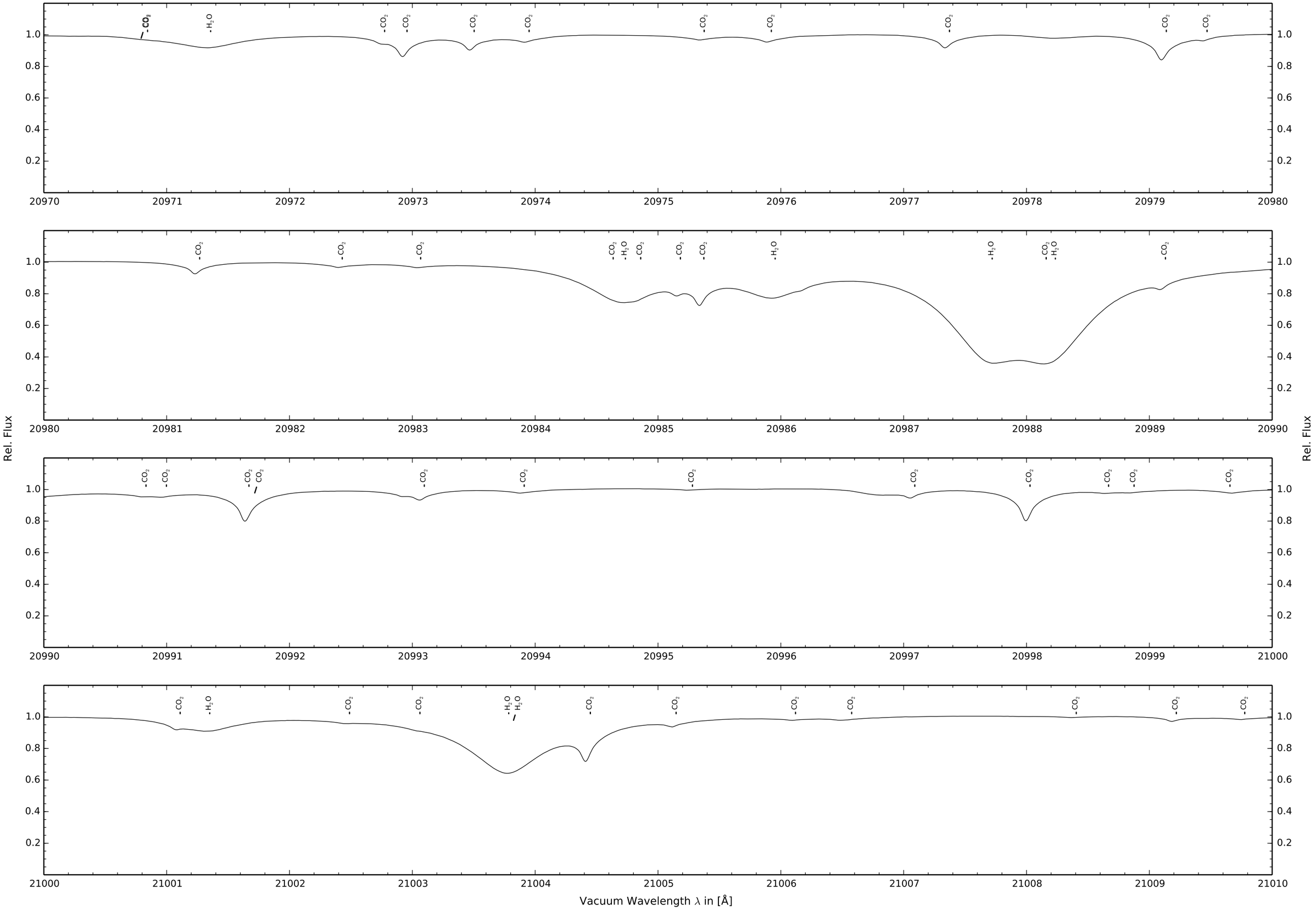

Rel. Flux
Vacuum Wavelength λ in [Å]
Mg I
Fe I

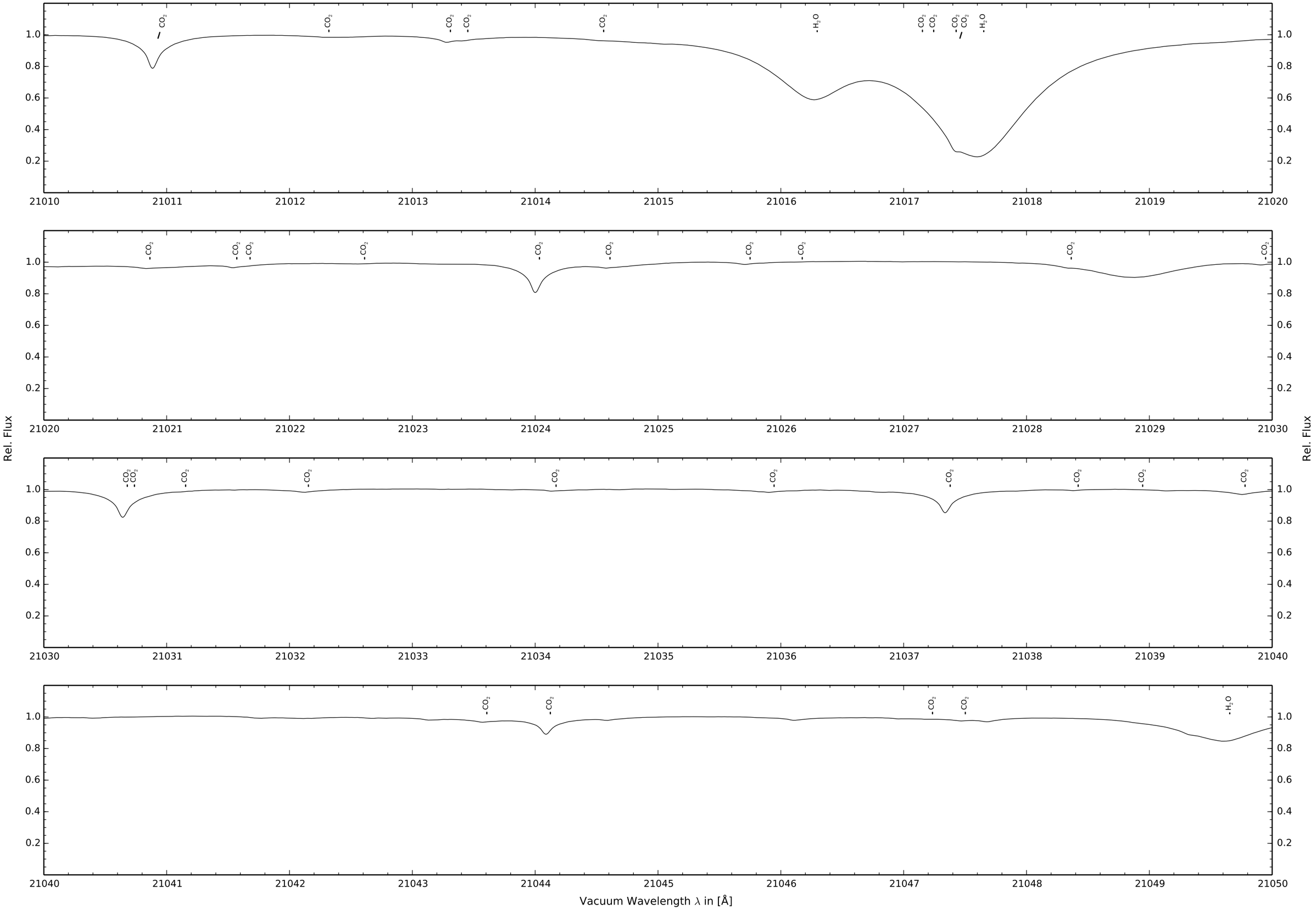

Rel. Flux
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]

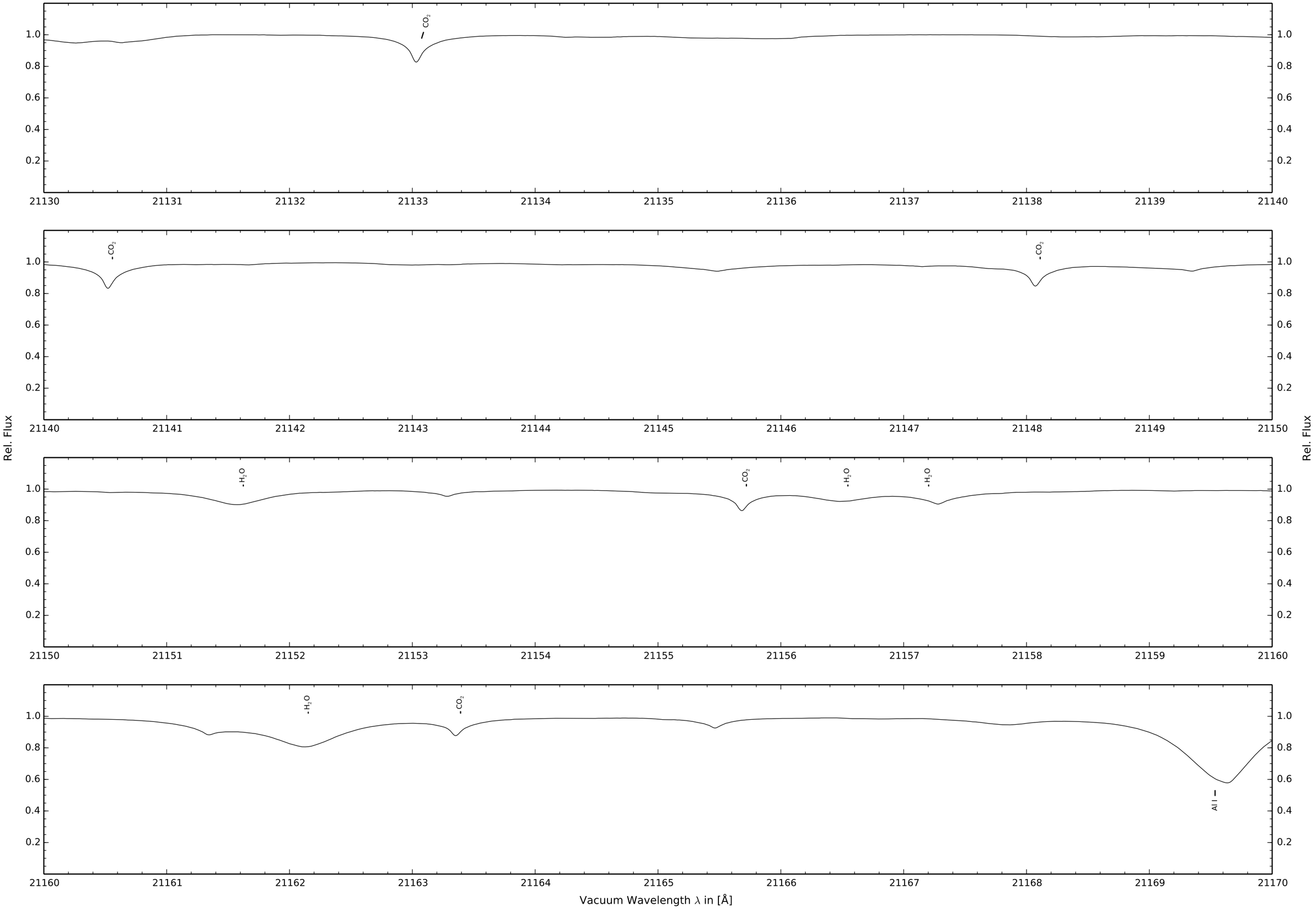
Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O

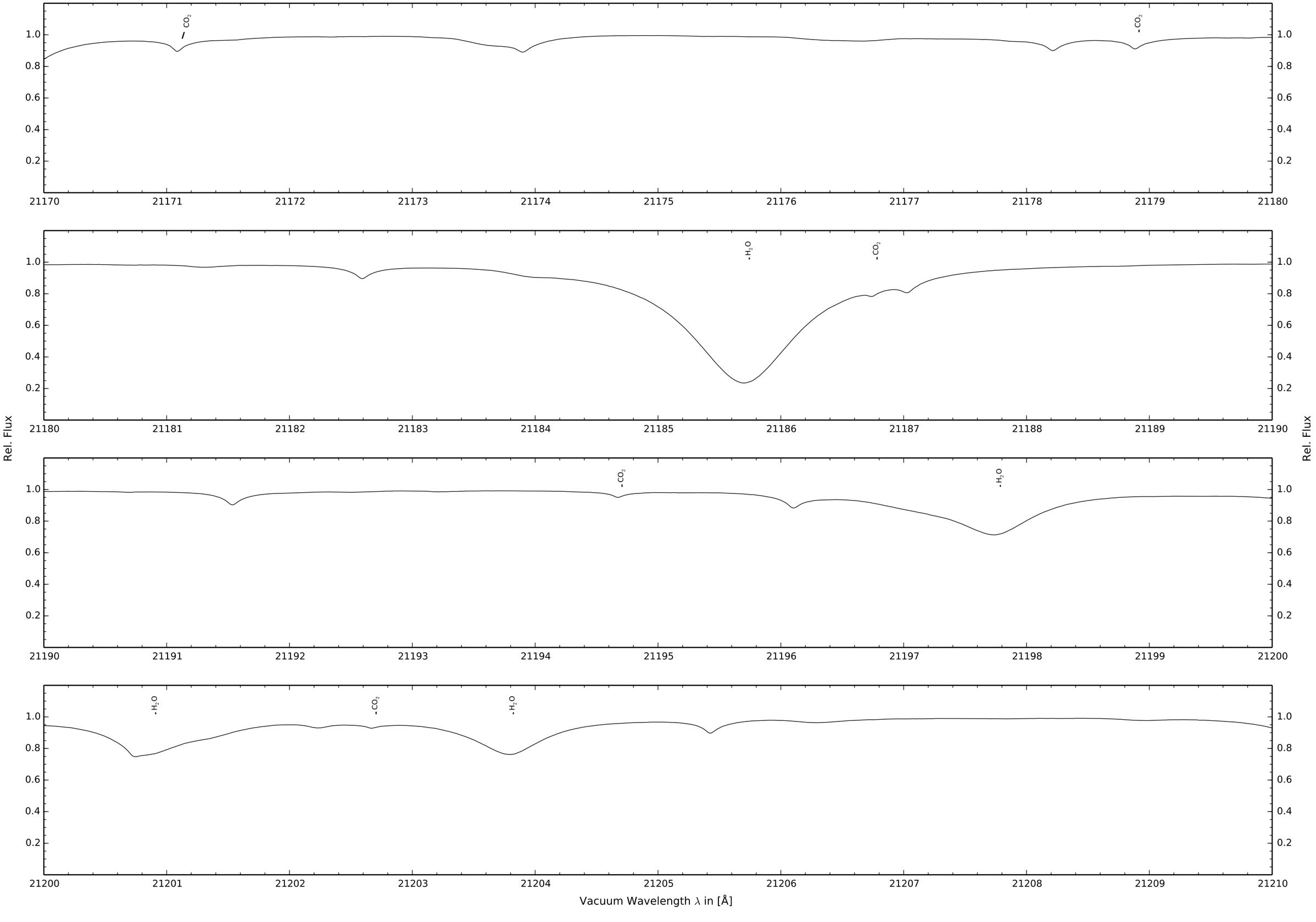

Rel. Flux
Vacuum Wavelength λ in [Å]

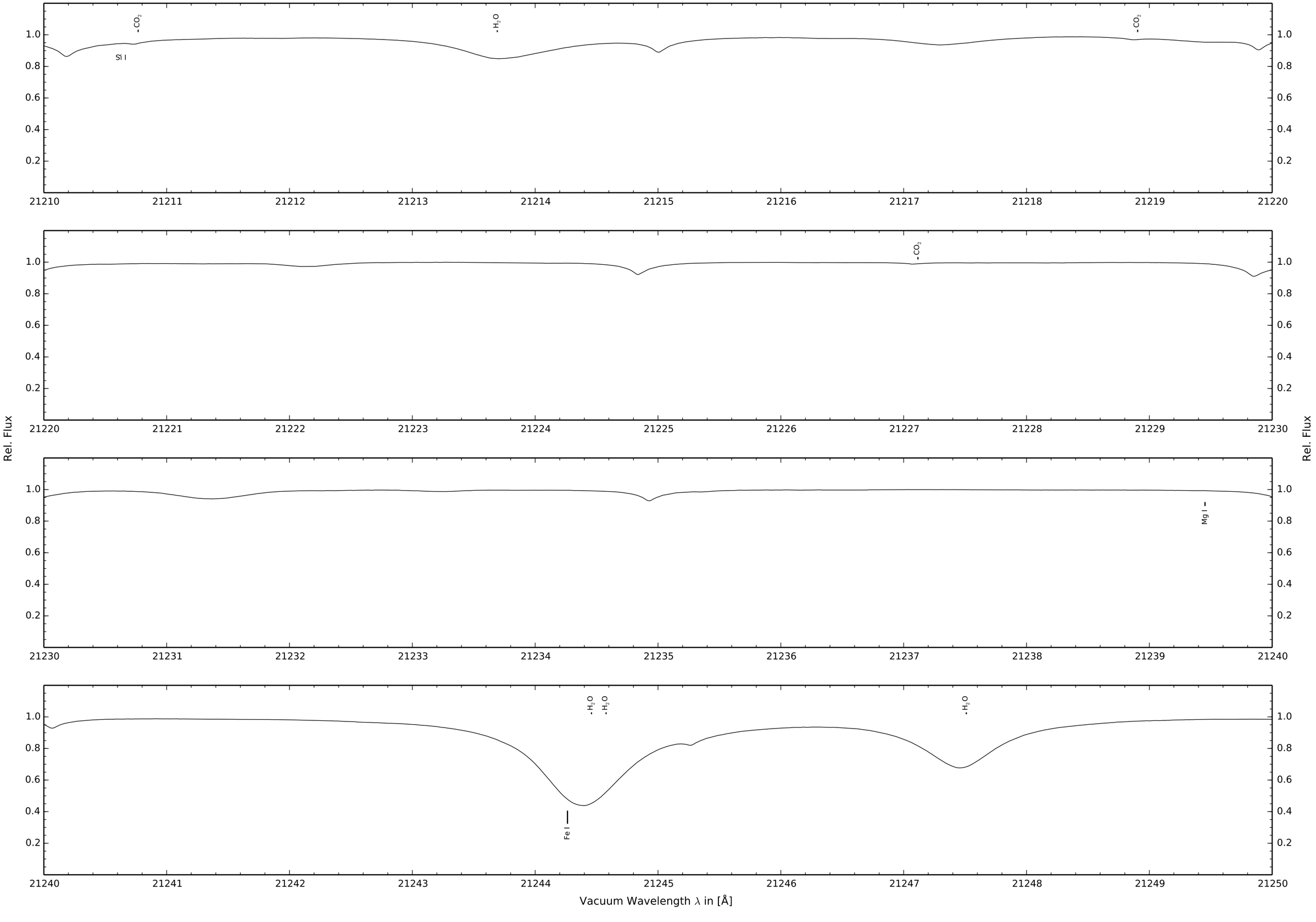

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O

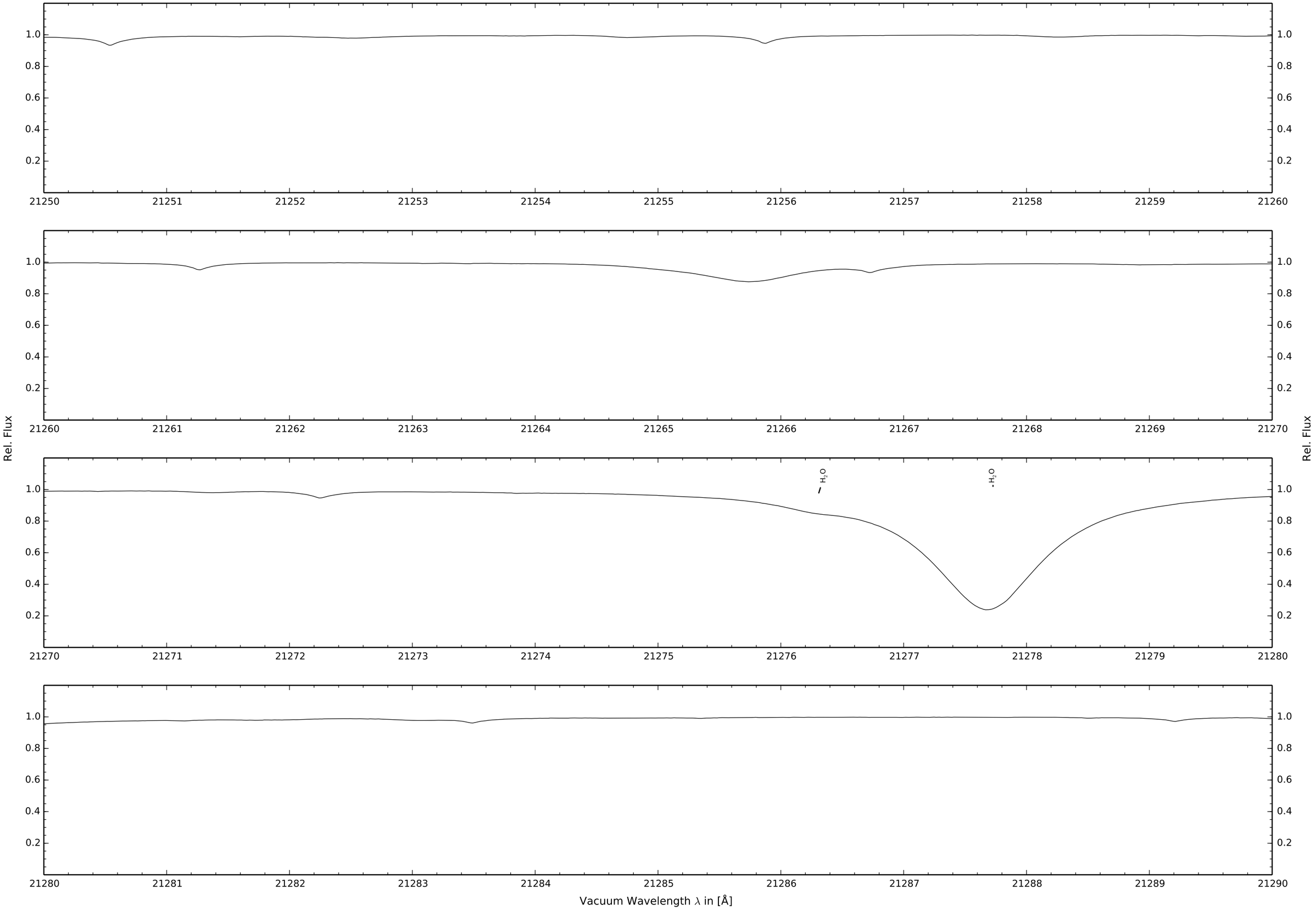
Rel. Flux
Vacuum Wavelength λ in [Å]
CO_2
H_2O
Mg I

Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Al I


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O
Al I


Rel. Flux
- CO_2
- CO_2
- H_2O
- CO_2
- CO_2
- H_2O
- H_2O
- H_2O
- CO_2
- H_2O
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
- CO2
- H2O
Si I
Mg I
Fe I


Rel. Flux
1.0
0.8
0.6
0.4
0.2
21250
21251
21252
21253
21254
21255
21256
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21258
21259
21260
21261
21262
21263
21264
21265
21266
21267
21268
21269
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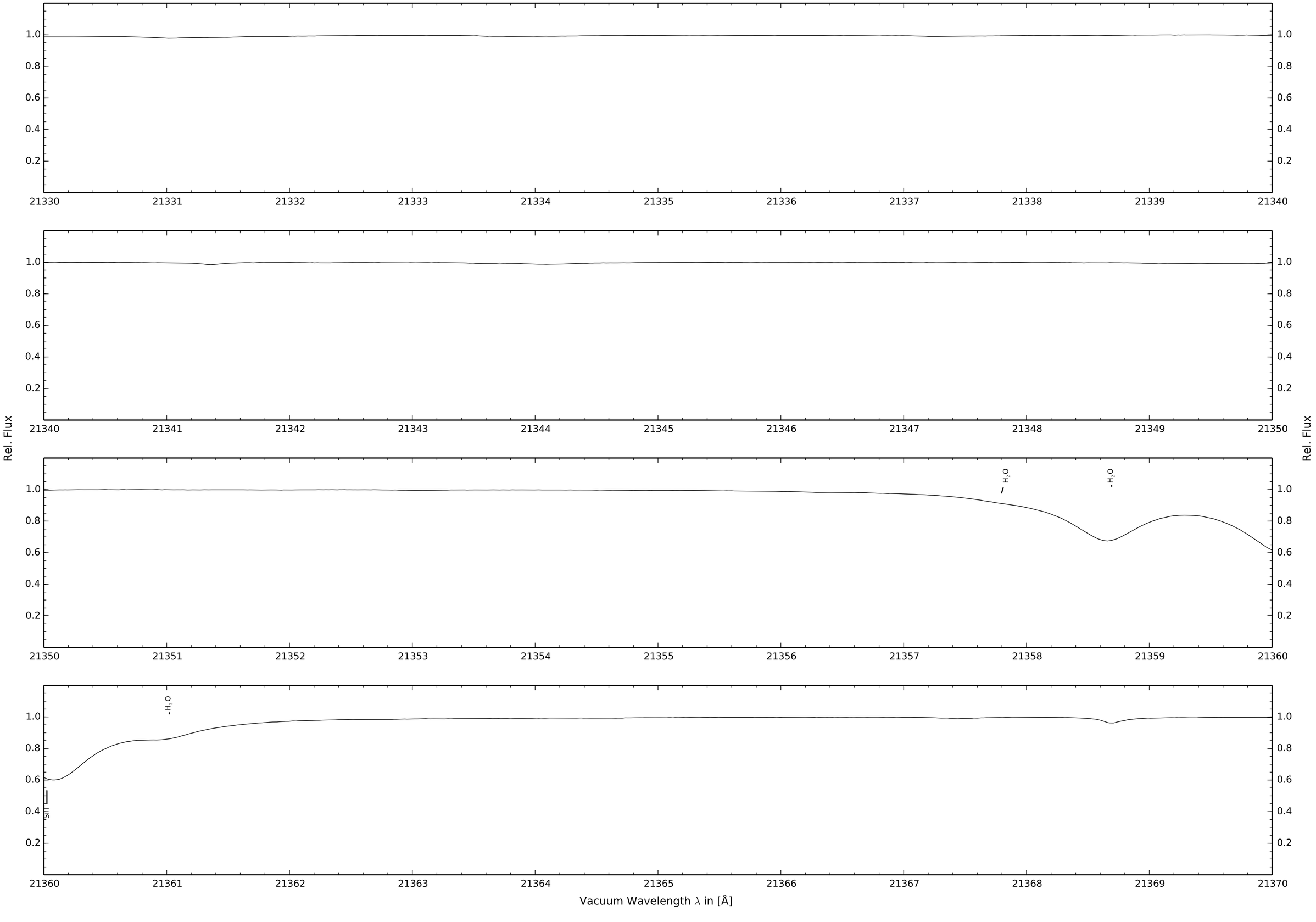
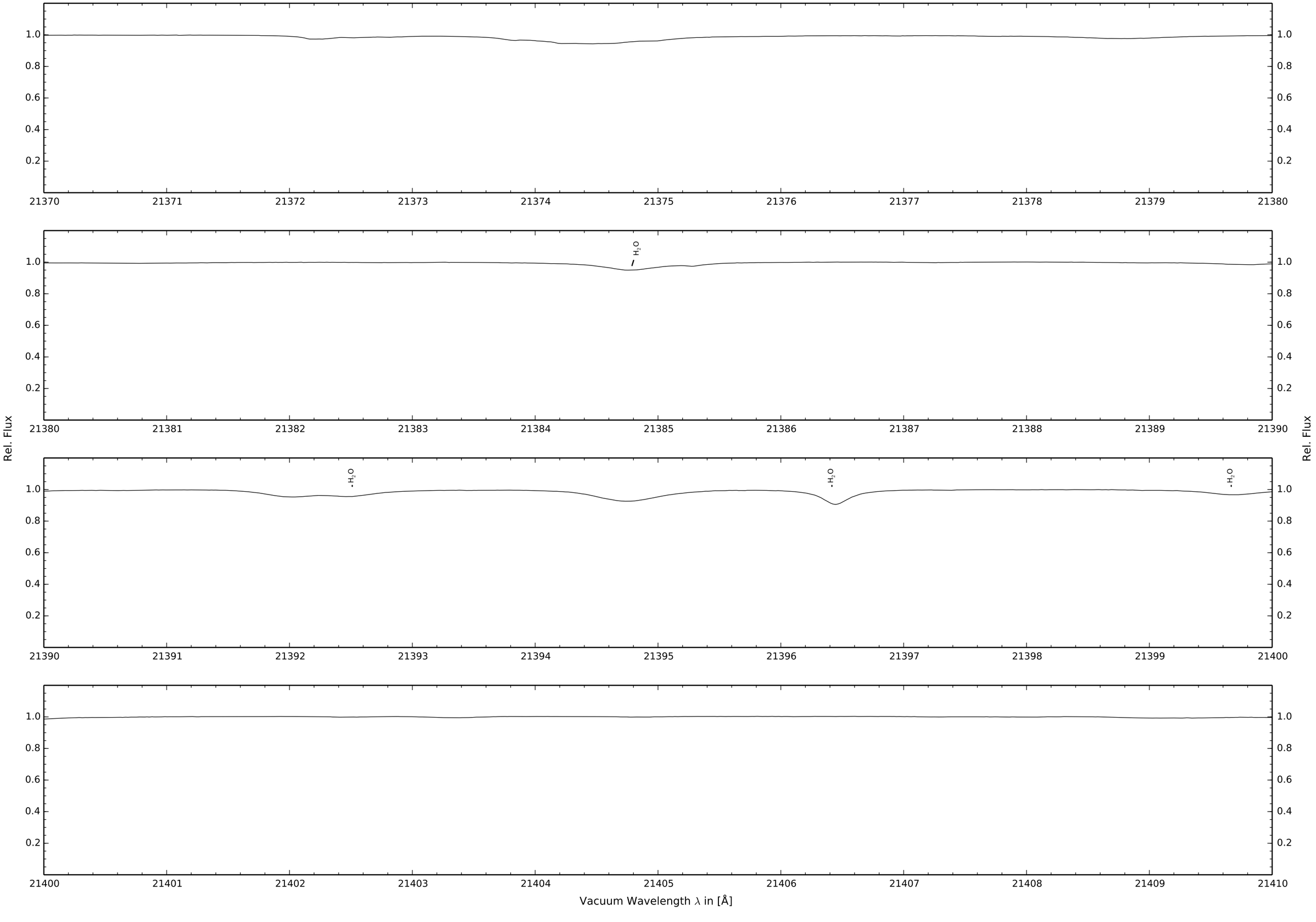
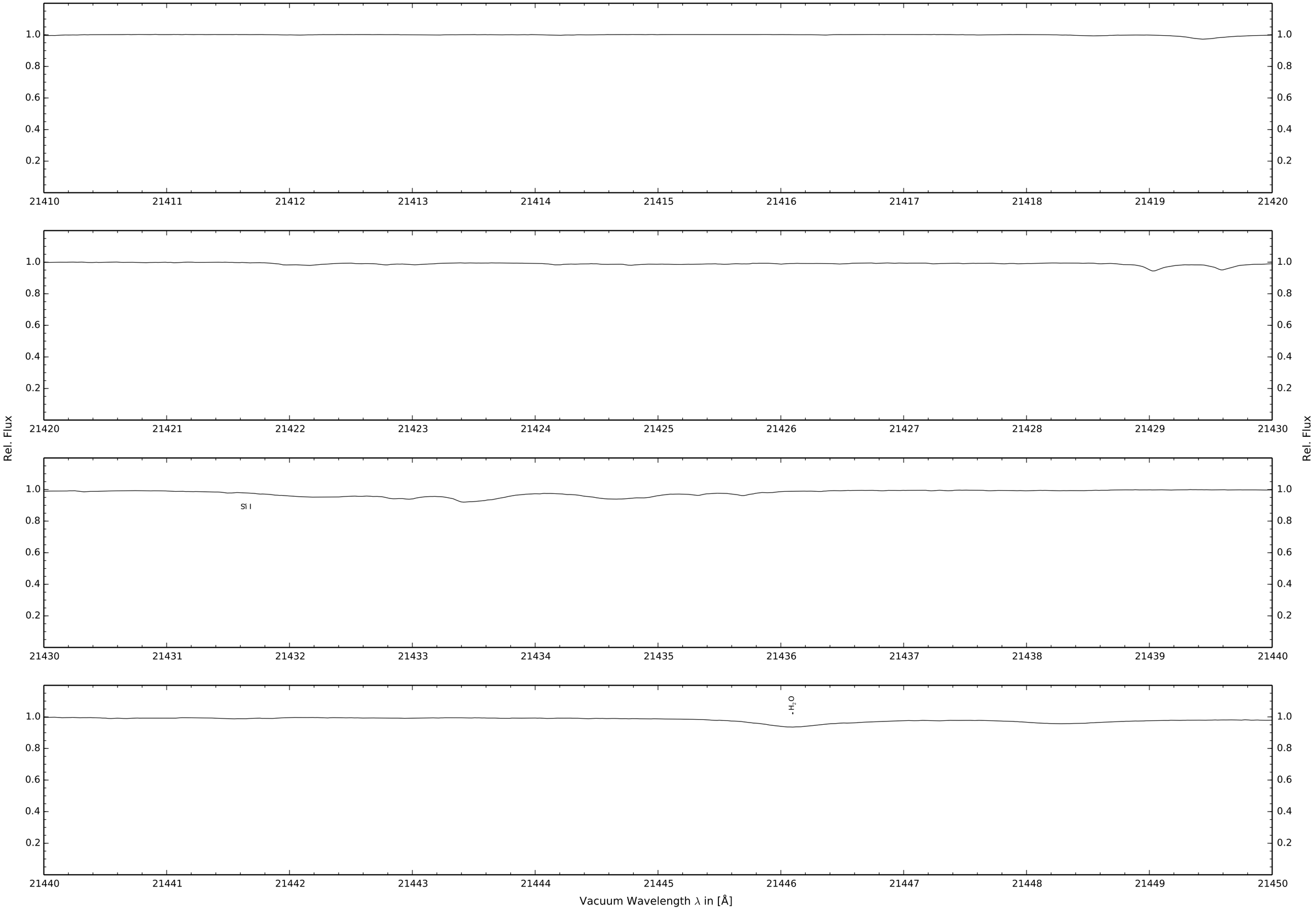
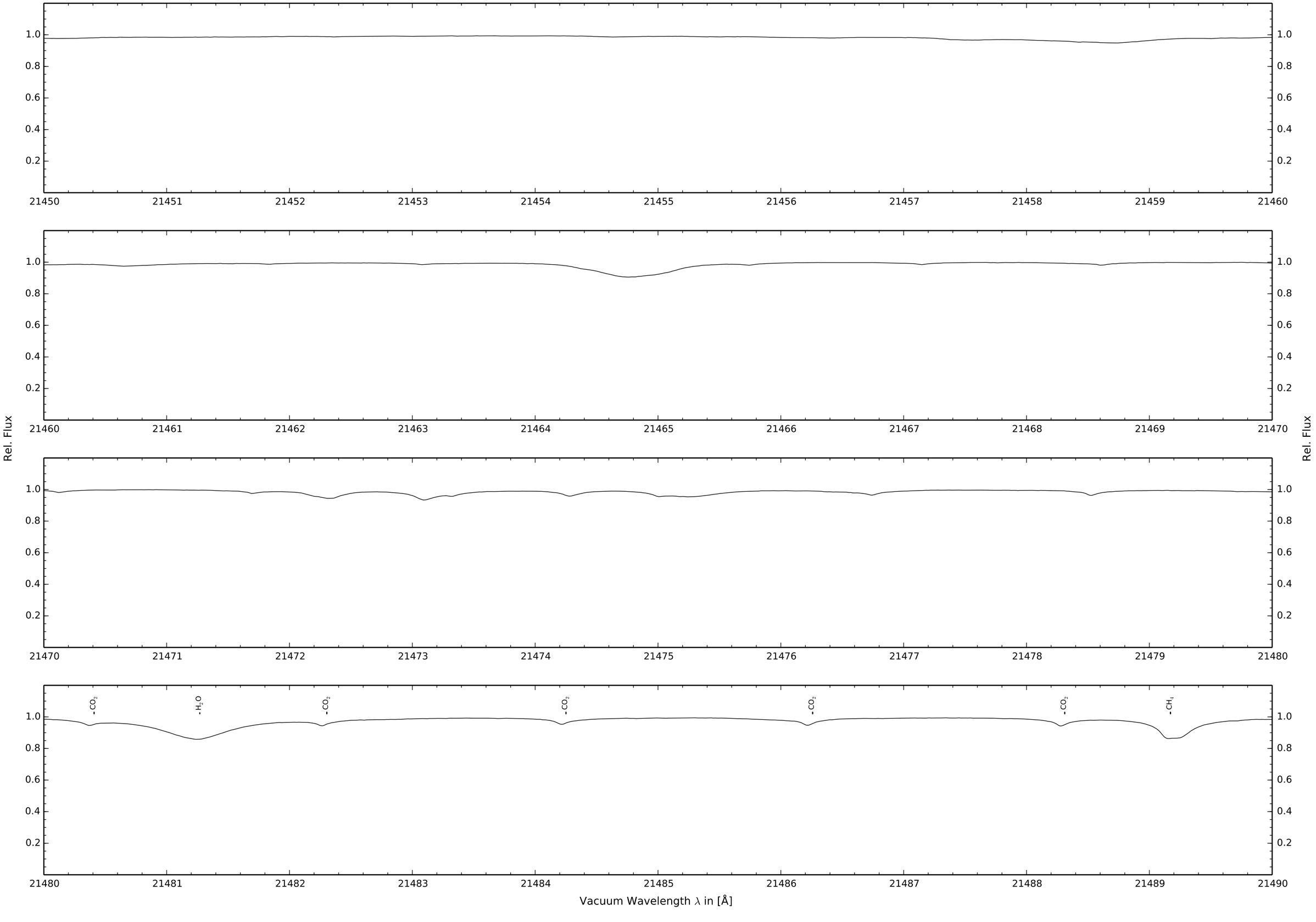
21271
21272
21273
21274
21275
21276
21277
21278
21279
21280
21281
21282
21283
21284
21285
21286
21287
21288
21289
21290
H_2O
H_2O
Vacuum Wavelength λ in [Å]

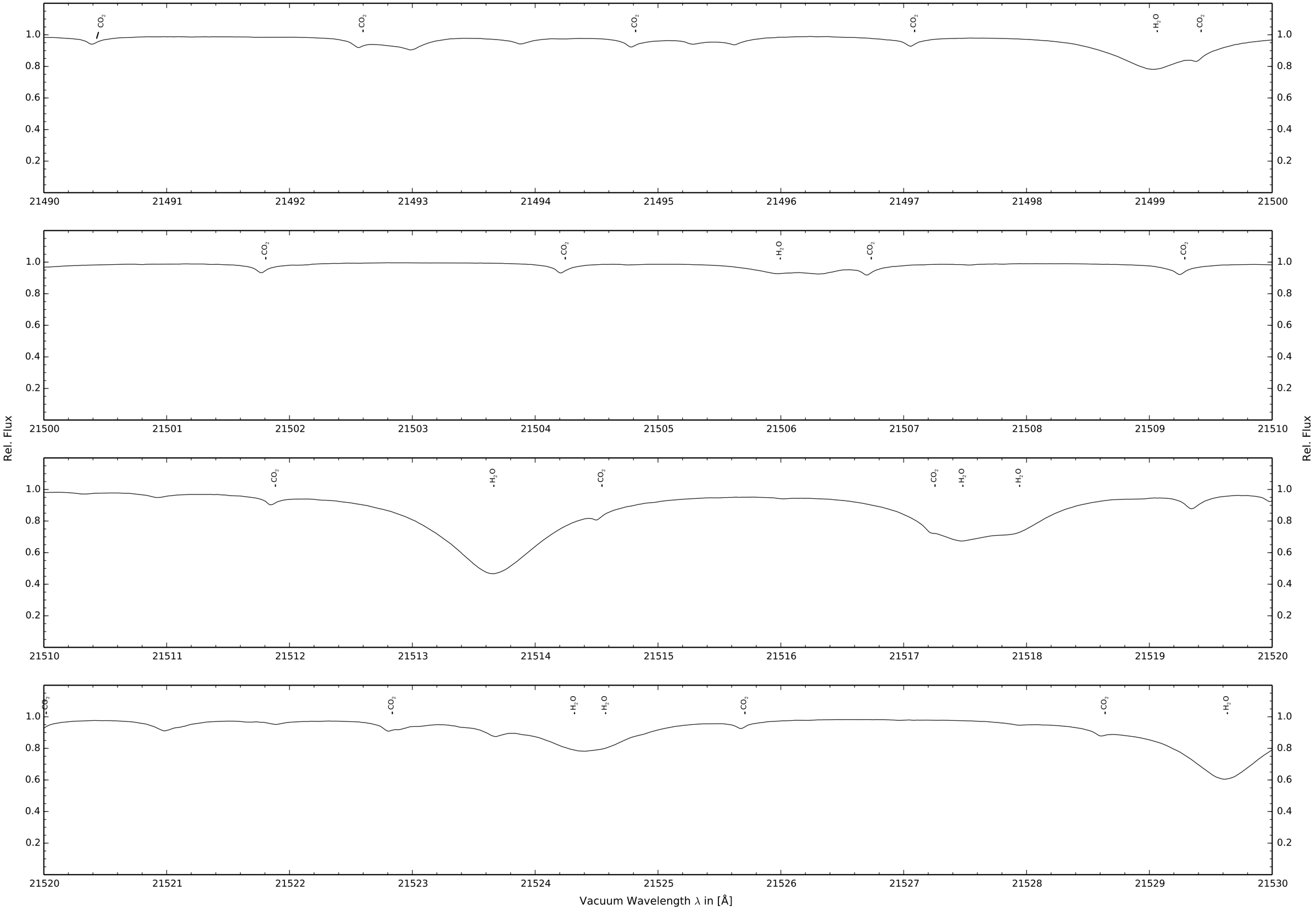
Rel. Flux
H_2O
H_2O
H_2O
Vacuum Wavelength λ in [Å]

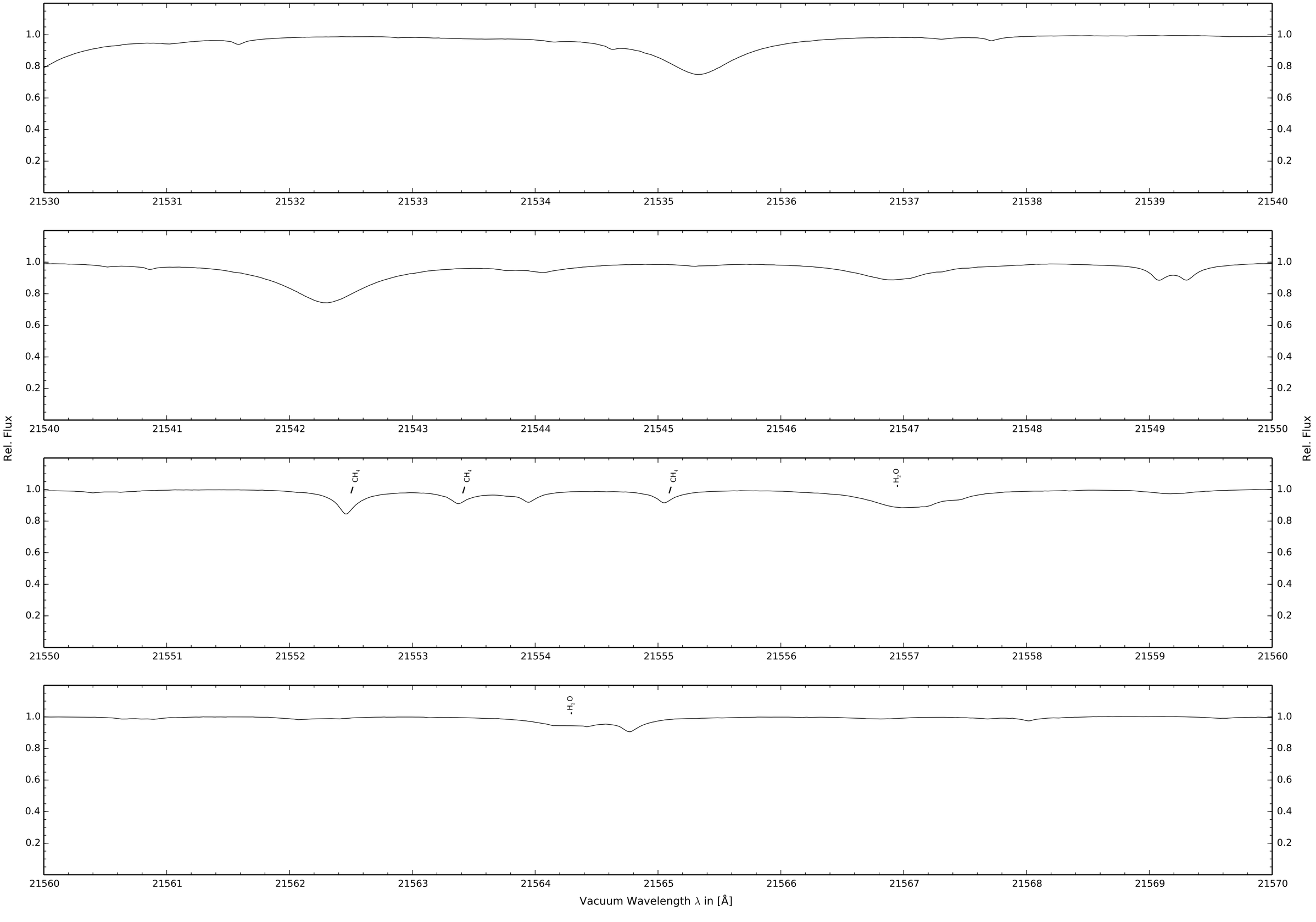

Rel. Flux
Rel. Flux
H_2O
H_2O
H_2O
Si II
Vacuum Wavelength λ in [Å]


Rel. Flux
H_2O
H_2O
H_2O
H_2O
Vacuum Wavelength λ in [Å]


Rel. Flux
Si I
-H2O
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
- CO_2
- H_2O
- CO_2
- CO_2
- CO_2
- CO_2
- CH_4
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
H2O


Rel. Flux
Vacuum Wavelength λ in [Å]
CH4
CH4
CH4
H2O
H2O

Rel. Flux

CO_2

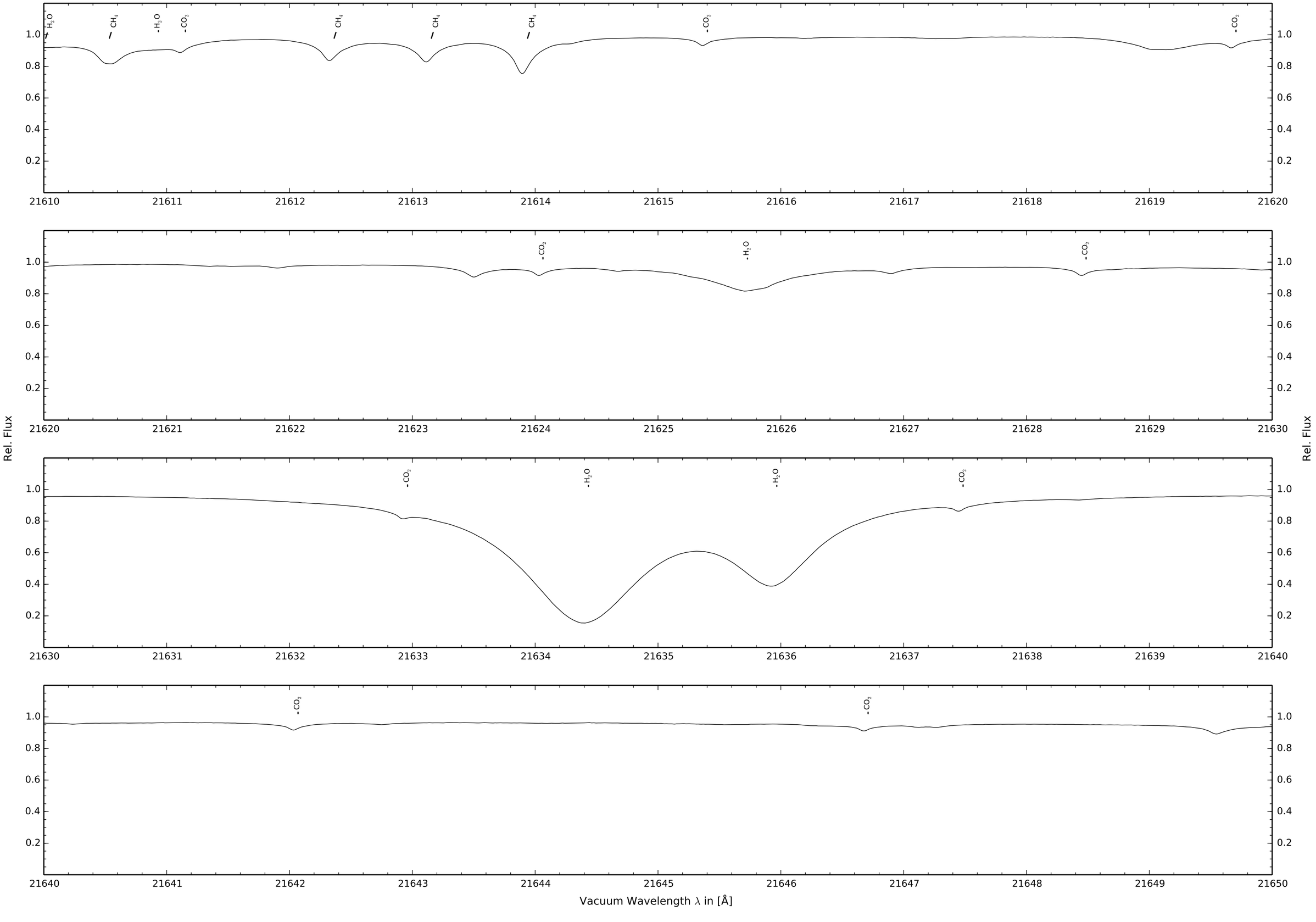
CO_2

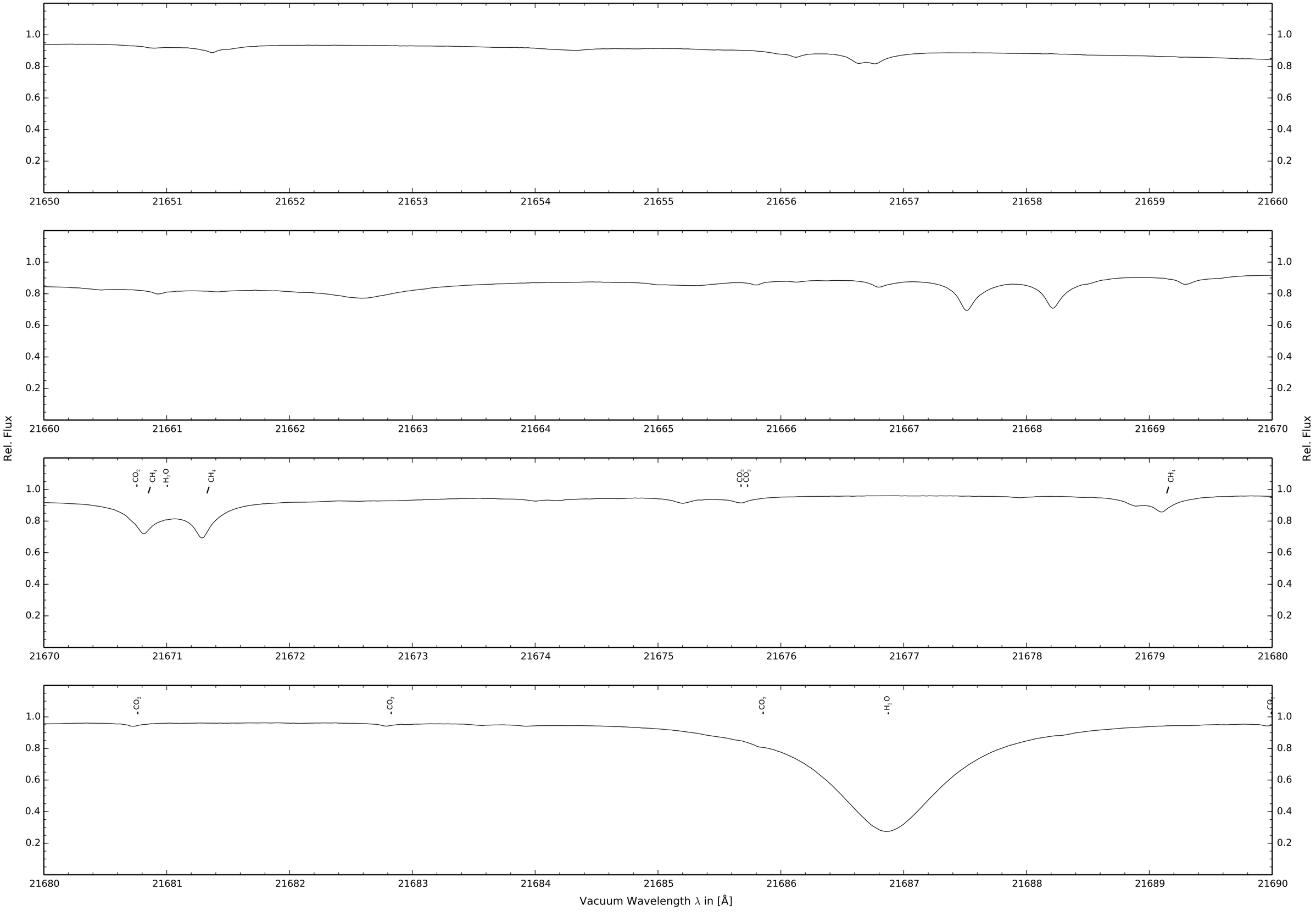
CH_4

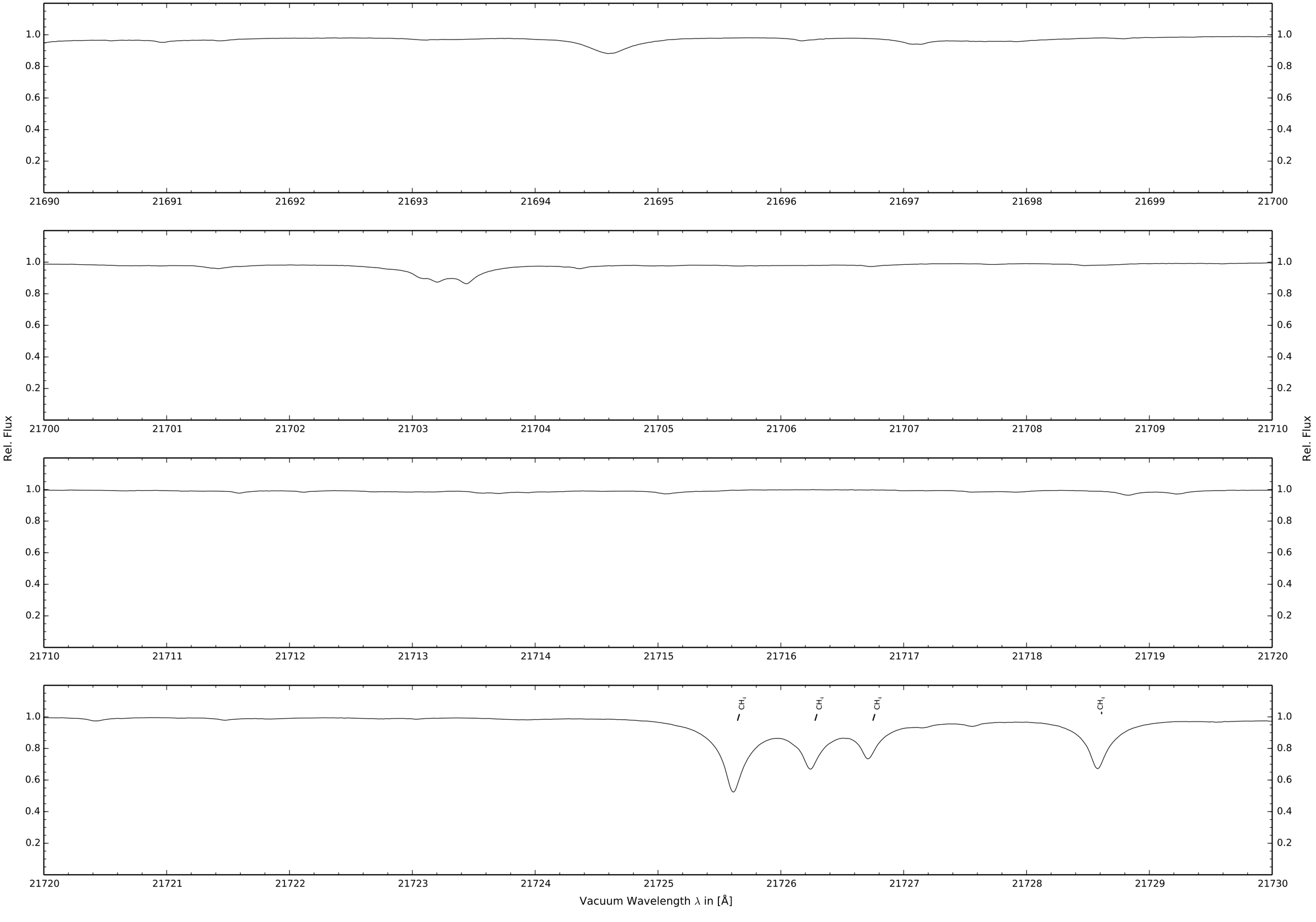
CH_4

CH_4

Vacuum Wavelength λ in [Å]


Rel. Flux
H_2O
CH_4
H_2O
CO_2
CH_4
CH_4
CH_4
CO_2
CO_2
CO_2
H_2O
CO_2
CO_2
H_2O
H_2O
CO_2
CO_2
CO_2
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CO2
CH4
H2O
CH4
CO2
CO2
CH4
CO2
CO2
CO2
H2O
CO2


Rel. Flux
Rel. Flux
1.0
0.8
0.6
0.4
0.2
21690
21691
21692
21693
21694
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21696
21697
21698
21699
21700
21701
21702
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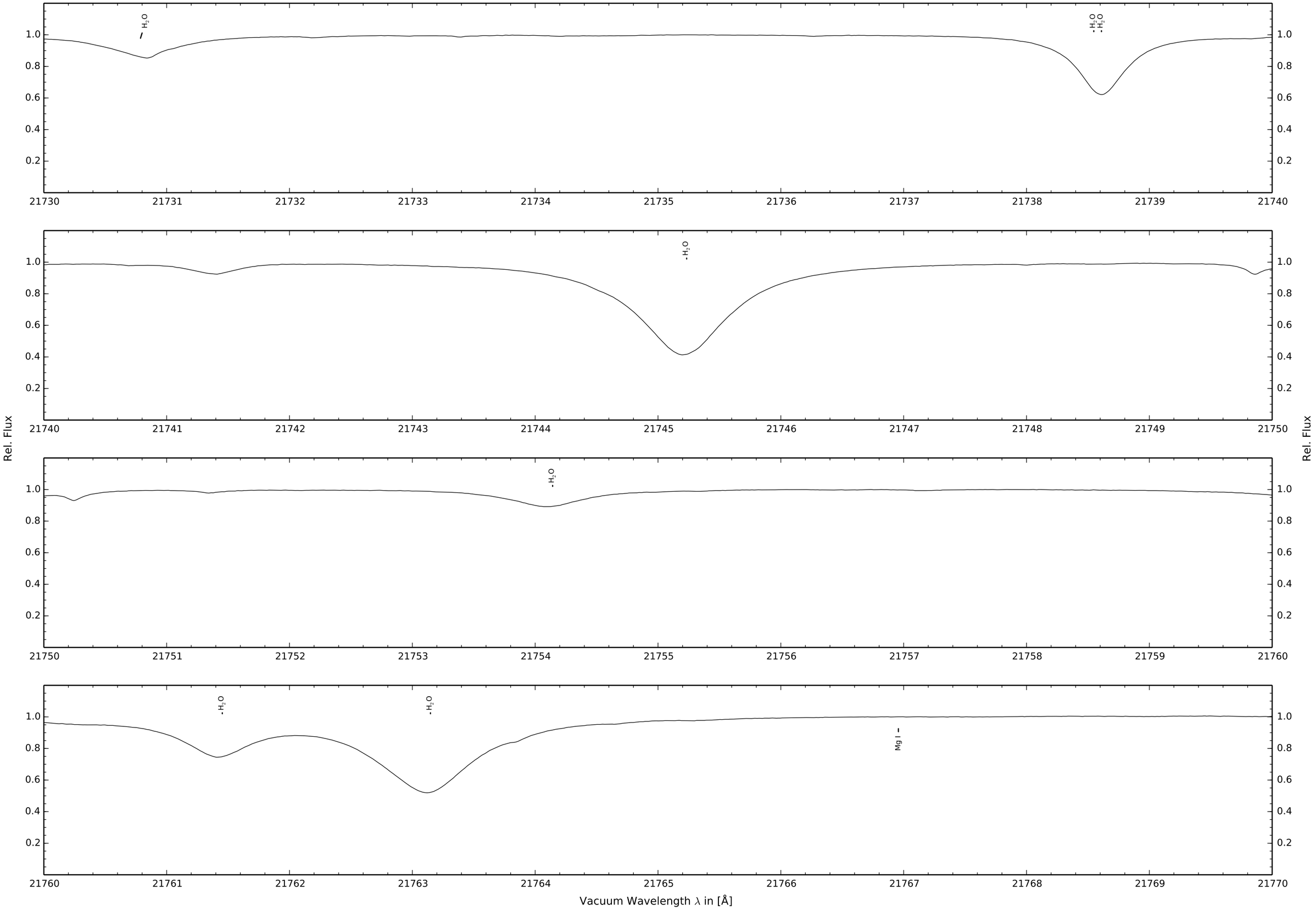
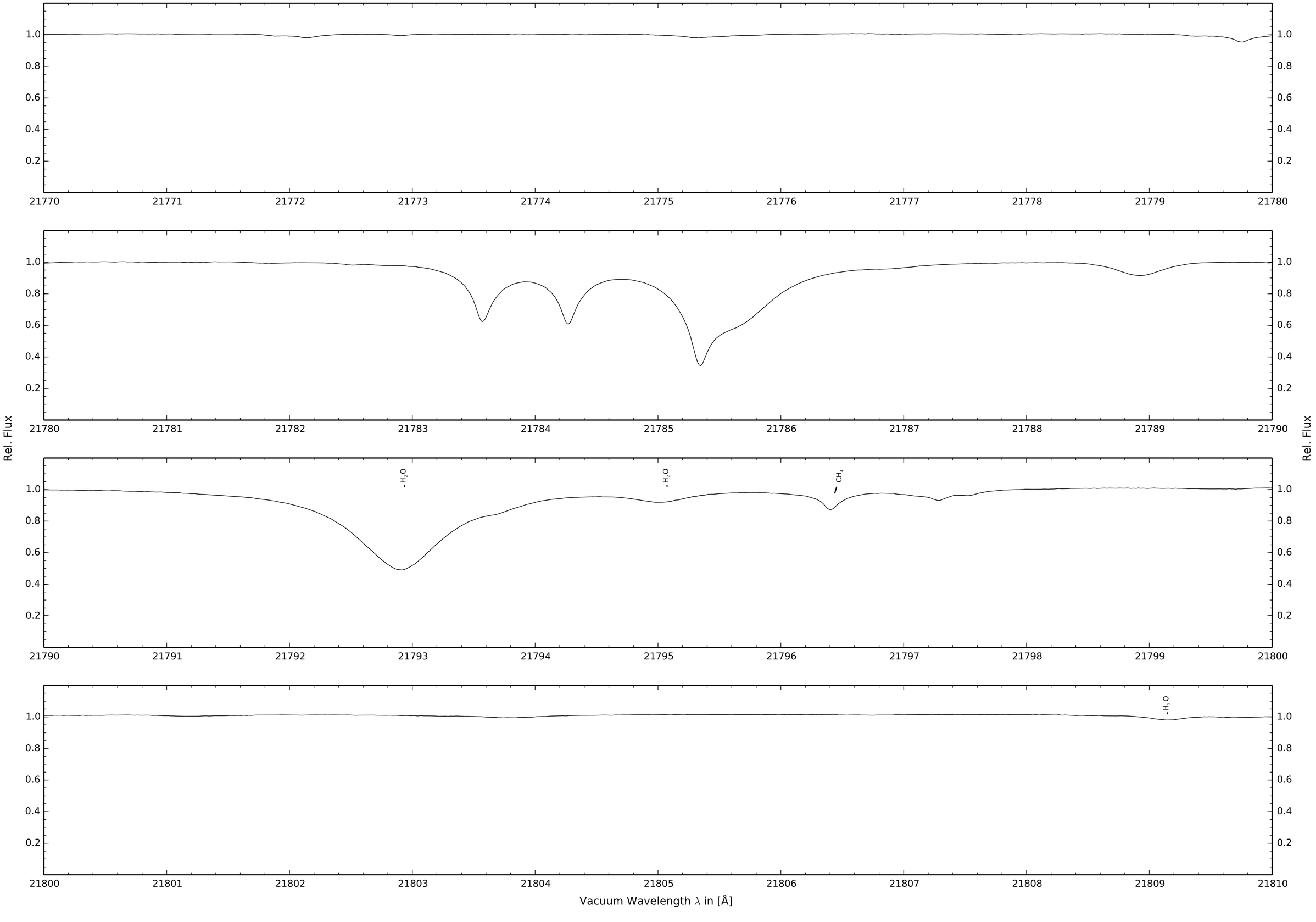
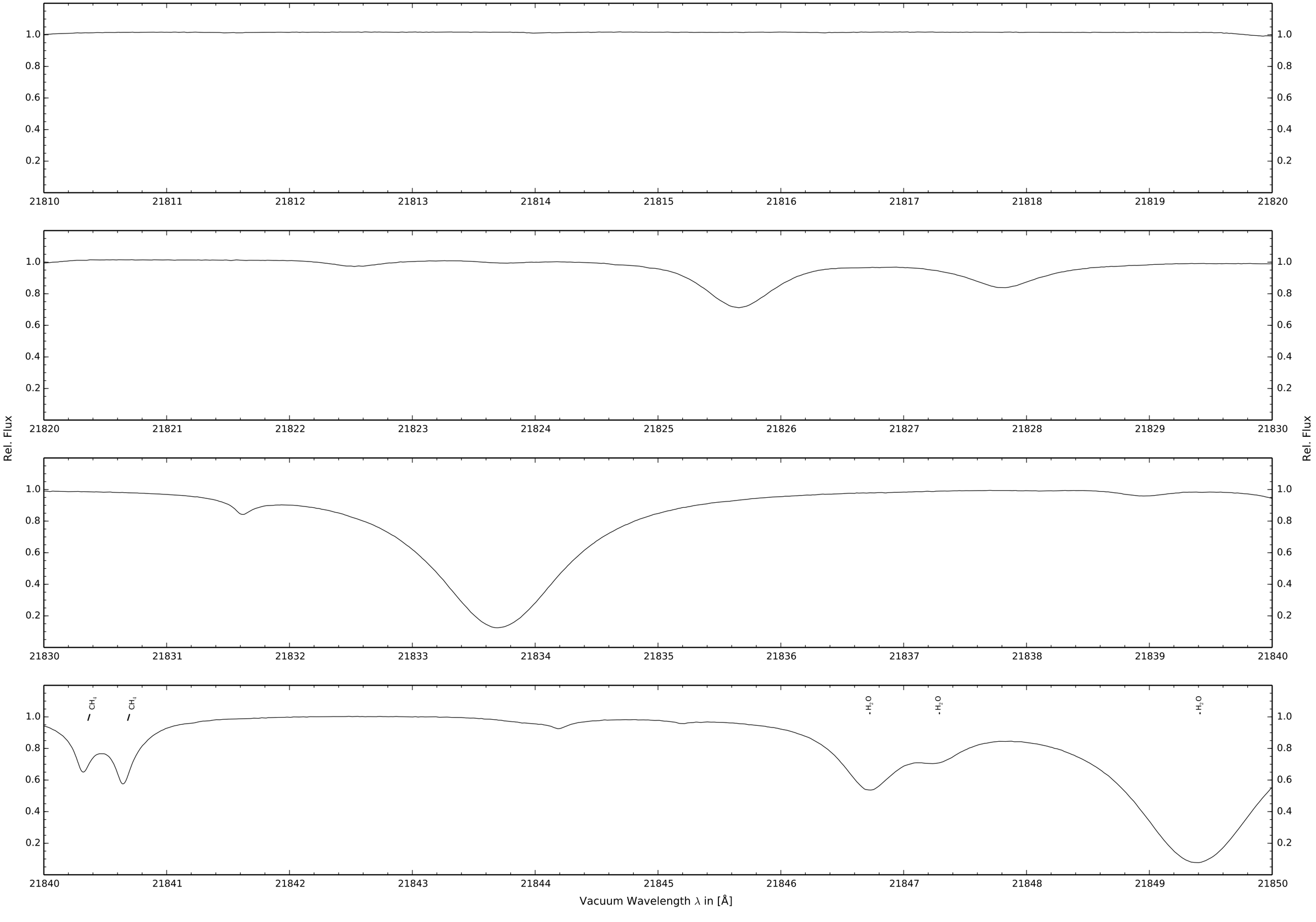
21726
21727
21728
21729
21730
CH4
CH4
CH4
CH4
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
H2O
H2O
H2O
H2O
H2O
H2O
Mg I


Rel. Flux
H_2O
H_2O
CH_4
H_2O
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
1.0
0.8
0.6
0.4
0.2
21810
21811
21812
21813
21814
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21816
21817
21818
21819
21820
21821
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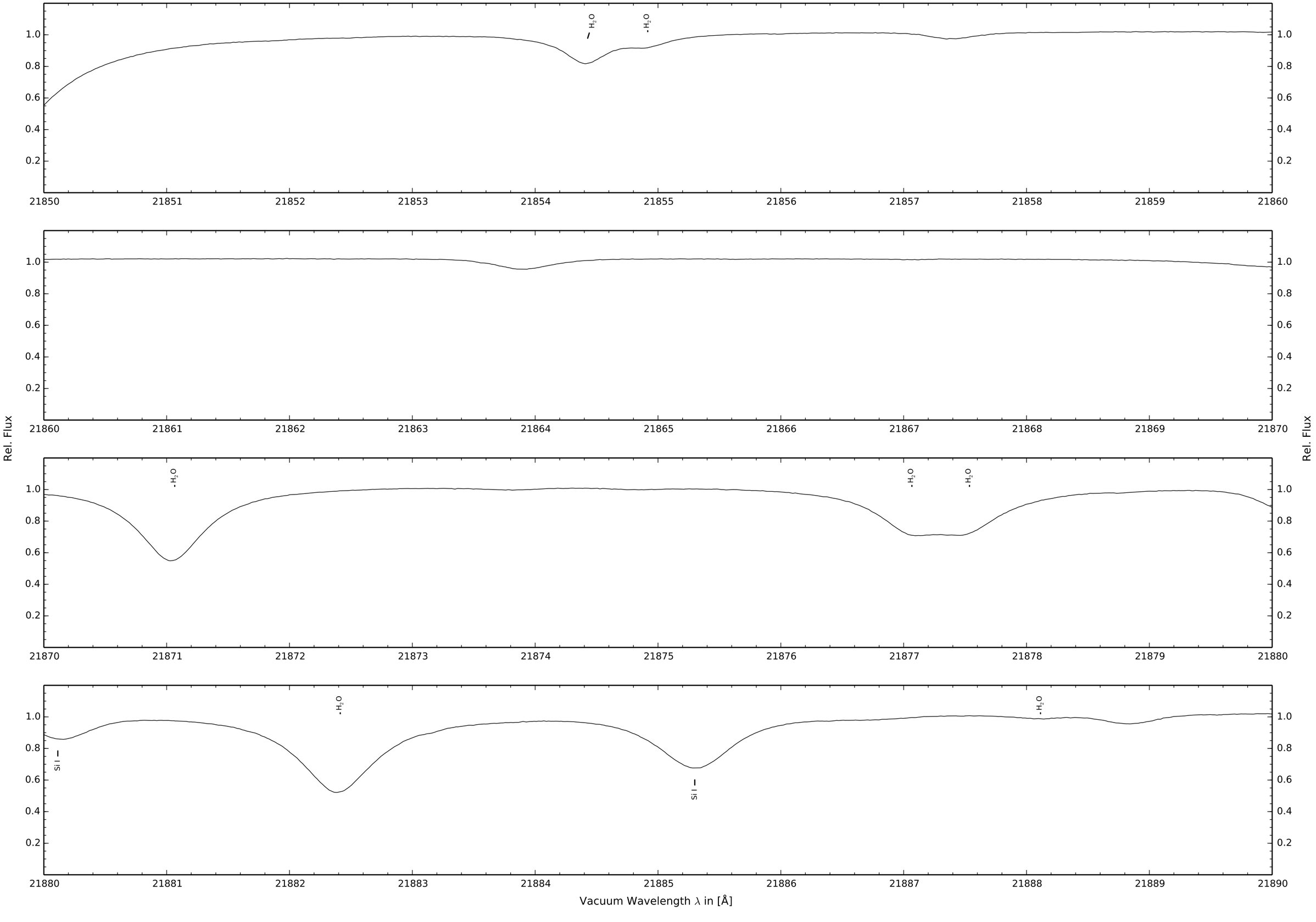
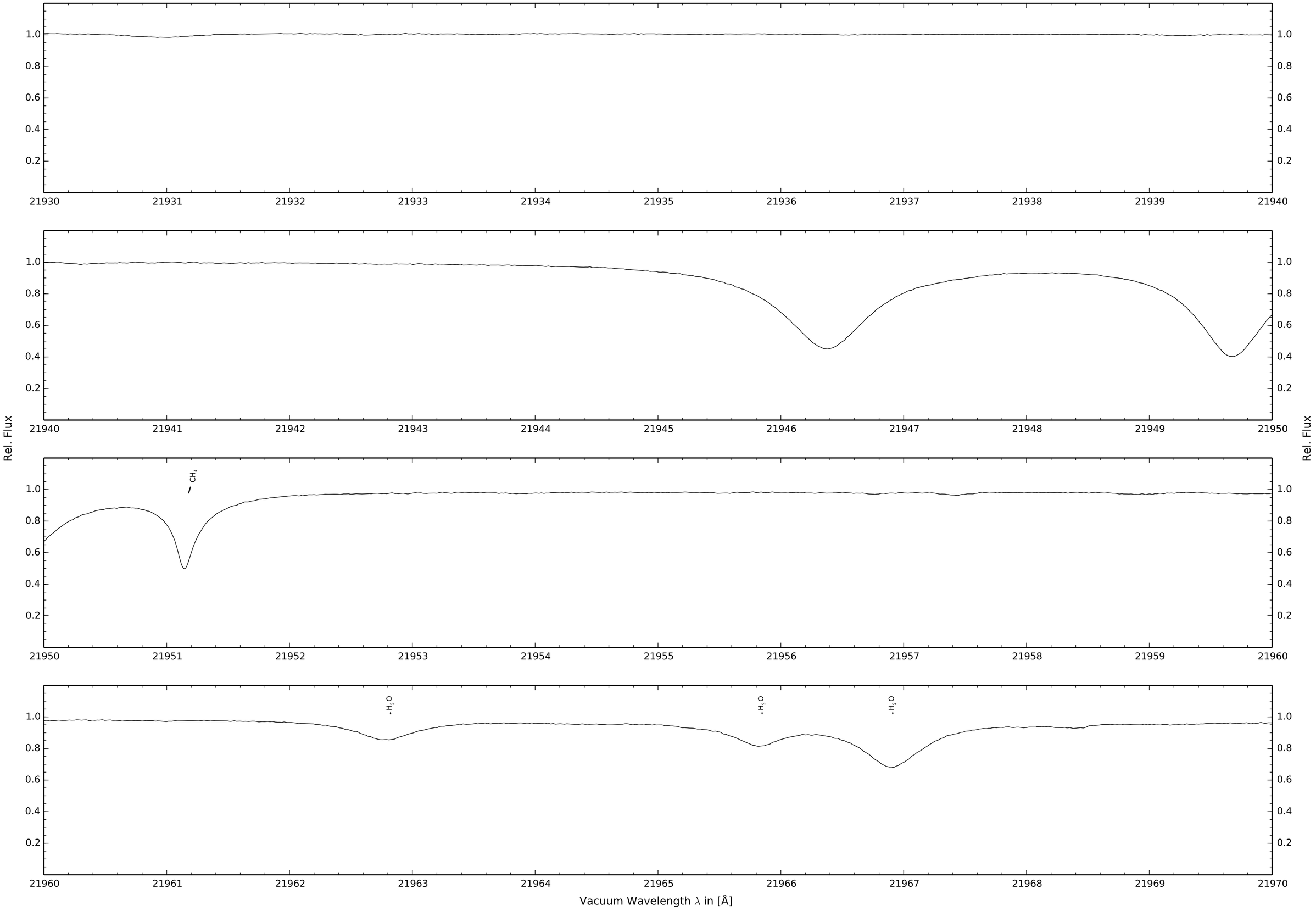
21836
21837
21838
21839
21840
21841
21842
21843
21844
21845
21846
21847
21848
21849
21850
CH4
CH4
H2O
H2O
H2O
Vacuum Wavelength λ in [Å]

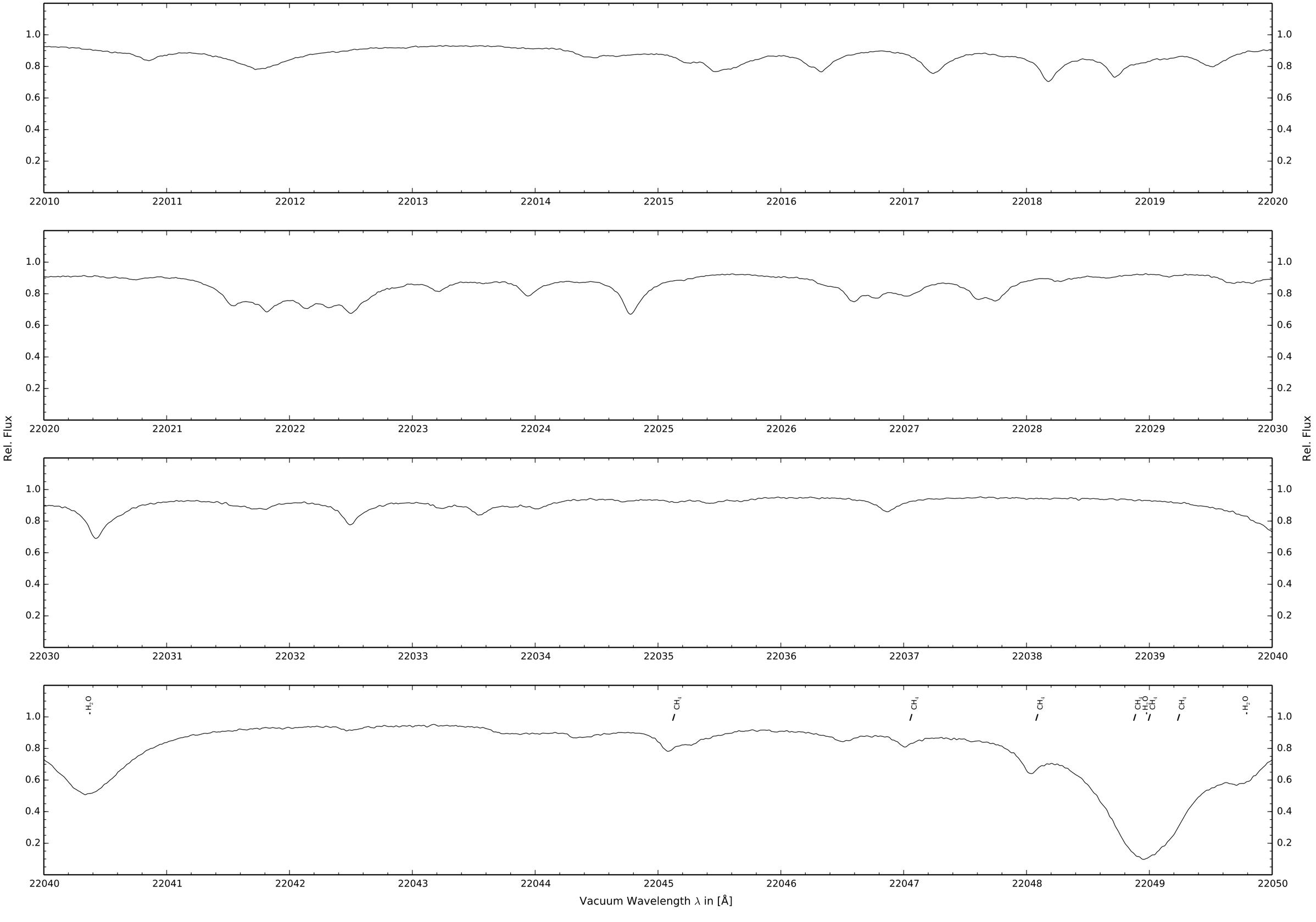

Rel. Flux
Vacuum Wavelength λ in [Å]
H2O
Si I

CH4
Fe I
H2O
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
CH_4
H_2O
H_2O
H_2O
Vacuum Wavelength λ in [Å]

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
1.0
0.8
0.6
0.4
0.2
22010
22011
22012
22013
22014
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22016
22017
22018
22019
22020
22021
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22023
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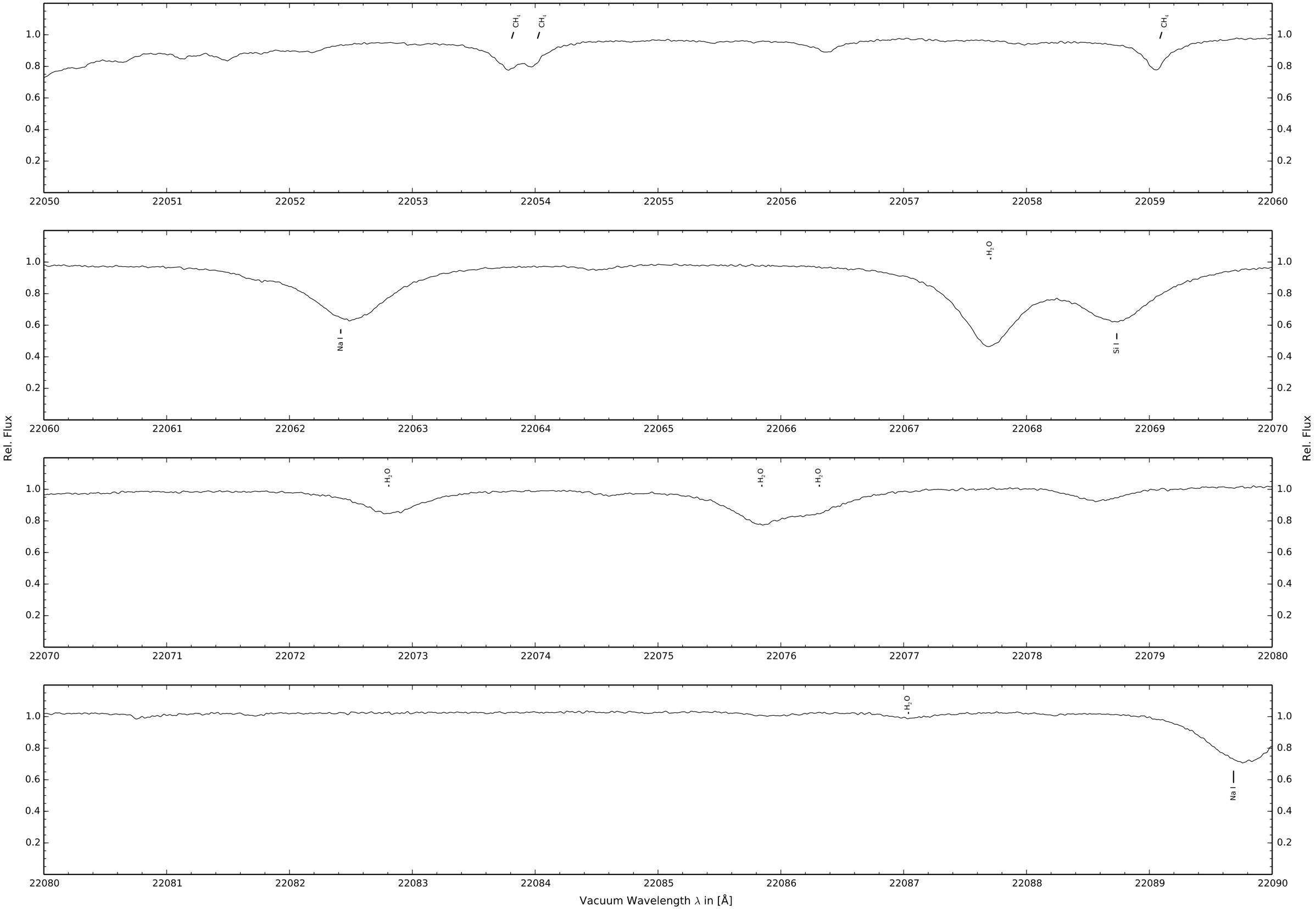
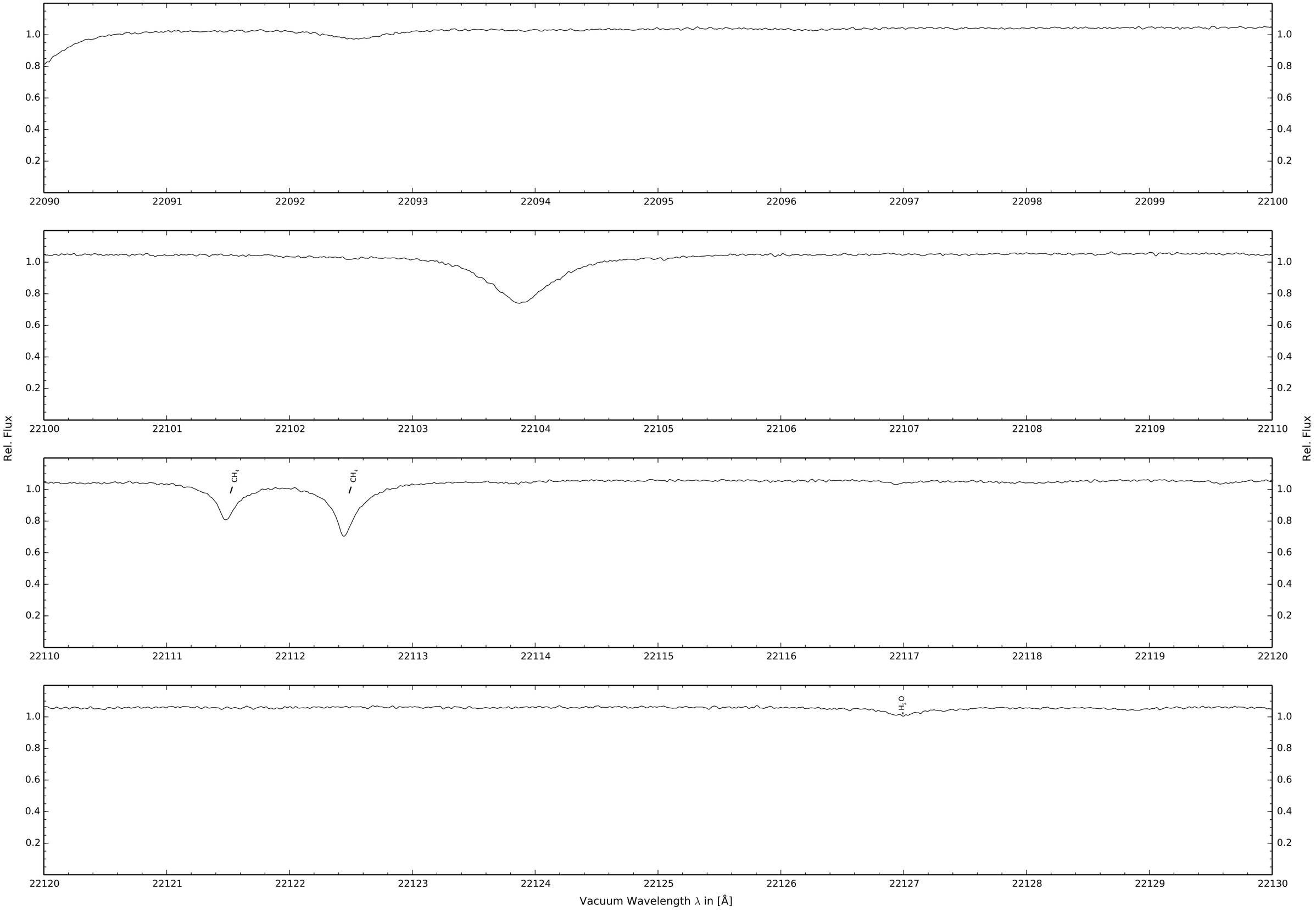
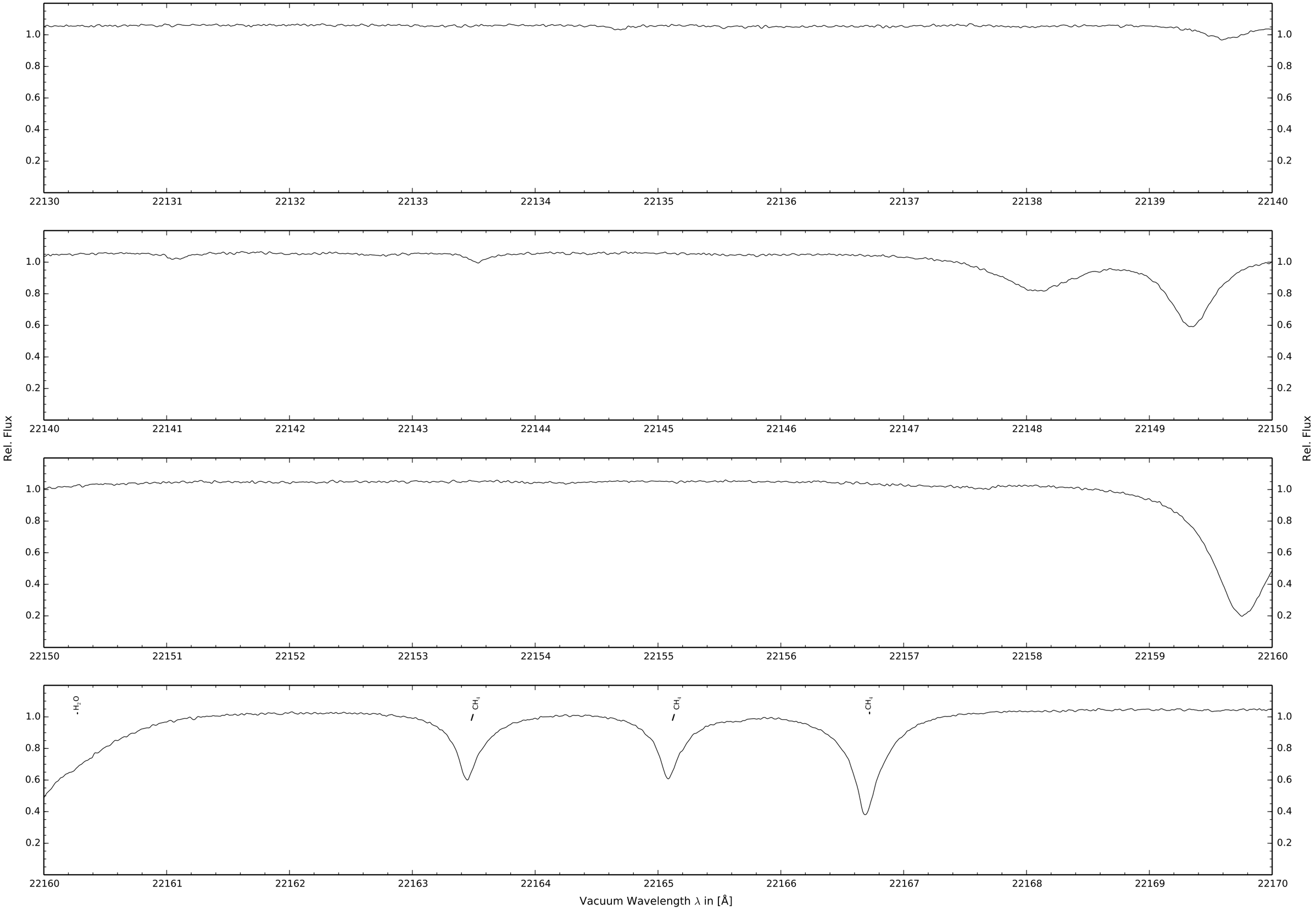
22035
22036
22037
22038
22039
22040
22041
22042
22043
22044
22045
22046
22047
22048
22049
22050
$-H_2O$
CH_4
CH_4
CH_4
CH_4
$-H_2O$
CH_4
CH_4
$-H_2O$
Vacuum Wavelength λ in [Å]


CH4
CH4
CH4
Na I
-H2O
Si I
-H2O
-H2O
-H2O
-H2O
Na I
Rel. Flux
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
CH_4
CH_4
H_2O
Vacuum Wavelength λ in [Å]


Rel. Flux
1.0
0.8
0.6
0.4
0.2
22130
22131
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22133
22134
22135
22136
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22138
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22140
22141
22142
22143
22144
22145
22146
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22149
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22151
22152
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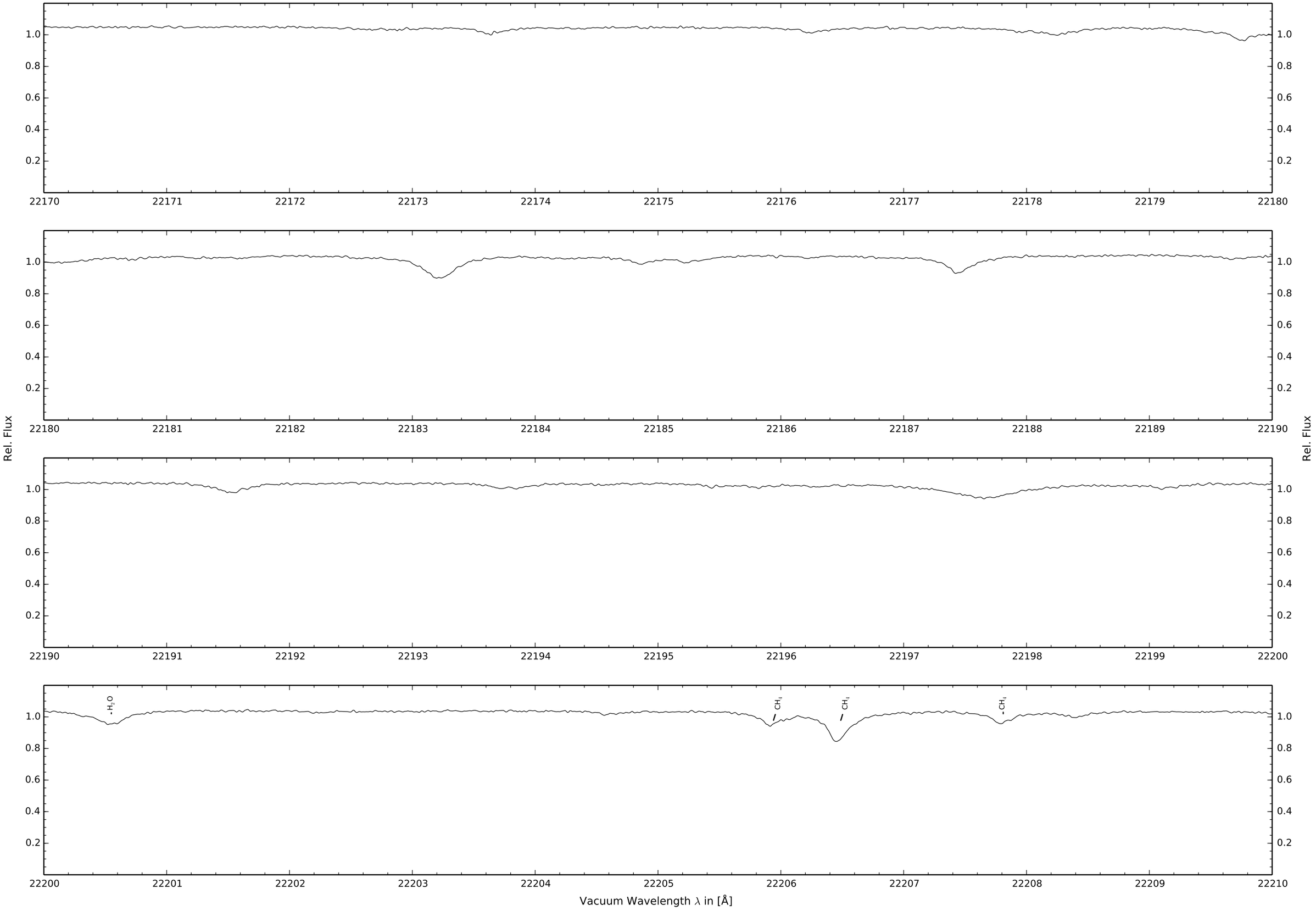
22156
22157
22158
22159
22160
22161
22162
22163
22164
22165
22166
22167
22168
22169
22170
-H2O
-CH4
-CH4
-CH4
Vacuum Wavelength λ in [Å]


Rel. Flux
1.0
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0.6
0.4
0.2
22170
22171
22172
22173
22174
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22176
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22197
22198
22199
22200
22201
22202
22203
22204
22205
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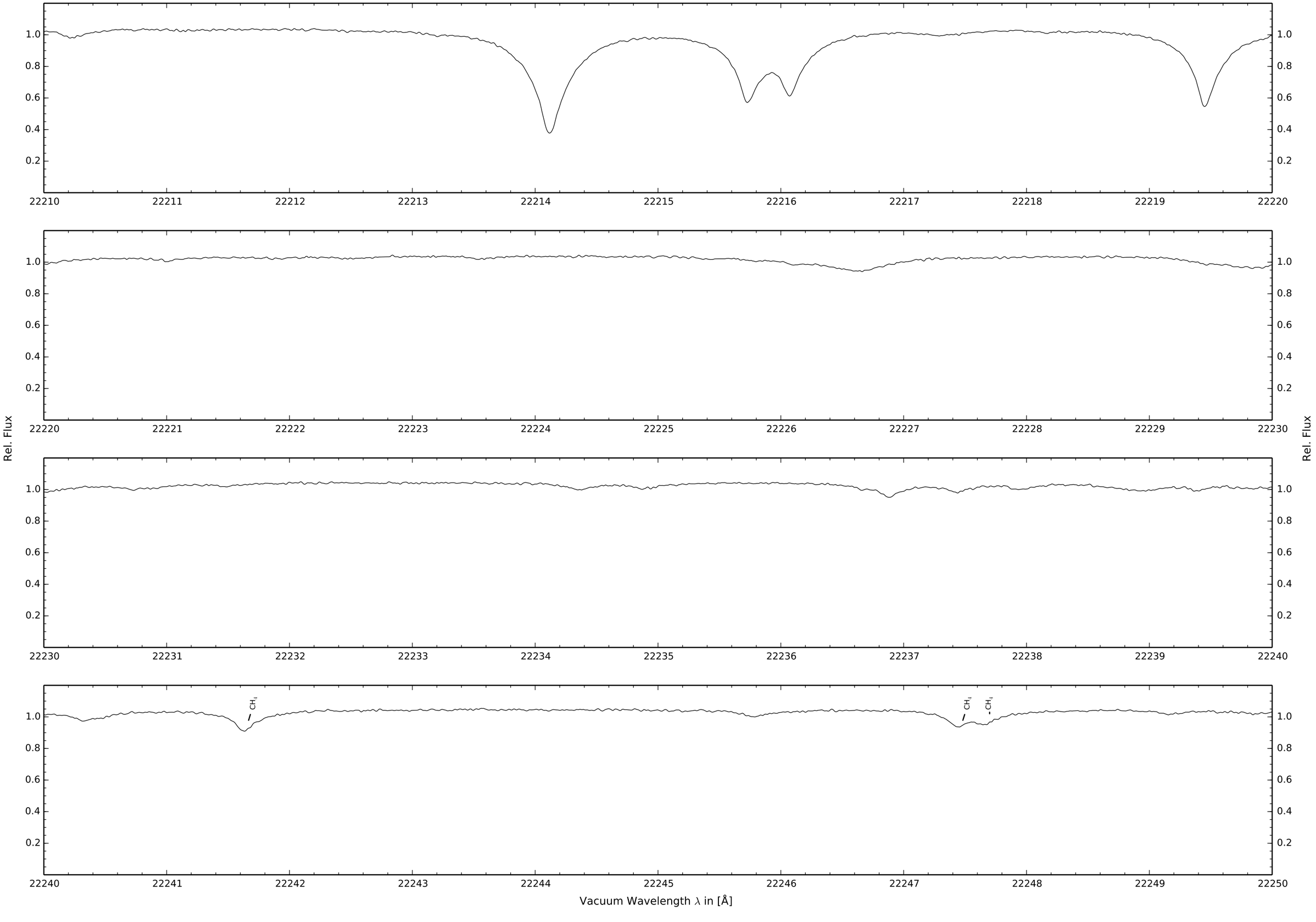
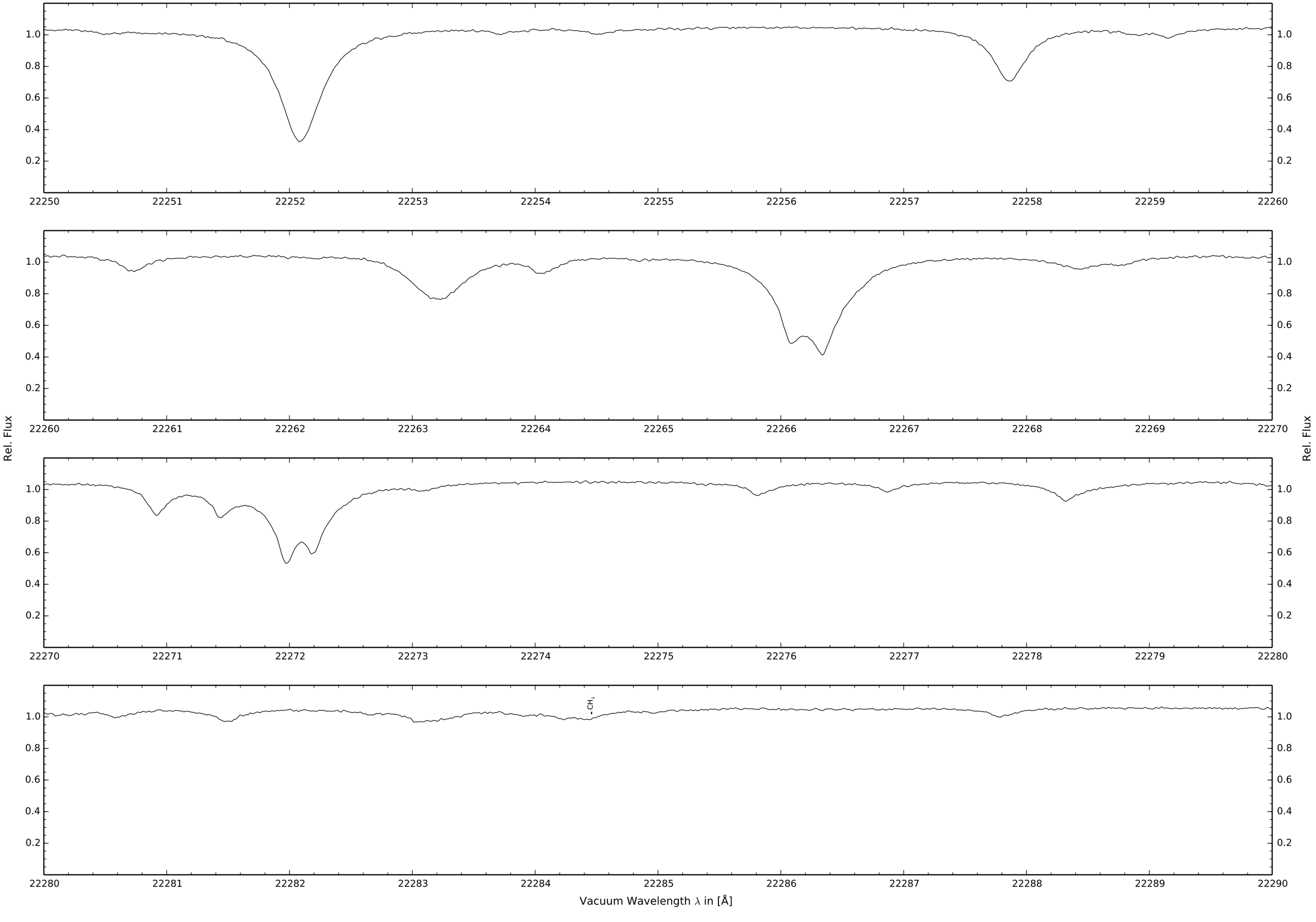
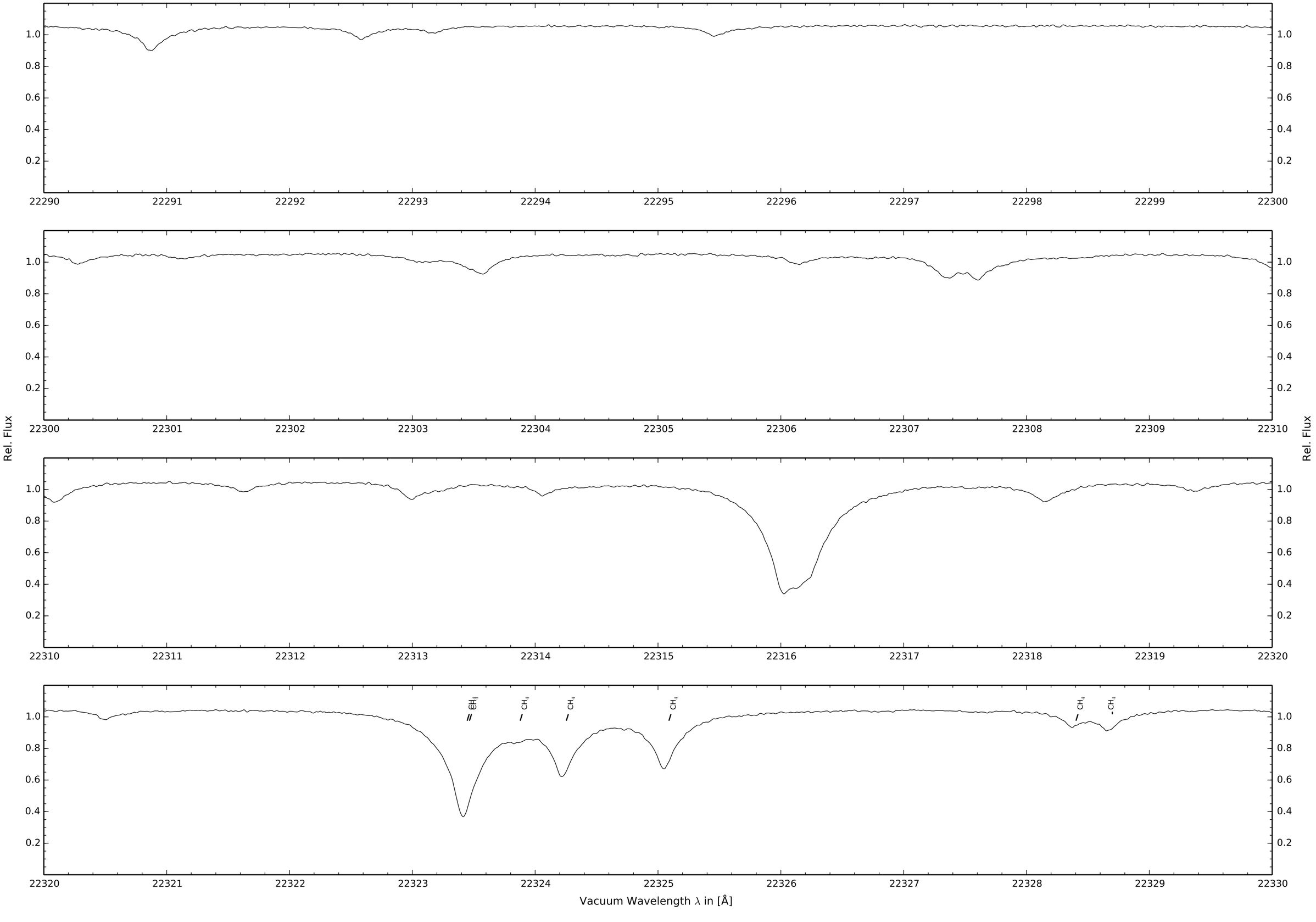
22207
22208
22209
22210
H_2O
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
$-CH_4$
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
1.0
0.8
0.6
0.4
0.2
22290
22291
22292
22293
22294
22295
22296
22297
22298
22299
22300
22301
22302
22303
22304
22305
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22310
22311
22312
22313
22314
22315
22316
22317
22318
22319
22320
22321
22322
22323
22324
22325
22326
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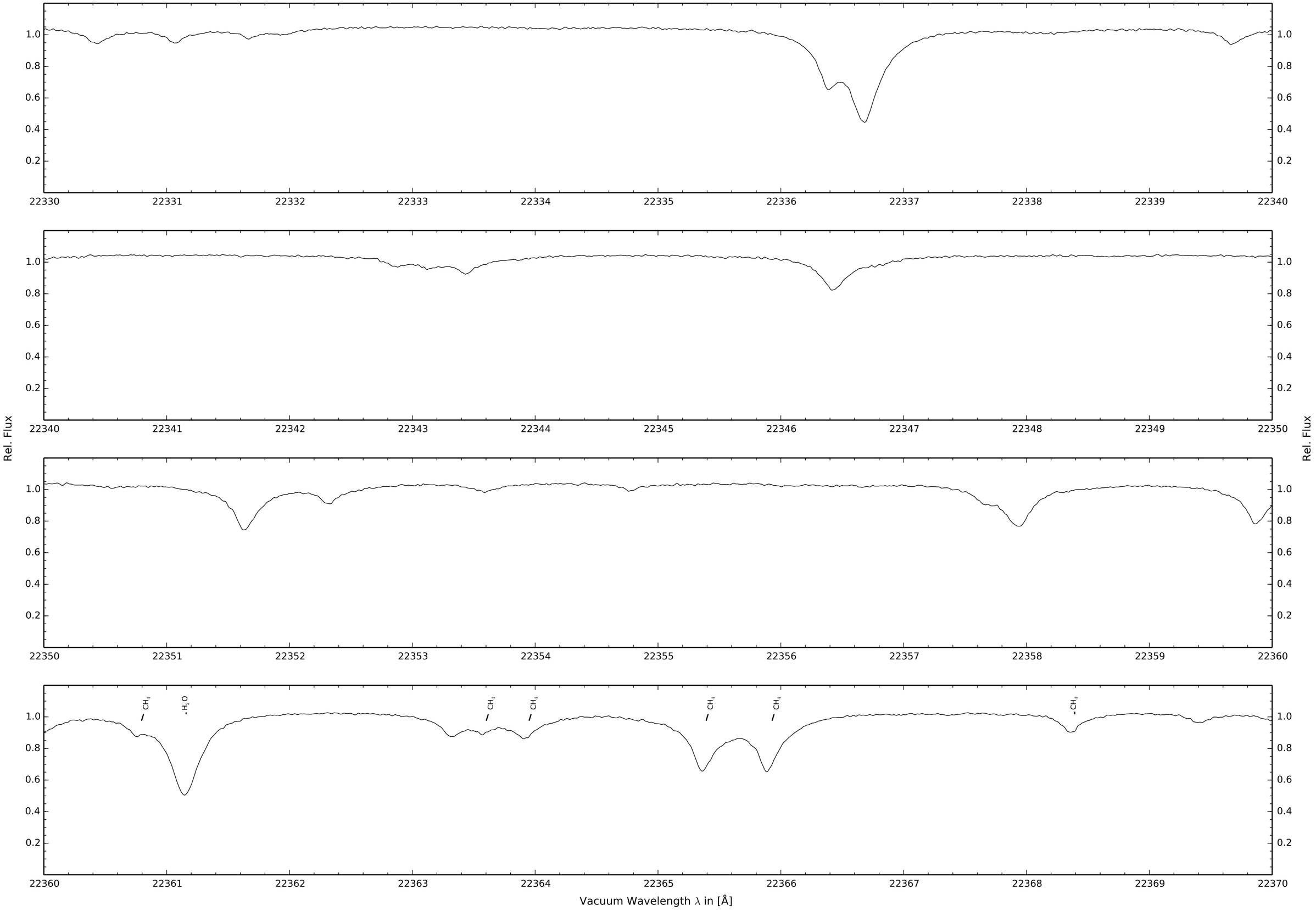
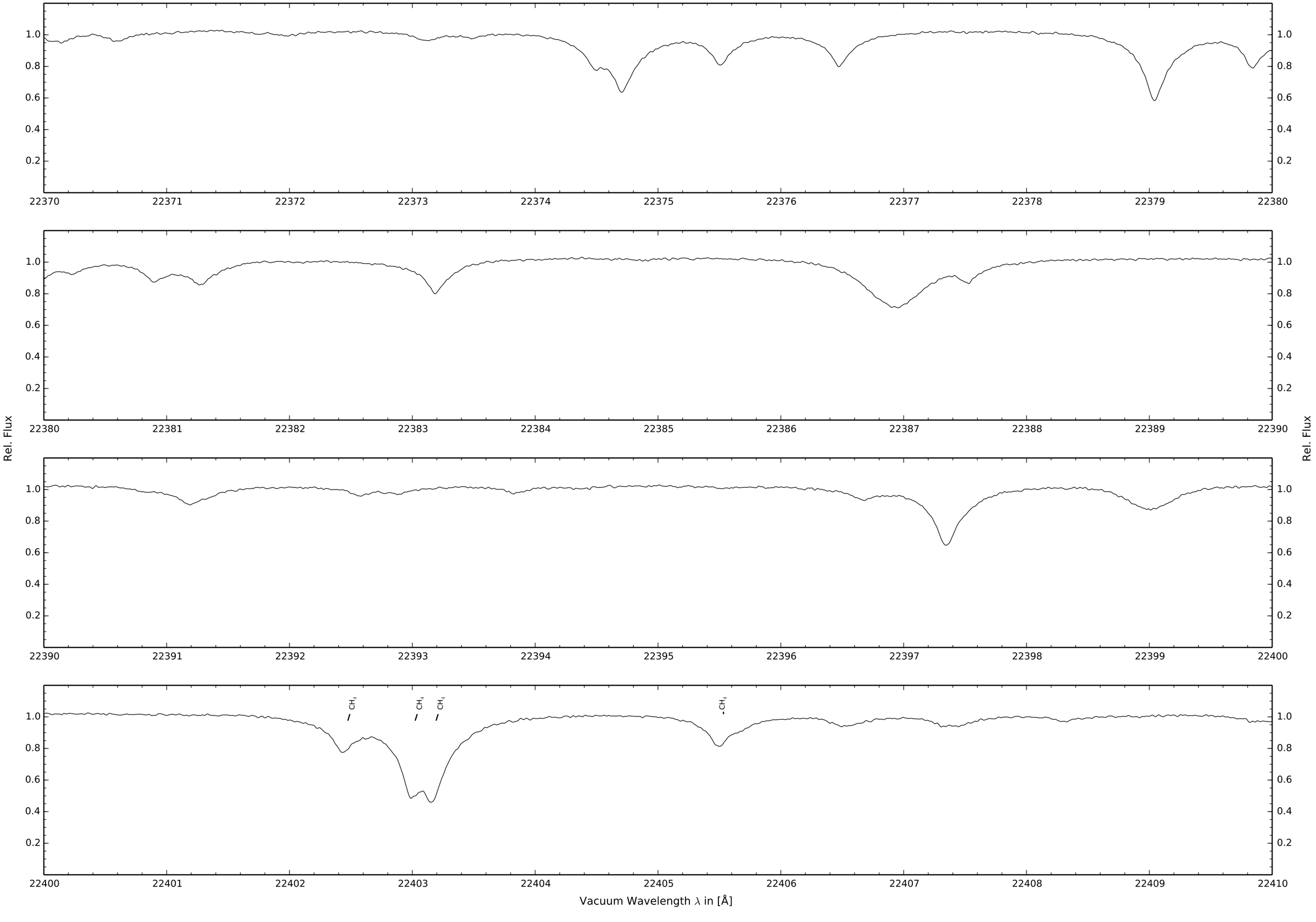
22329
22330
CH_4
CH_4
CH_4
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]


Rel. Flux
Vacuum Wavelength λ in [Å]
CH4
H2O

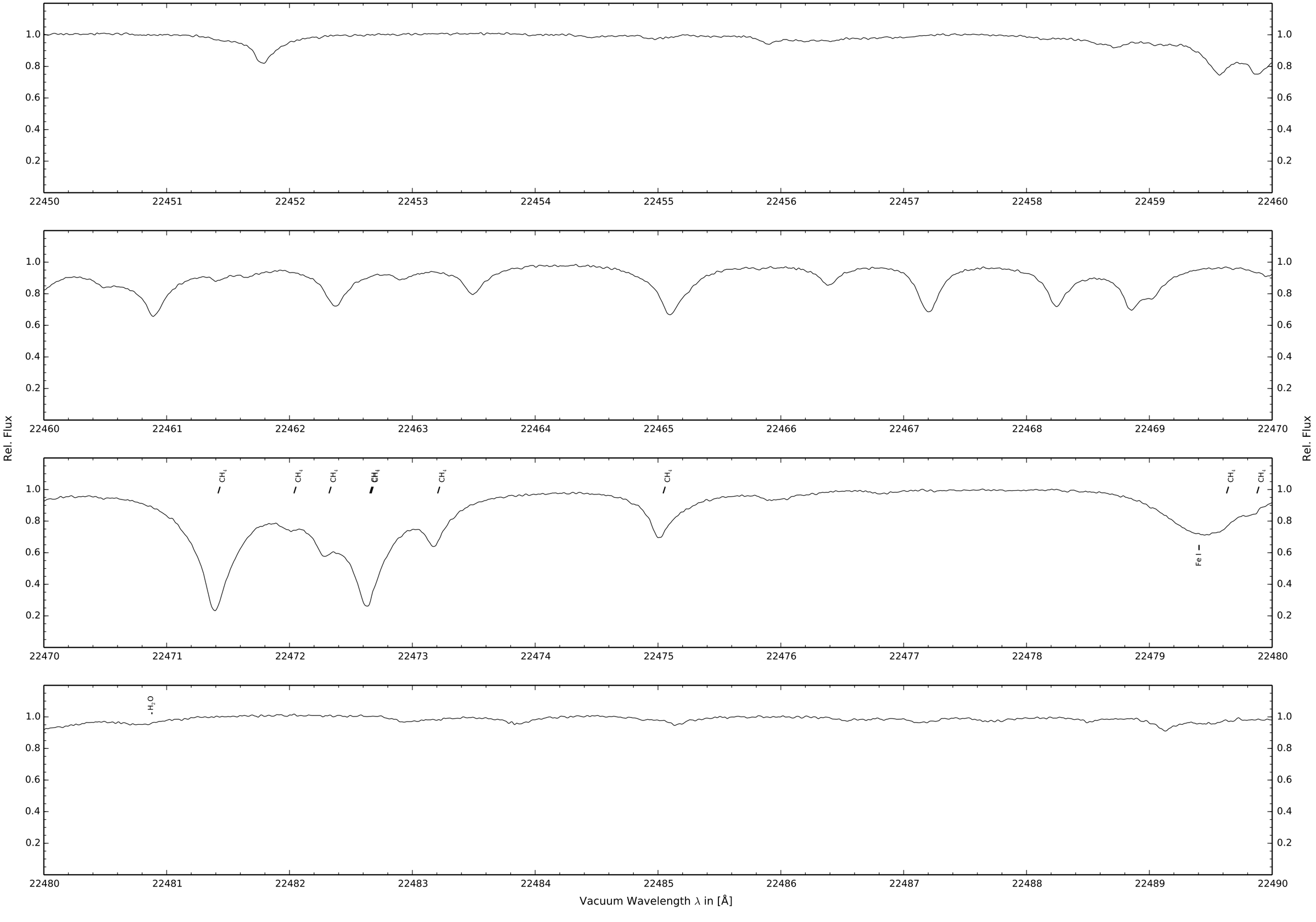

Rel. Flux
Rel. Flux
CH_4
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]

Rel. Flux

Rel. Flux

CH_4 CH_4 CH_4 CH_4 H_2O

Vacuum Wavelength λ in [Å]


Rel. Flux
1.0
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0.6
0.4
0.2
22450
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22477
22478
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22480
22481
22482
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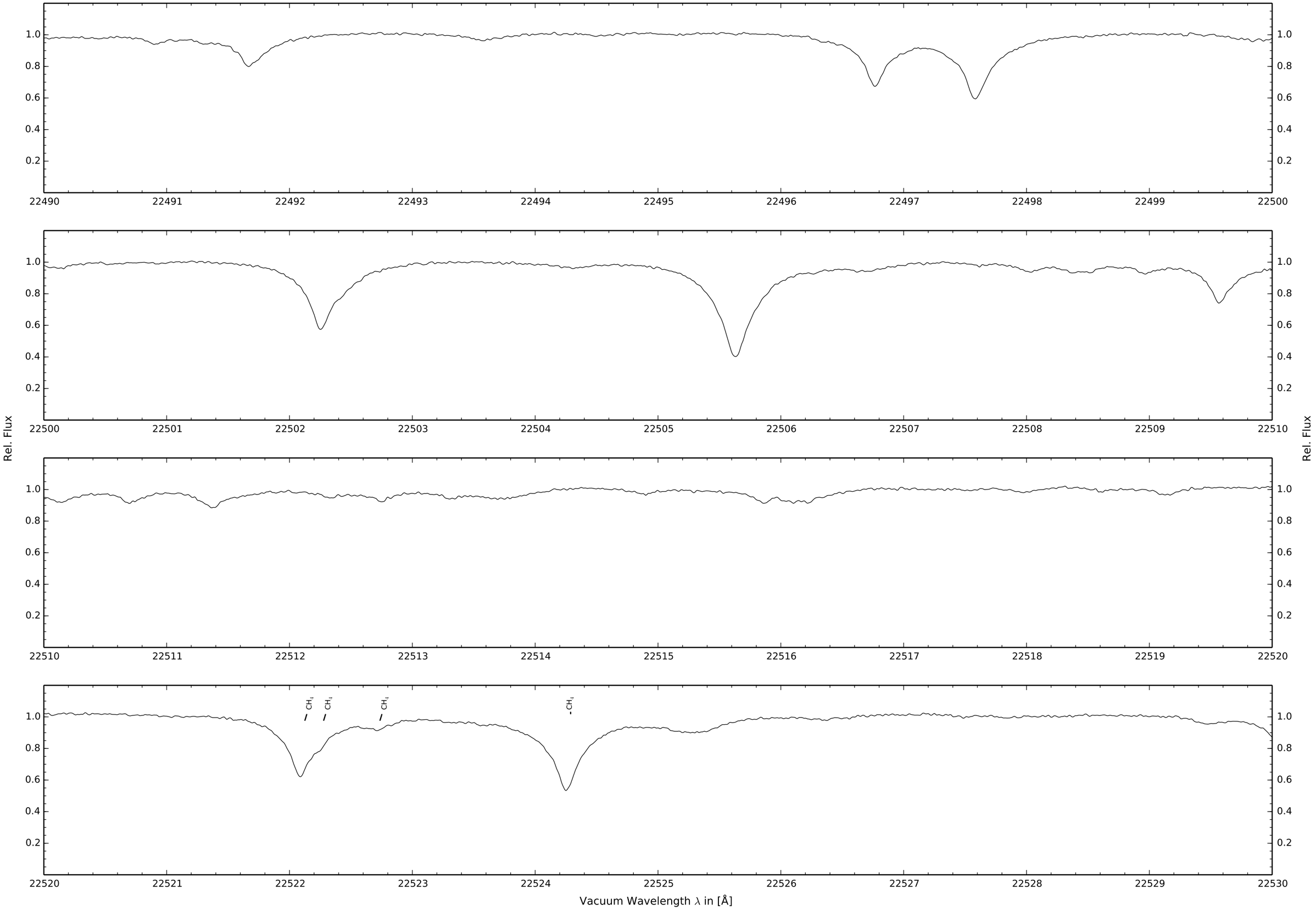
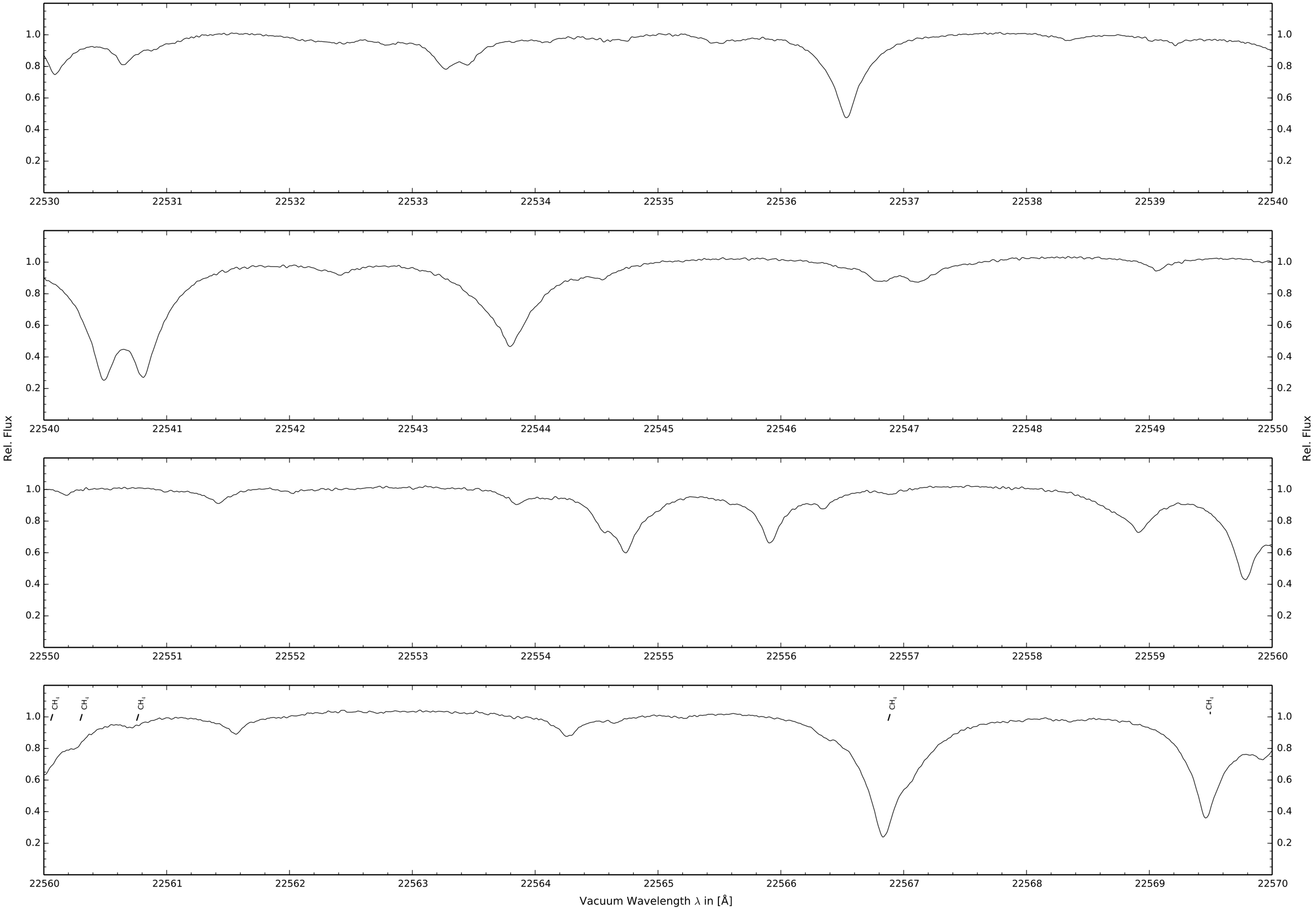
22485
22486
22487
22488
22489
22490
CH_4
H_2O
Fe I
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
CH_4
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
CH_4
CH_4
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]

Rel. Flux

1.0
0.8
0.6
0.4
0.2

22570 22571 22572 22573 22574 22575 22576 22577 22578 22579 22580

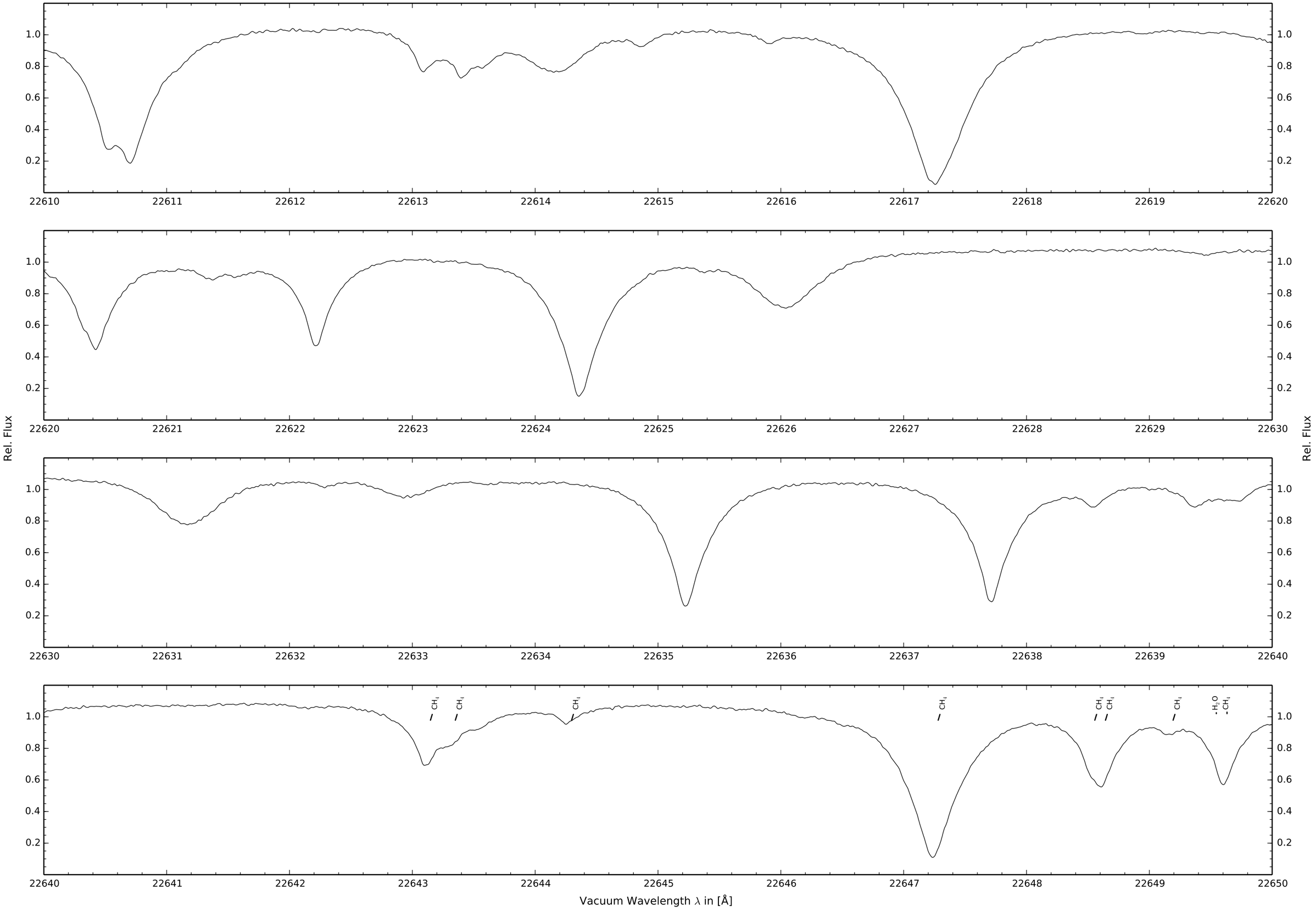
22580 22581 22582 22583 22584 22585 22586 22587 22588 22589 22590

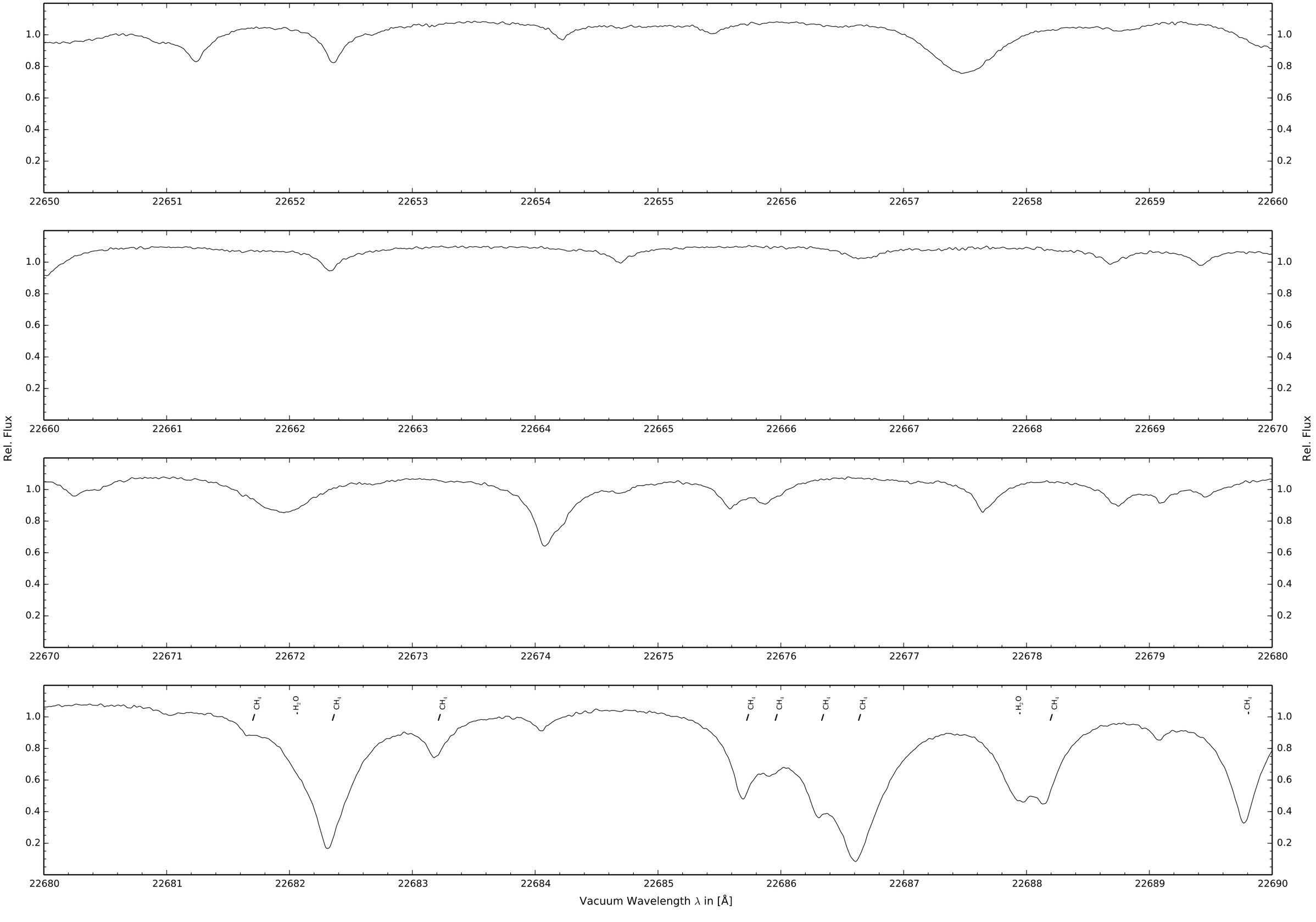
22590 22591 22592 22593 22594 22595 22596 22597 22598 22599 22600

CH_4 CH_4 CH_4 CH_4 CH_4 CH_4 CH_4

22600 22601 22602 22603 22604 22605 22606 22607 22608 22609 22610

Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
CH4
CH4
CH4
CH4
CH4
CH4
CH4
H2O
CH4
Vacuum Wavelength λ in [Å]


Rel. Flux
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0.4
0.2
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22658
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22679
22680
22681
22682
22683
22684
22685
22686
22687
22688
22689
22690
CH_4
H_2O
Vacuum Wavelength λ in [Å]

Rel. Flux

Rel. Flux

CH_4

H_2O

CH_4

CH_4

CH_4

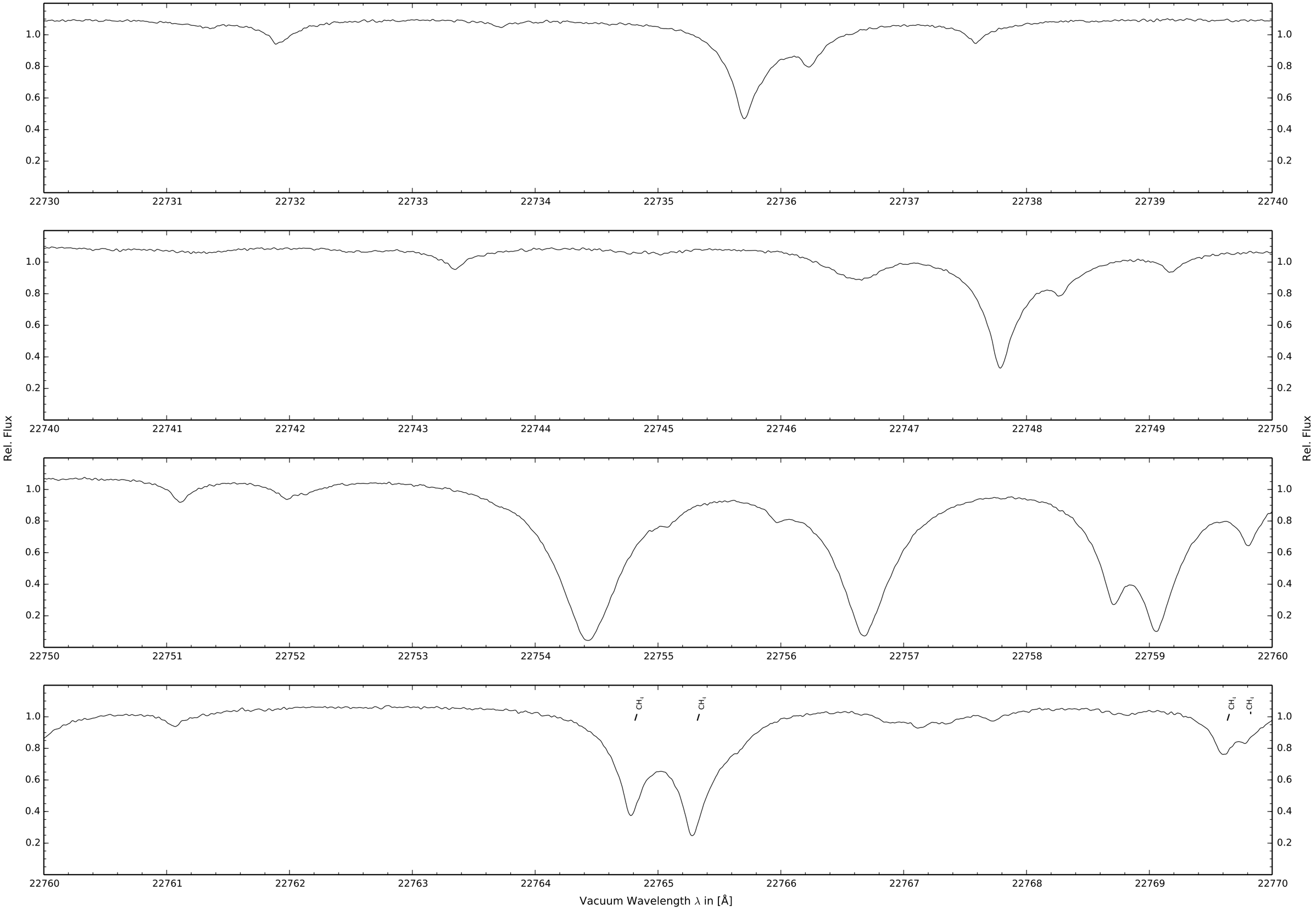
CH_4

CH_4

CH_4

CH_4

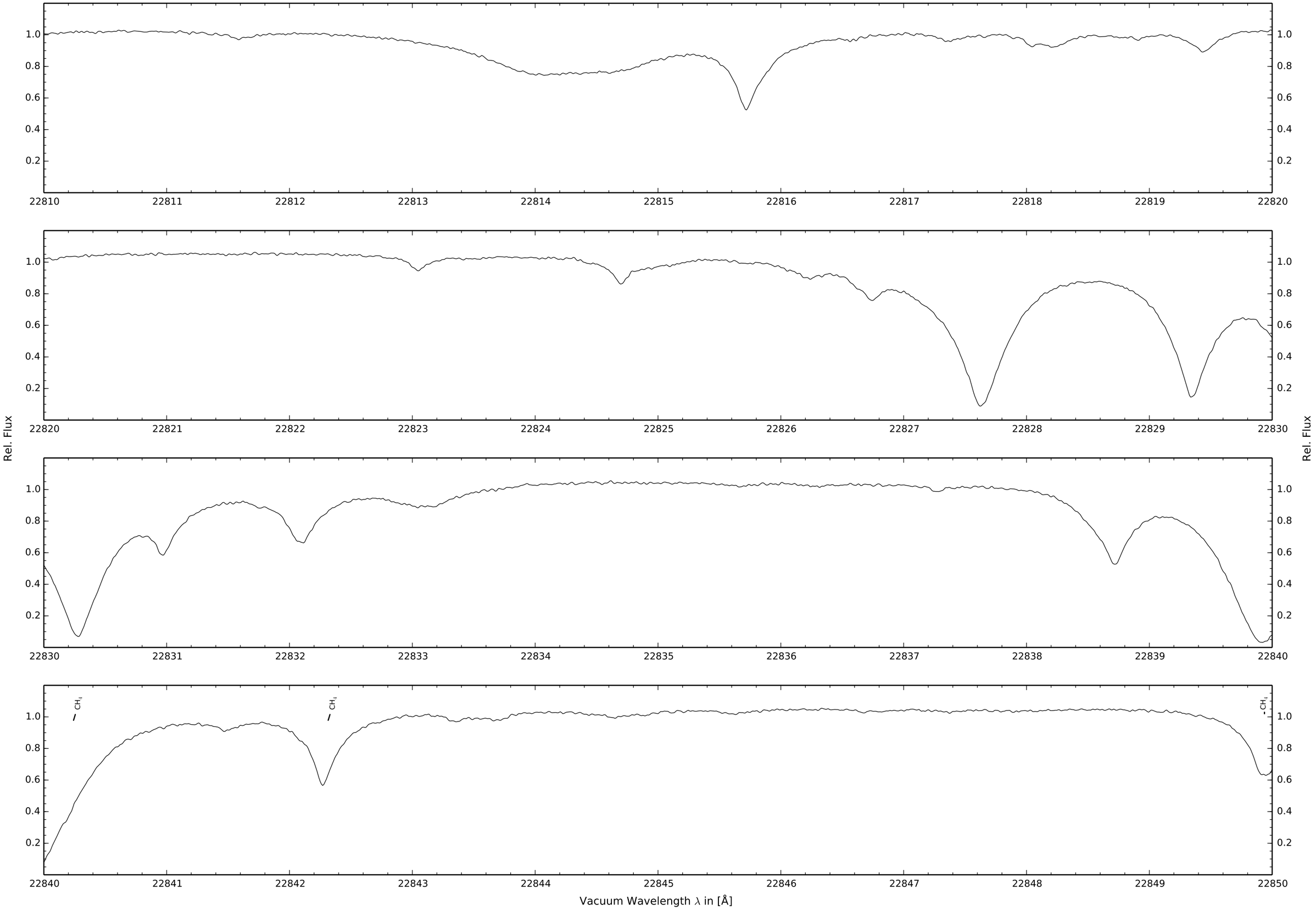
Vacuum Wavelength λ in [Å]

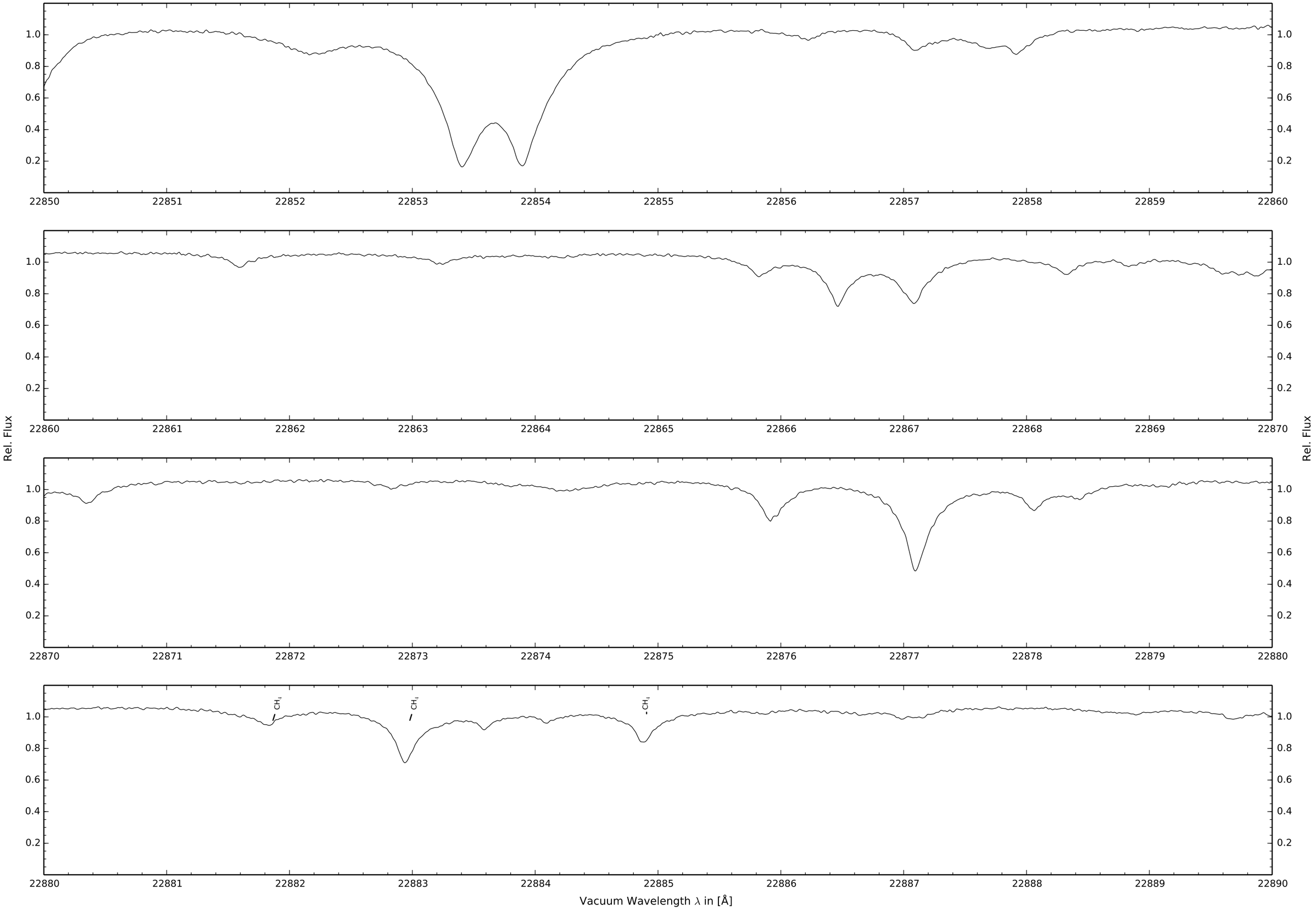

Rel. Flux
Rel. Flux
CH_4
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]

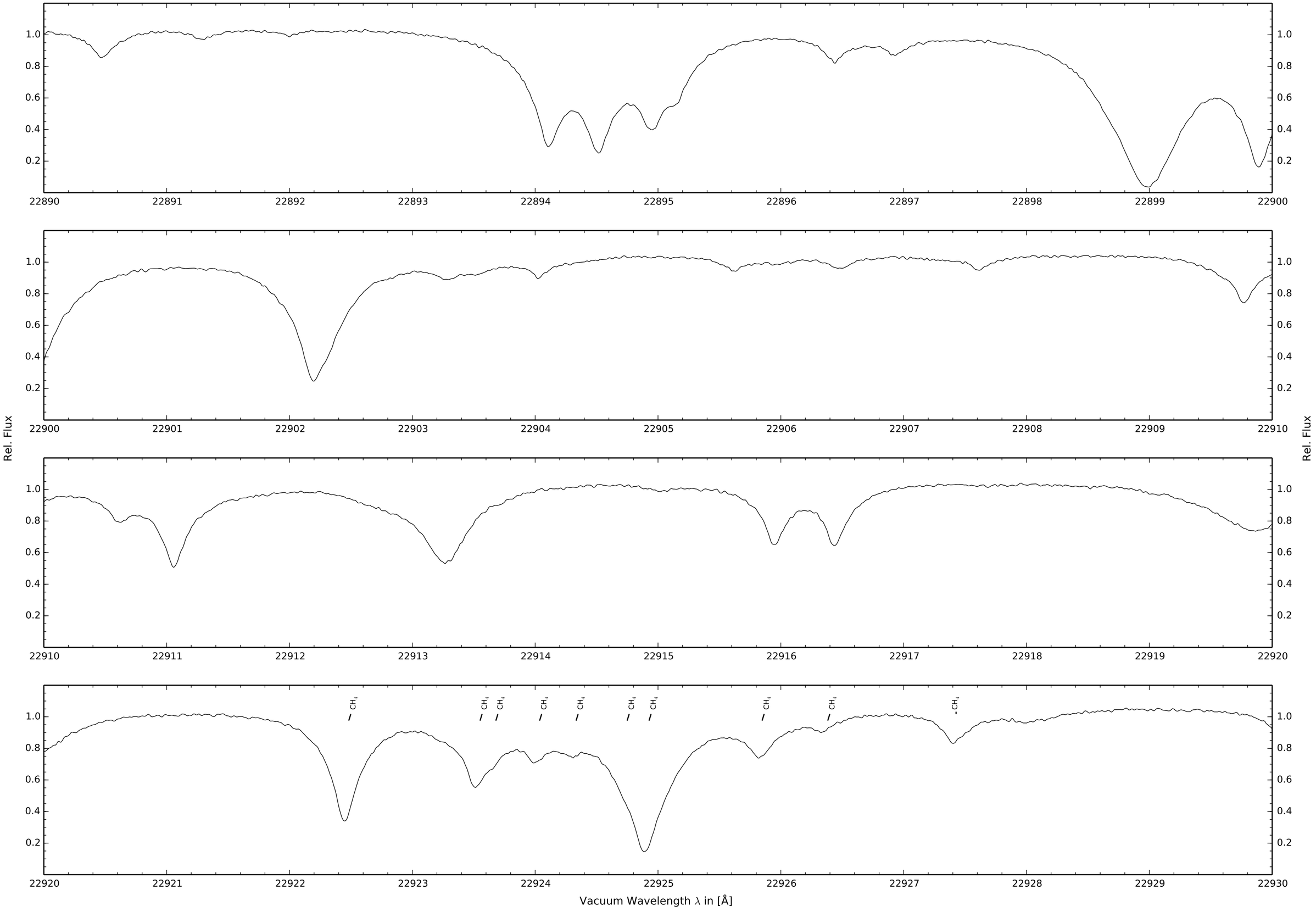
Rel. Flux

Vacuum Wavelength λ in [Å]

CH_4

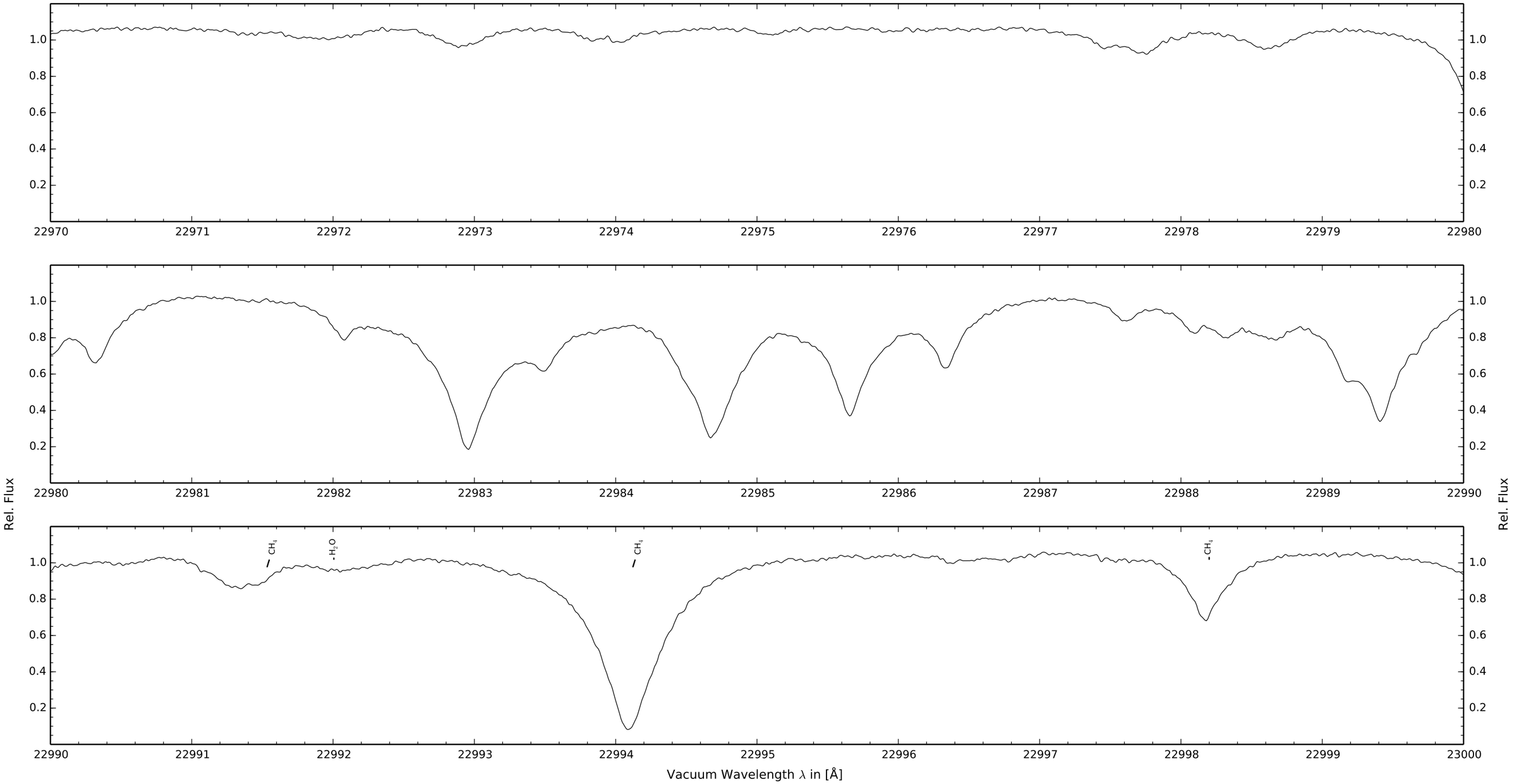

Rel. Flux
Rel. Flux
CH_4
CH_4
CH_4
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
CH_3
CH_3
CH_3
Vacuum Wavelength λ in [Å]


Rel. Flux
Rel. Flux
Vacuum Wavelength λ in [Å]
CH4
CH4
CH4
CH4
CH4
CH4
CH4
CH4
CH4

Rel. Flux

Vacuum Wavelength λ in [Å]


Rel. Flux
1.0
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0.4
0.2
22970
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22991
22992
22993
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22995
22996
22997
22998
22999
23000
CH_4
H_2O
CH_4
CH_4
Vacuum Wavelength λ in [Å]