Tests of spectroscopic linelists

Application to Jungfraujoch spectra

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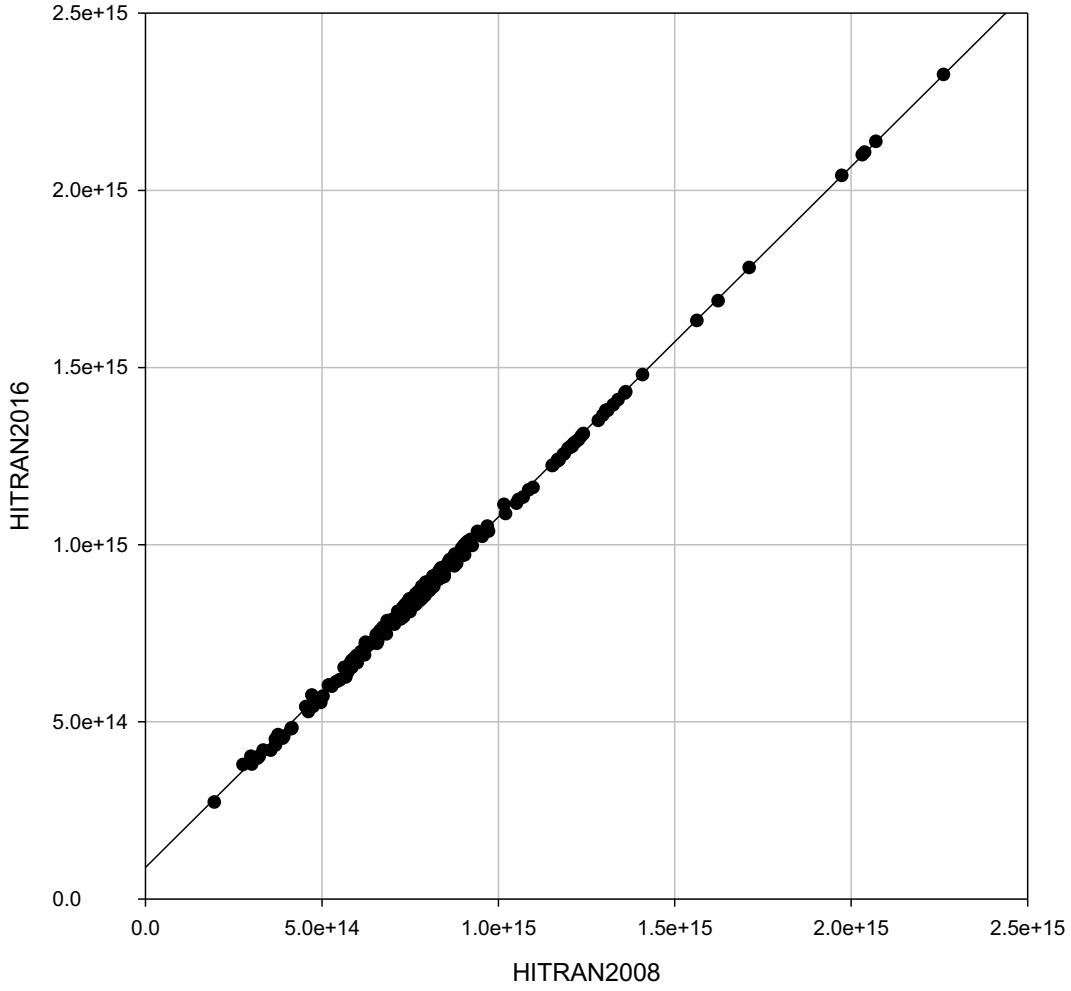
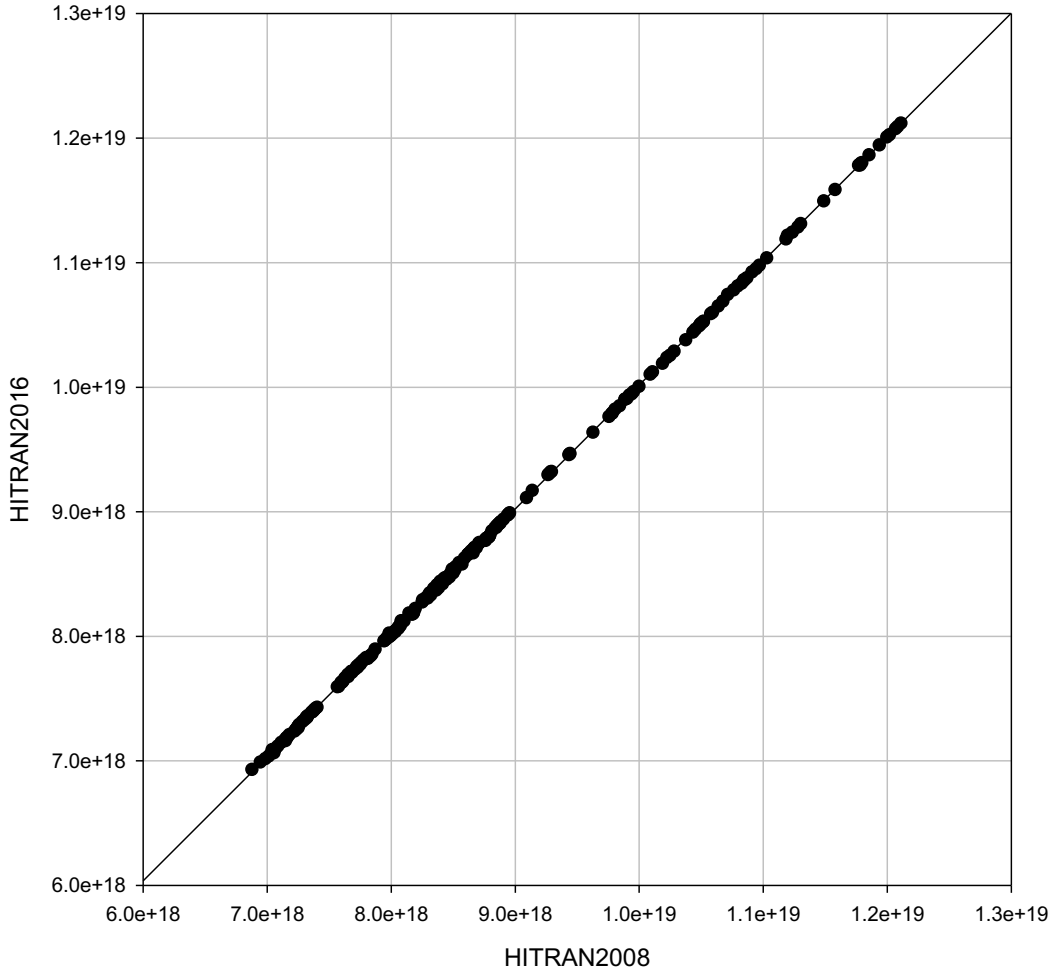
ClONO2

Chlorine nitrate – HITRAN2016 vs HITRAN2008



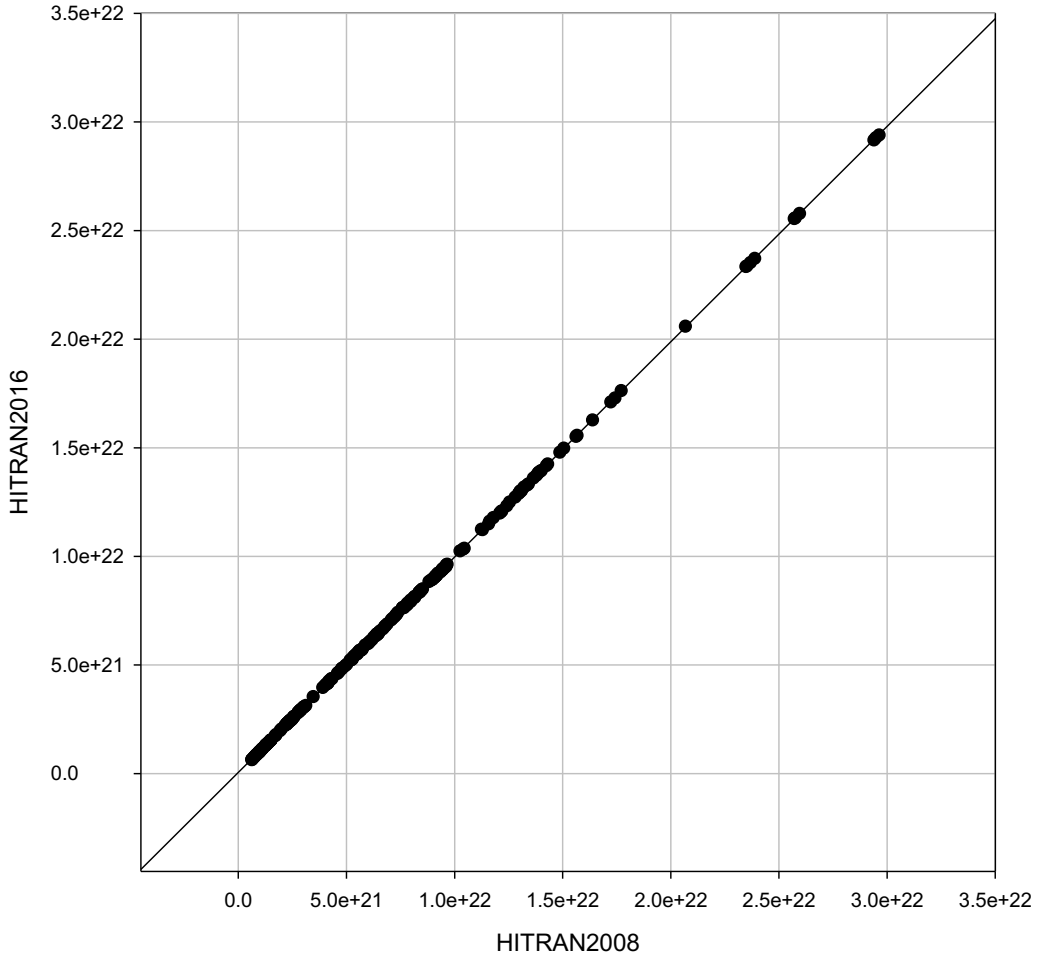
- All Jungfraujoch spectra for 2018
- SFIT-4 v0.9.7.3 or v0.9.4.4
- Compact correlation
- Total columns larger by (11±5)%

Chlorine nitrate – HITRAN2016 vs HITRAN2008



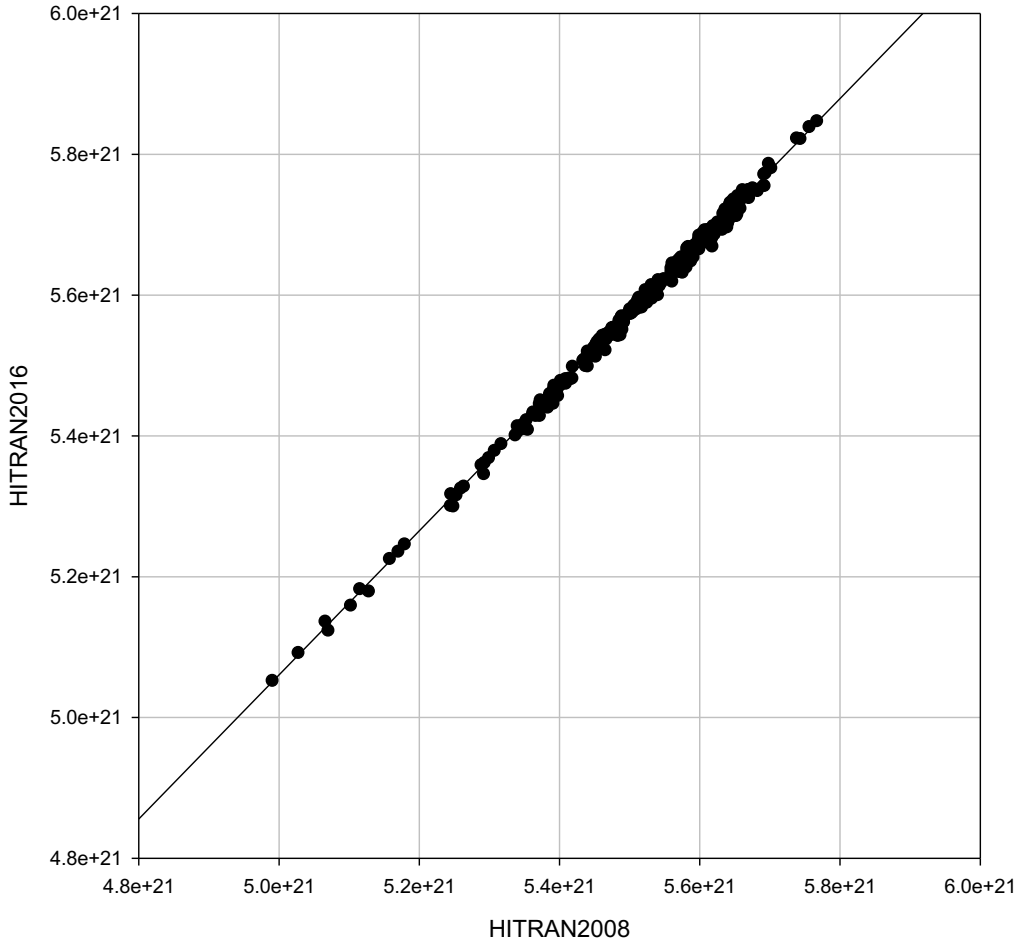
- All Jungfraujoch spectra for 2018
- Compact correlation, ozone interference unchanged

Chlorine nitrate – HITRAN2016 vs HITRAN2008



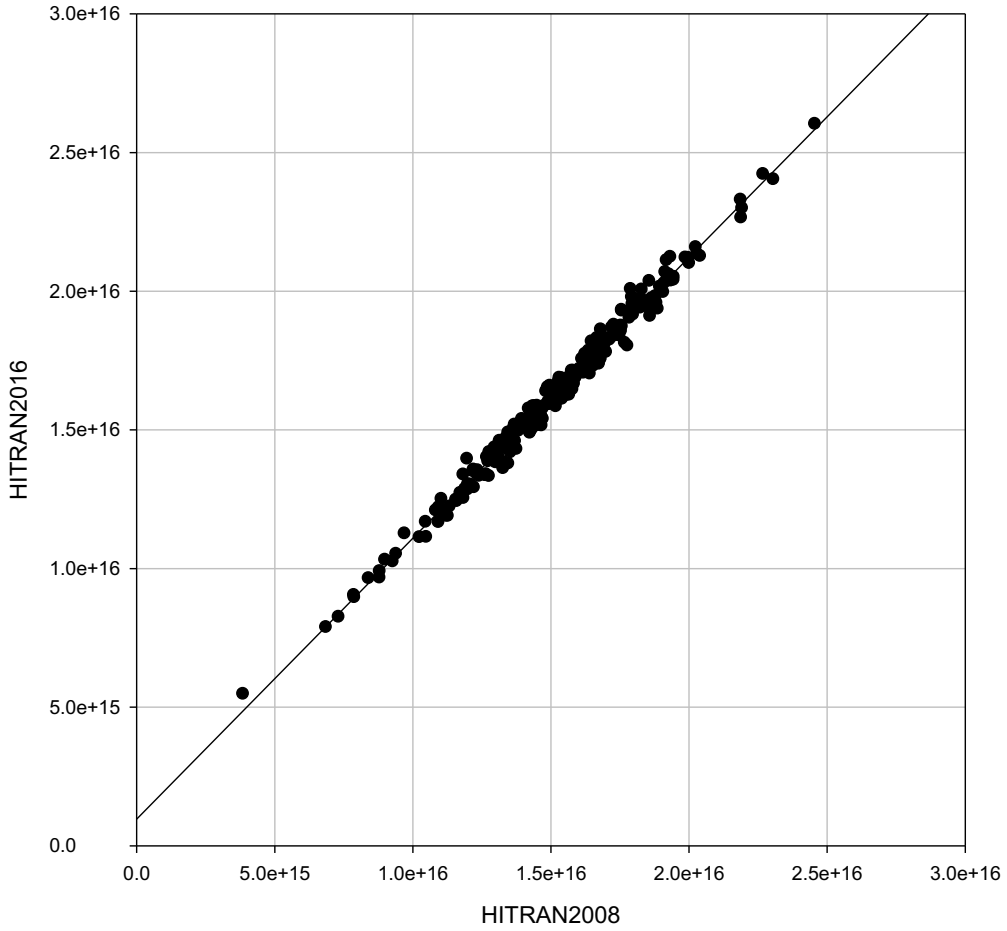
- All Jungfraujoch spectra for 2018
- Compact correlation, water vapor interference unchanged

Chlorine nitrate – HITRAN2016 vs HITRAN2008



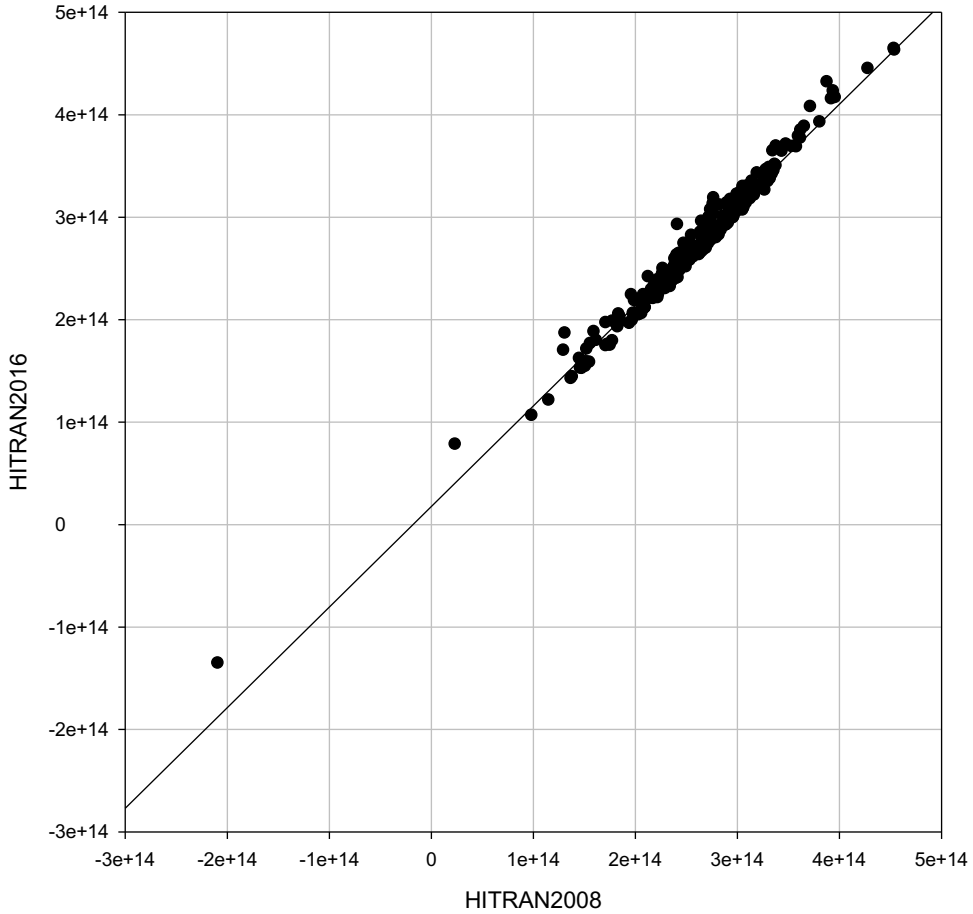
- All Jungfraujoch spectra for 2018
- Compact correlation
- CO2 total columns larger by (1.3±0.1)%

Chlorine nitrate – HITRAN2016 vs HITRAN2008



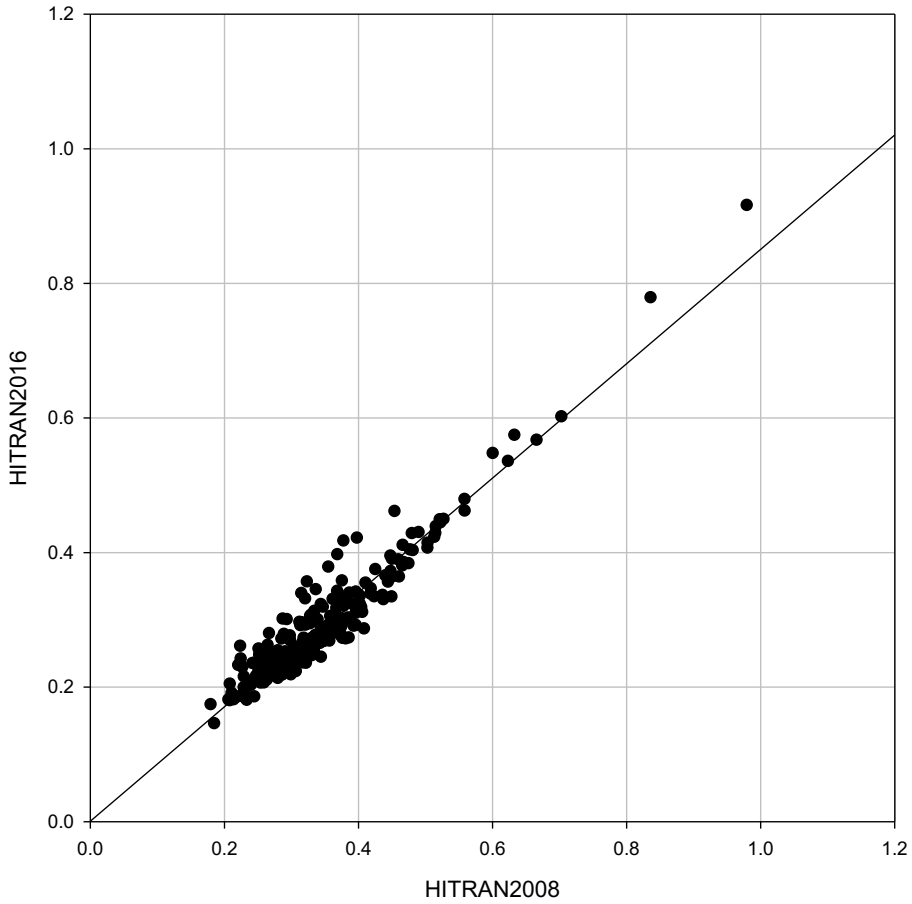
- All Jungfraujoch spectra for 2018
- Compact correlation
- HNO3 total columns larger by (8±3)%

Chlorine nitrate – HITRAN2016 vs HITRAN2008



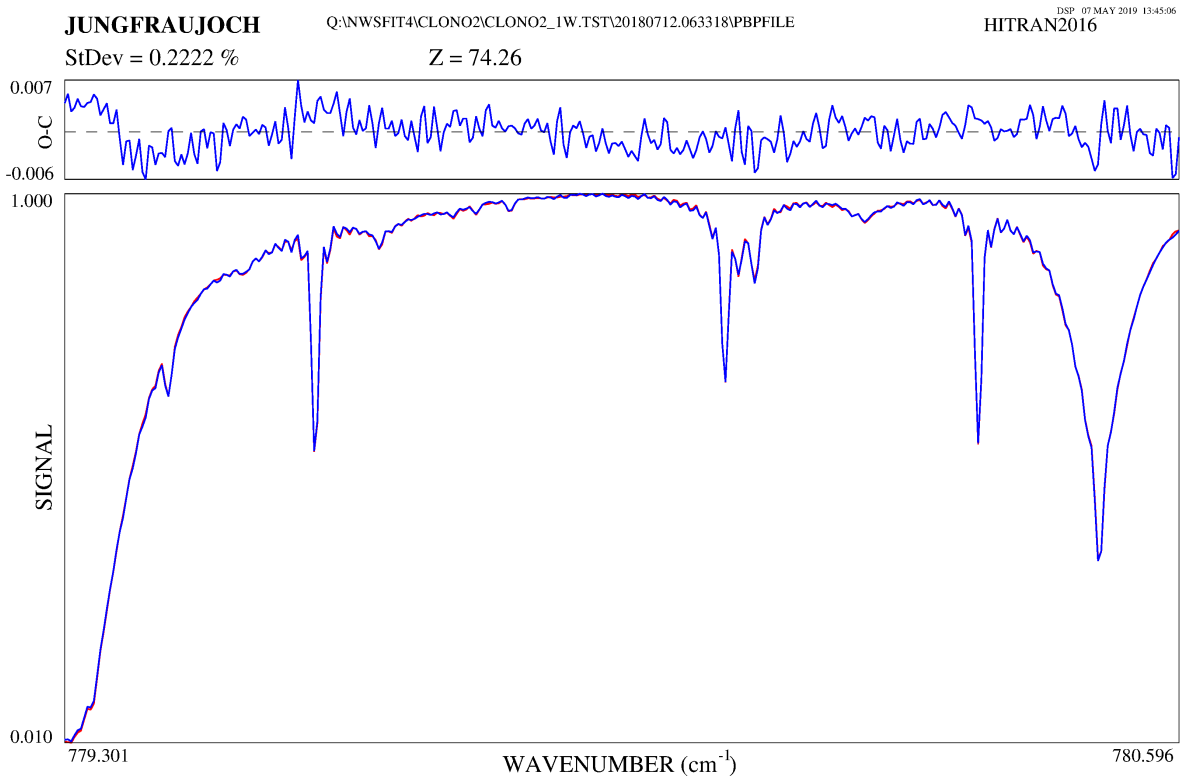
- All Jungfraujoch spectra for 2018
- Compact correlation
- No significant change in the COF2 total columns (6±16)%

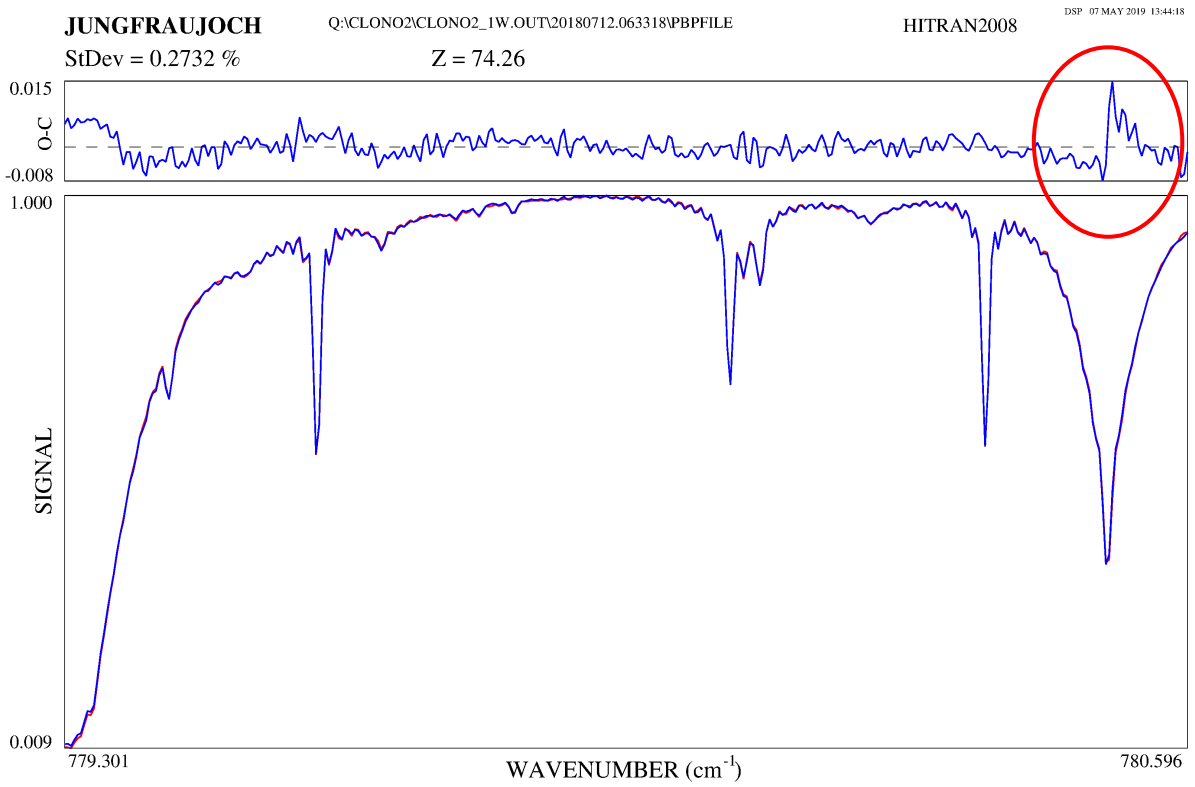
Chlorine nitrate – HITRAN2016 vs HITRAN2008



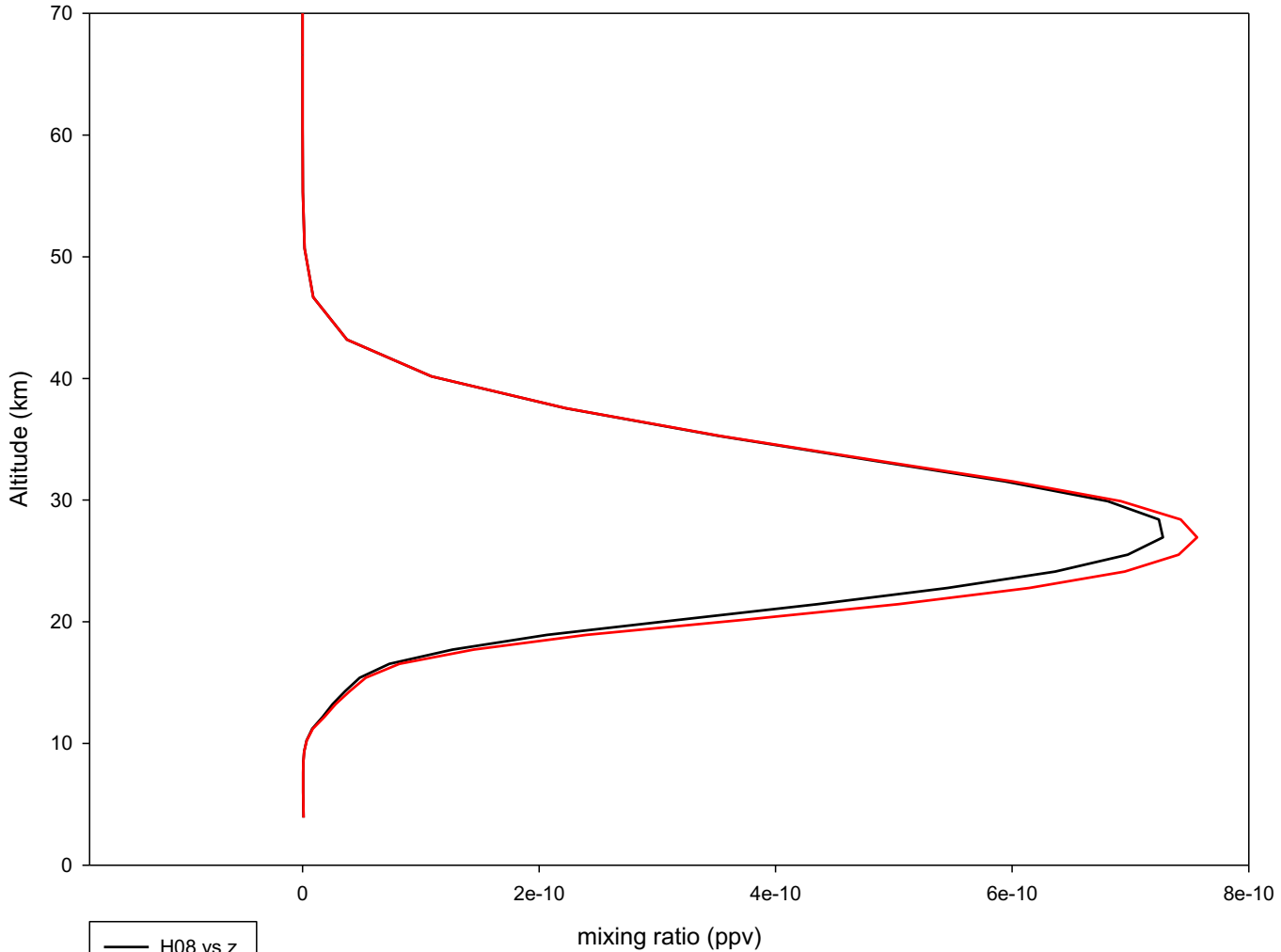
- All Jungfraujoch spectra for 2018
- Improved fitting residuals in most cases (239 of the 256 fits)

Chlorine nitrate – HITRAN2016 vs HITRAN2008





Chlorine nitrate – HITRAN2016 vs HITRAN2008



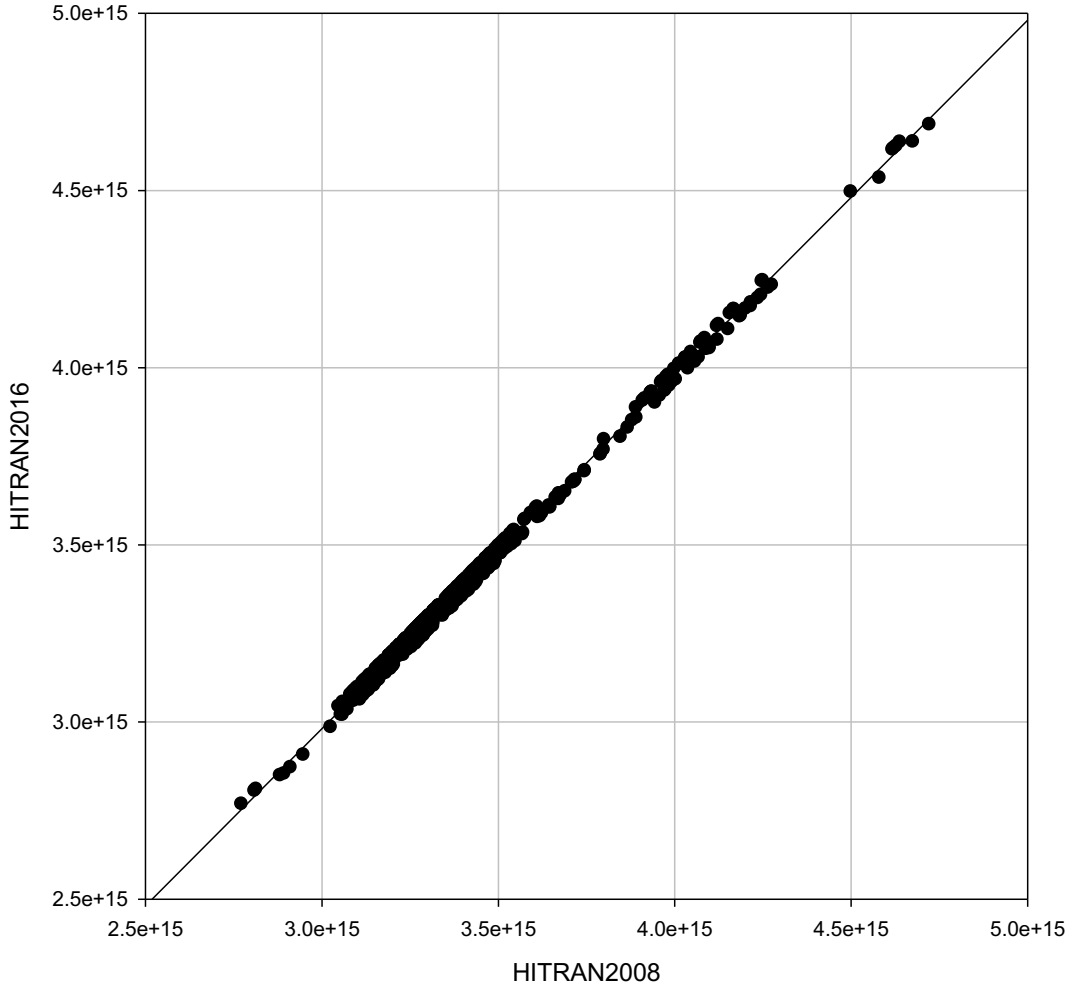
- Mean retrieved profiles

Chlorine nitrate – HITRAN2016 vs HITRAN2008

- HITRAN 2016 provides better fits (CO2 line on the right-hand side), with an impact on the ClONO2 total columns which remains below the mean systematic uncertainty affecting the total columns (11±5)% compared to 15%
- Similar tests have been conducted with ATM.20181101; the conclusions are mostly consistent with the following differences:
  - we note some impact on the H2O total columns (larger by 7±1%)
  - the fitting residuals are improved, but to a smaller extent (195 over 256 sp. i.o. 239/256)
- HITRAN2016 would be the preferred linelist in this case

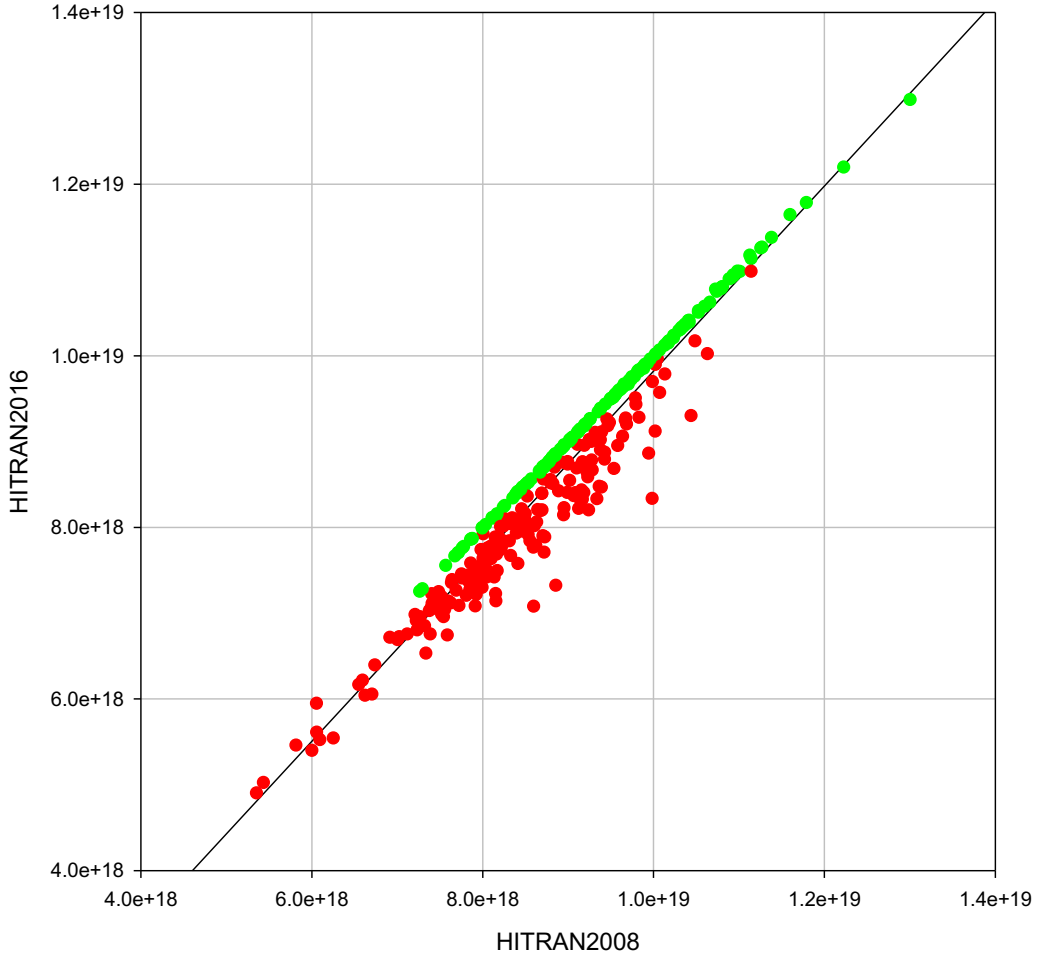
HCl

Hydrogen chloride – HITRAN2016 vs HITRAN2008



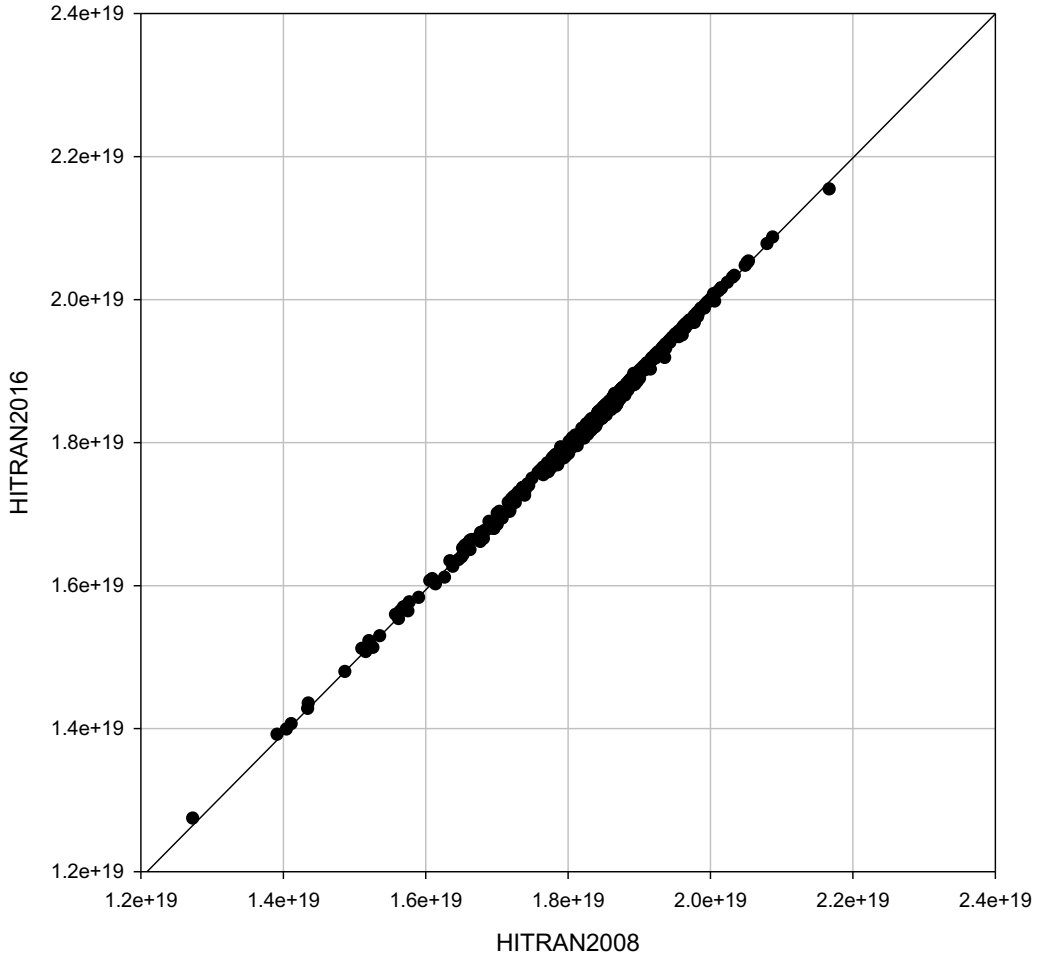
- All Jungfraujoch spectra for 2018
- SFIT-4 v0.9.7.3 or v0.9.4.4
- Compact correlation
- No significant change in the total columns

Hydrogen chloride – HITRAN2016 vs HITRAN2008



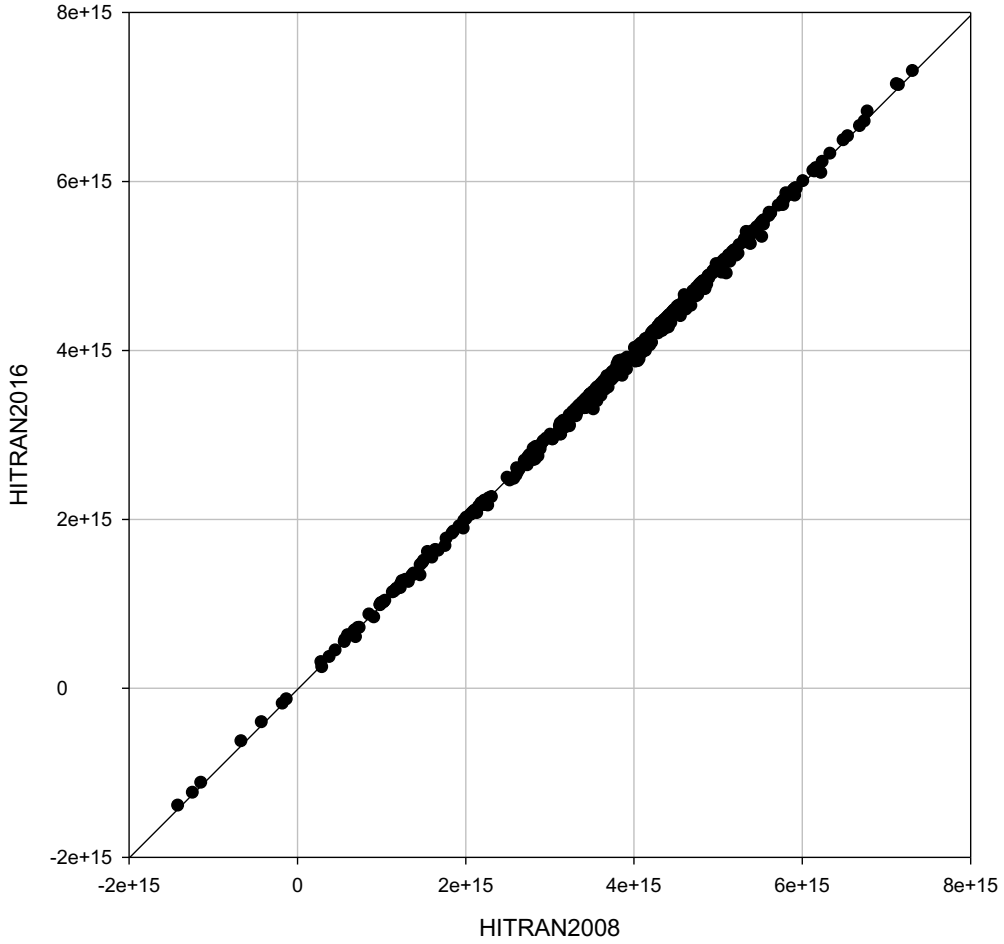
- All Jungfraujoch spectra for 2018
- Correlation quite compact for the ozone interference, esp. for high resolution spectra (OPDmax of 125 cm)

Hydrogen chloride – HITRAN2016 vs HITRAN2008



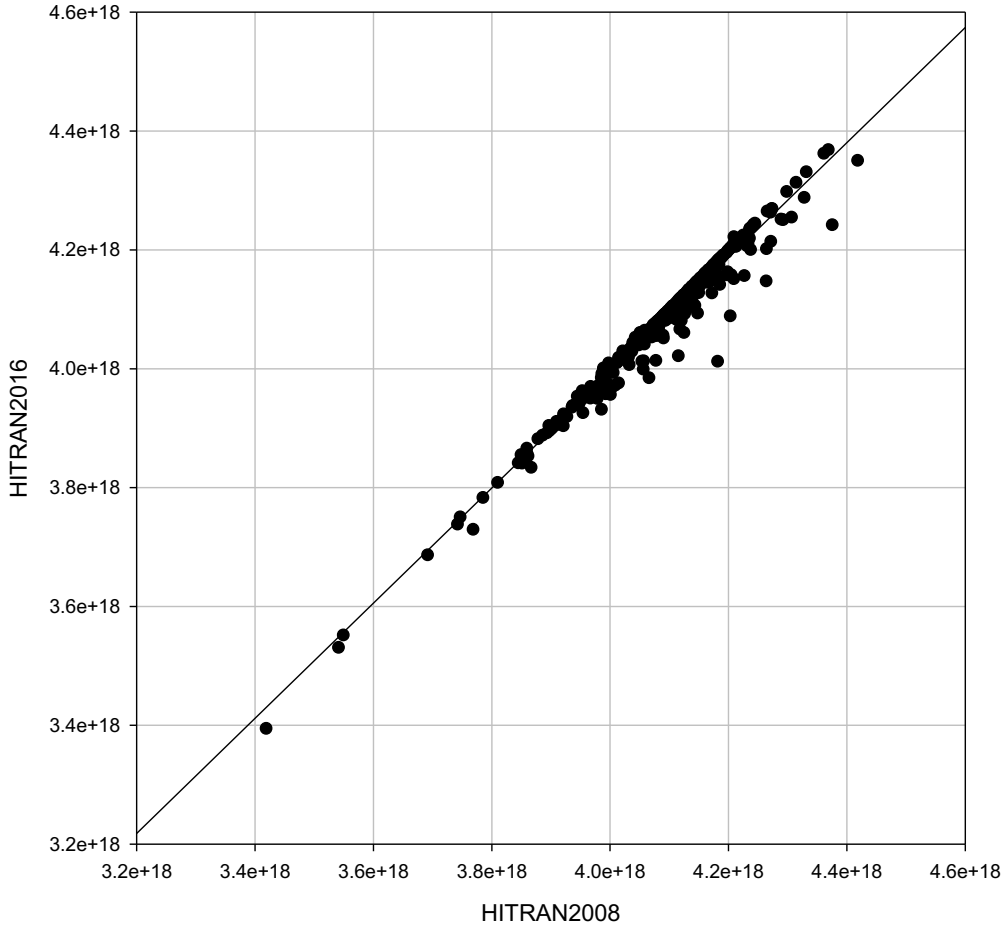
- All Jungfraujoch spectra for 2018
- Compact correlation, methane interference unchanged

Hydrogen chloride – HITRAN2016 vs HITRAN2008



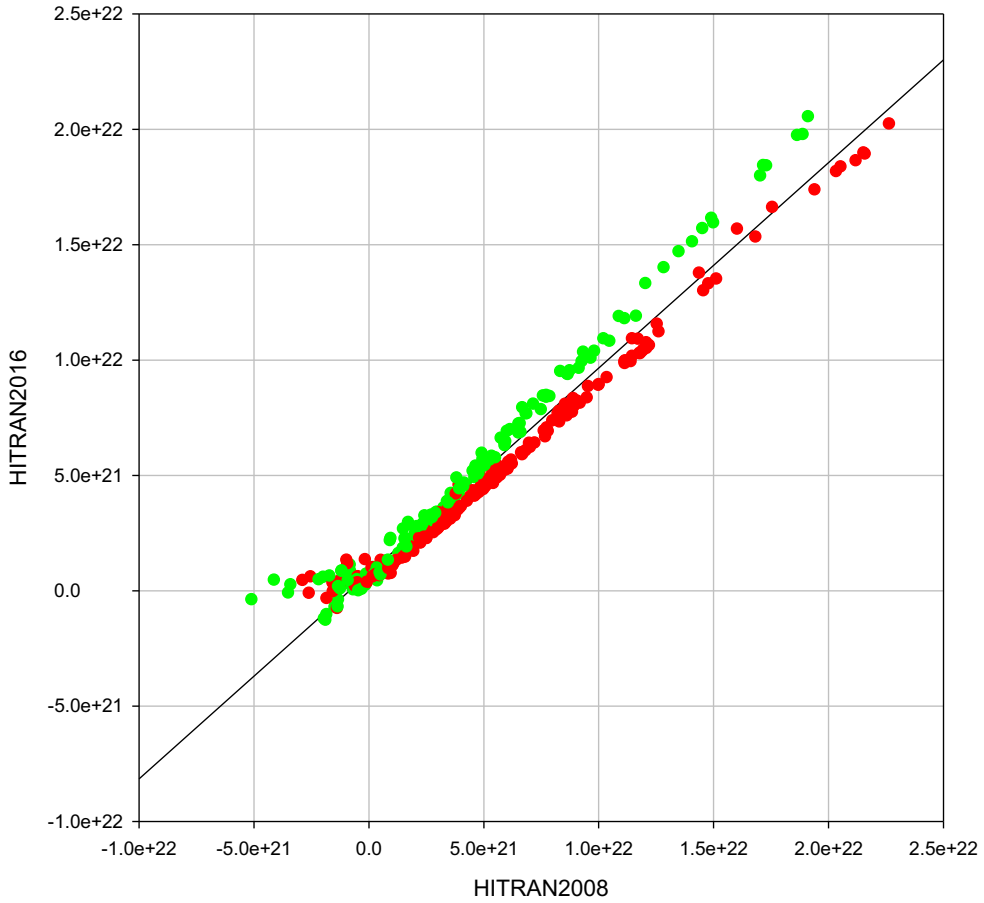
- All Jungfraujoch spectra for 2018
- Compact correlation, nitrogen dioxide interference unchanged

Hydrogen chloride – HITRAN2016 vs HITRAN2008



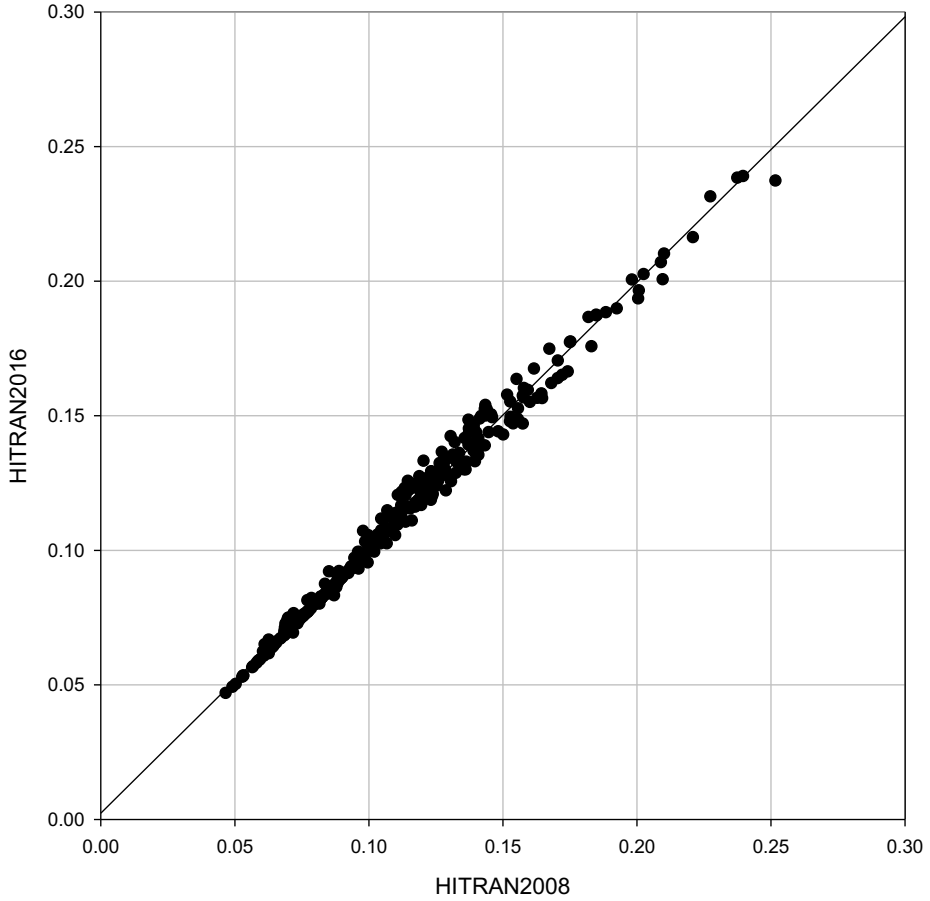
- All Jungfraujoch spectra for 2018
- Compact correlation for nitrous oxide

Hydrogen chloride – HITRAN2016 vs HITRAN2008



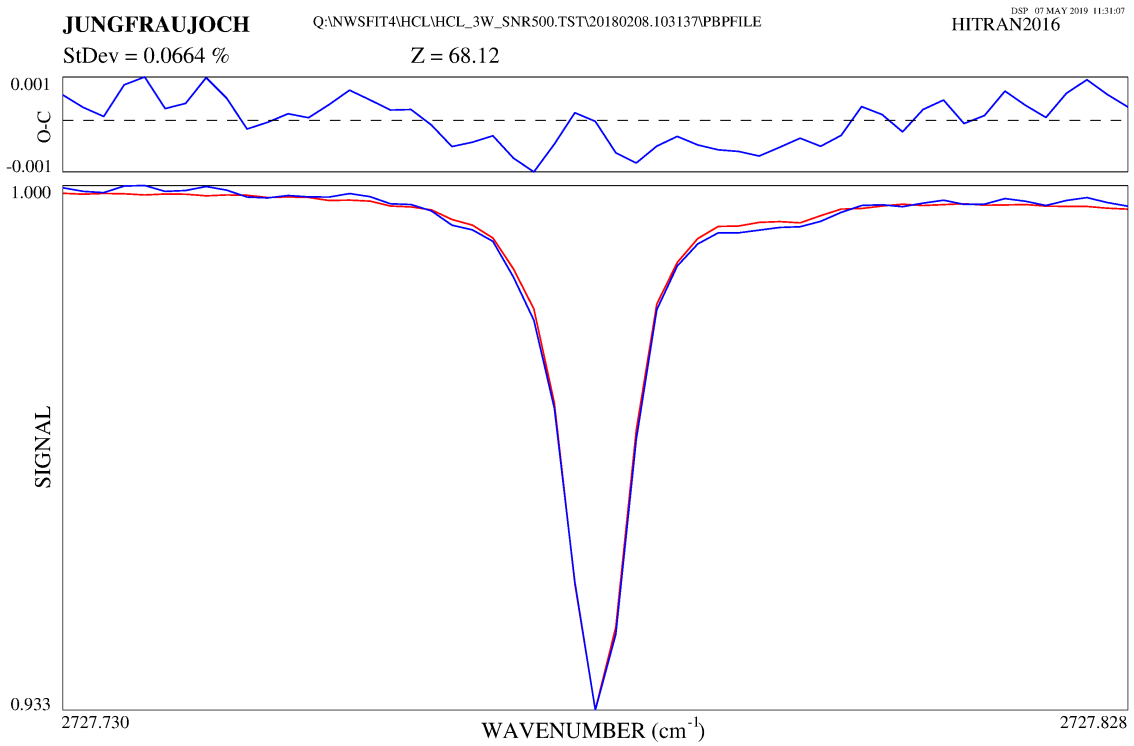
- All Jungfraujoch spectra for 2018
- Compact correlation for HDO, but with two subsets

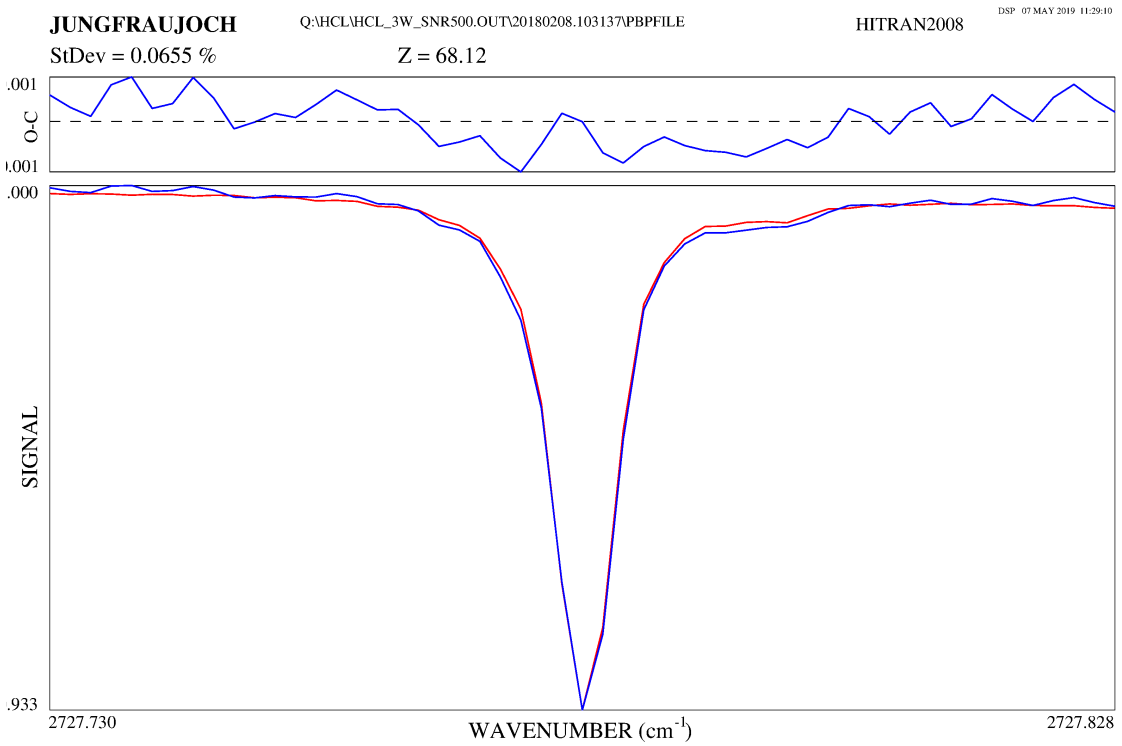
Hydrogen chloride – HITRAN2016 vs HITRAN2008



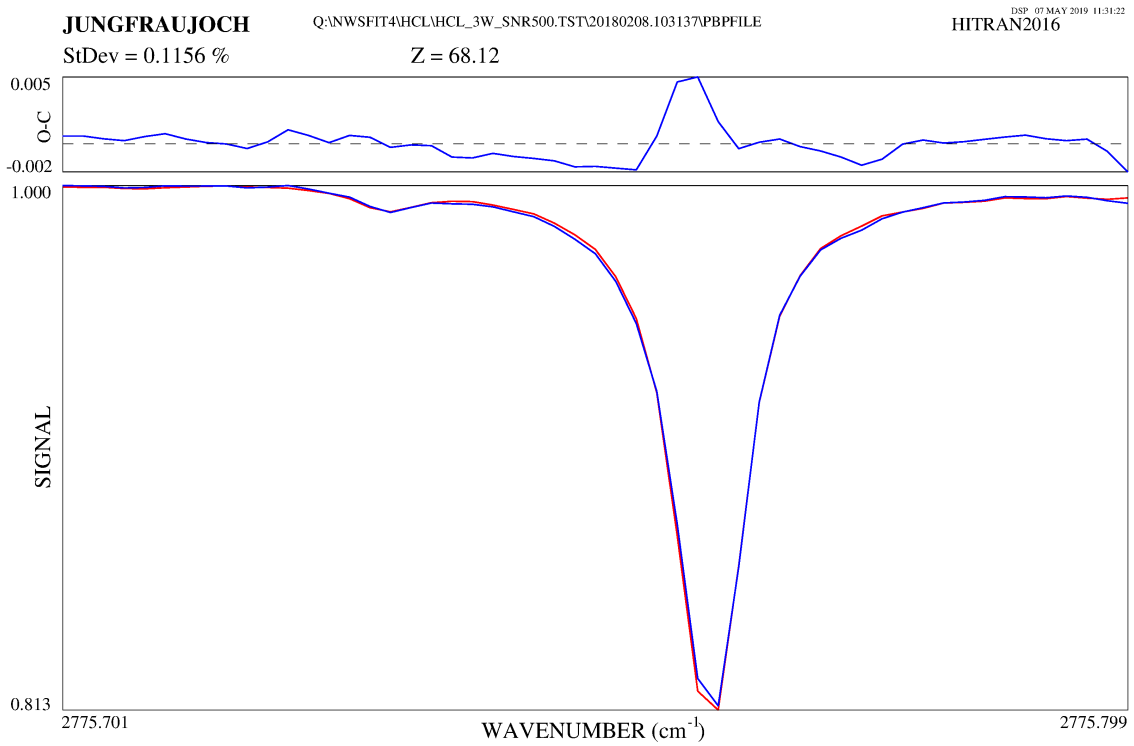
- All Jungfraujoch spectra for 2018
- Fitting residuals mostly unaffected

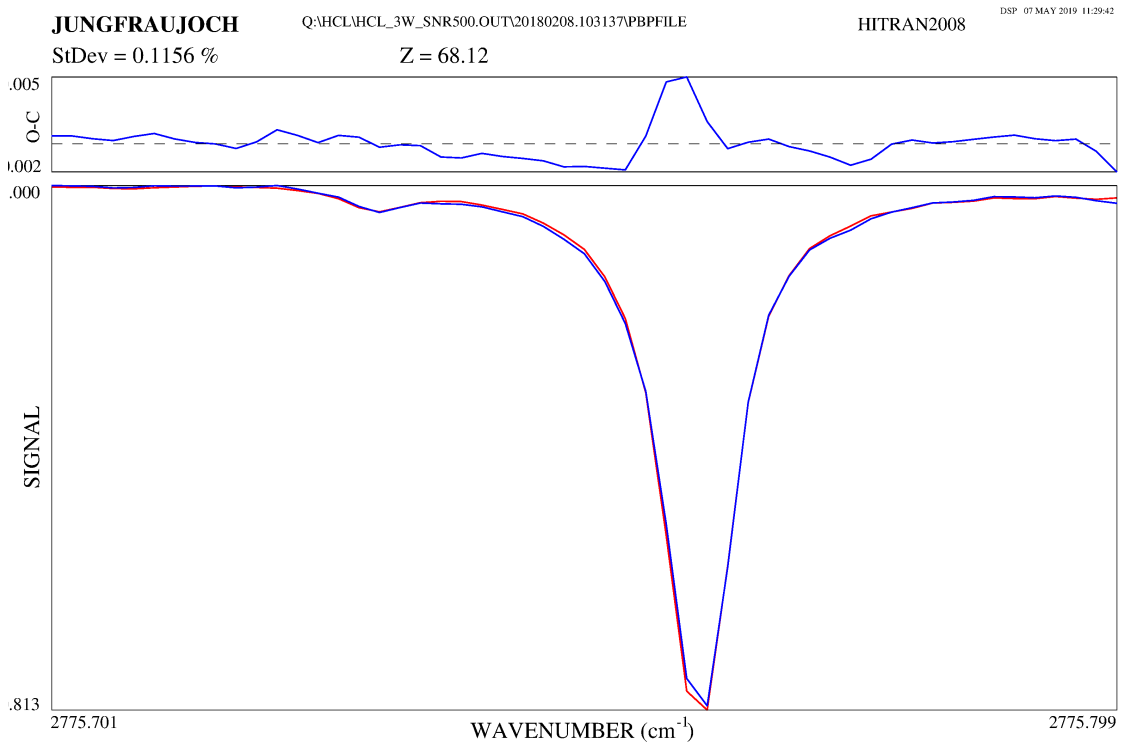
Hydrogen chloride – HITRAN2016 vs HITRAN2008



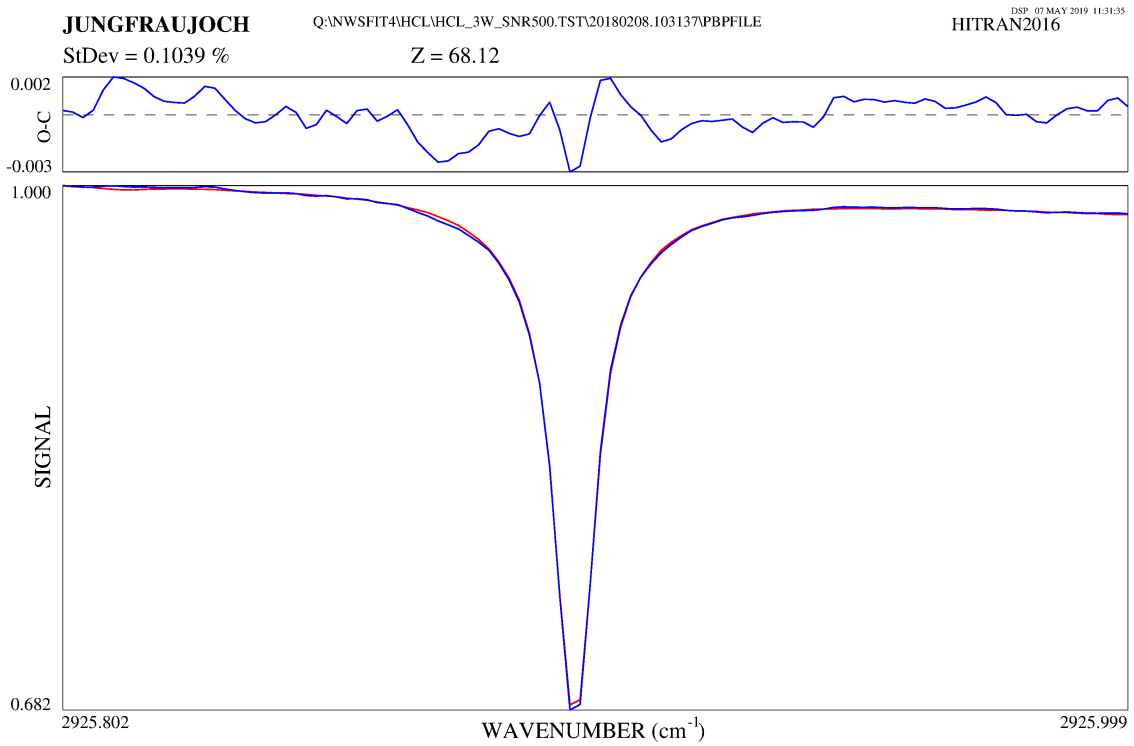


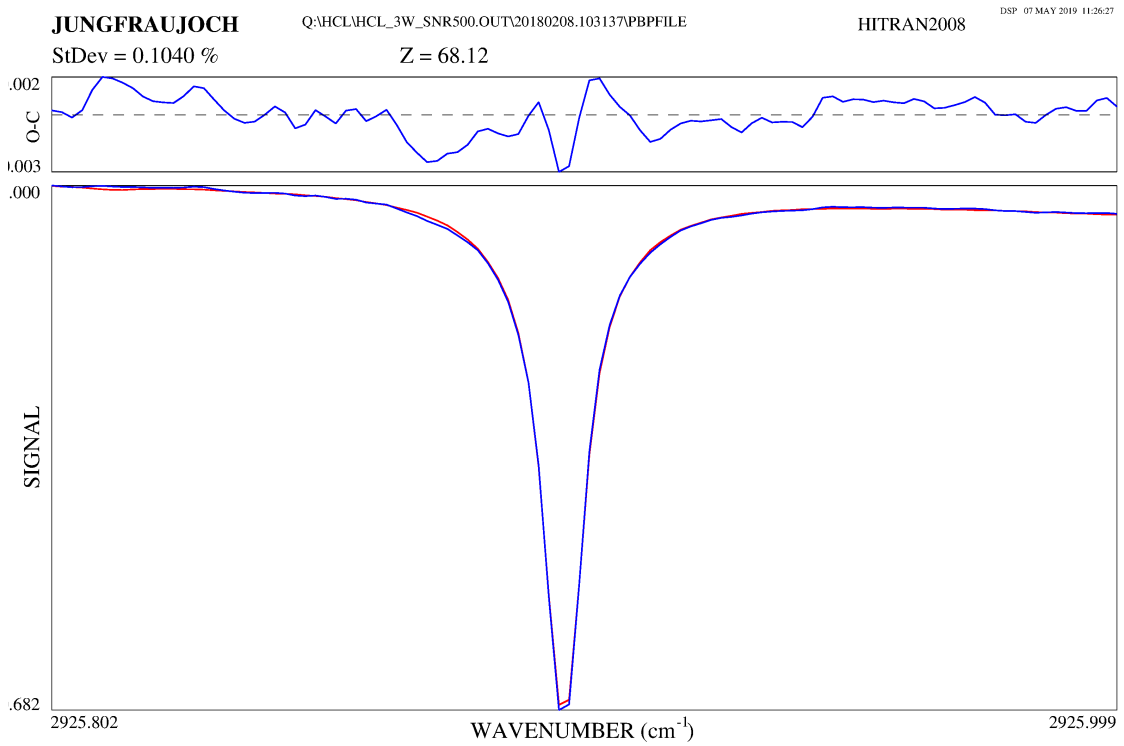
Hydrogen chloride – HITRAN2016 vs HITRAN2008



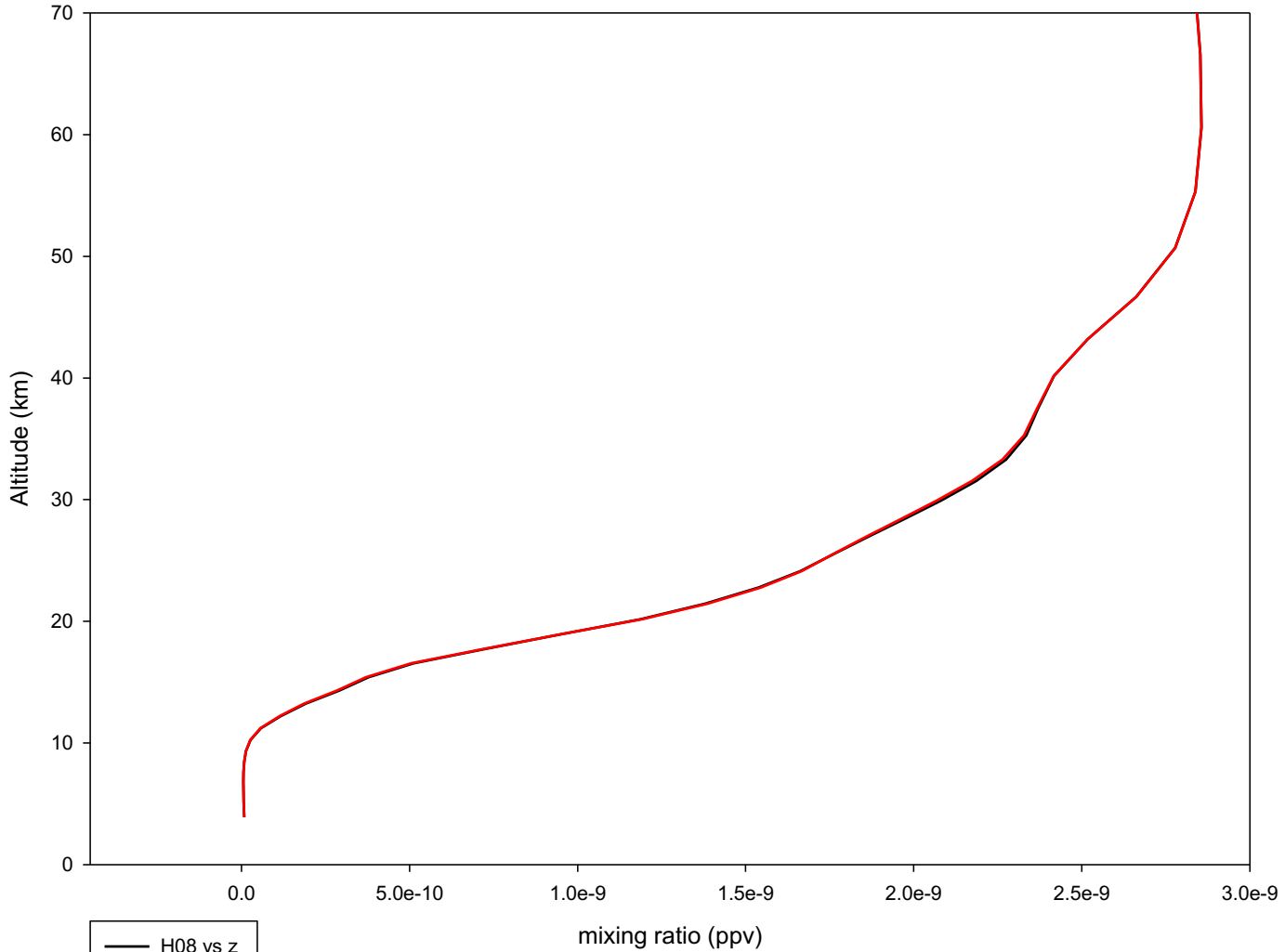


Hydrogen chloride – HITRAN2016 vs HITRAN2008





Hydrogen chloride – HITRAN2016 vs HITRAN2008



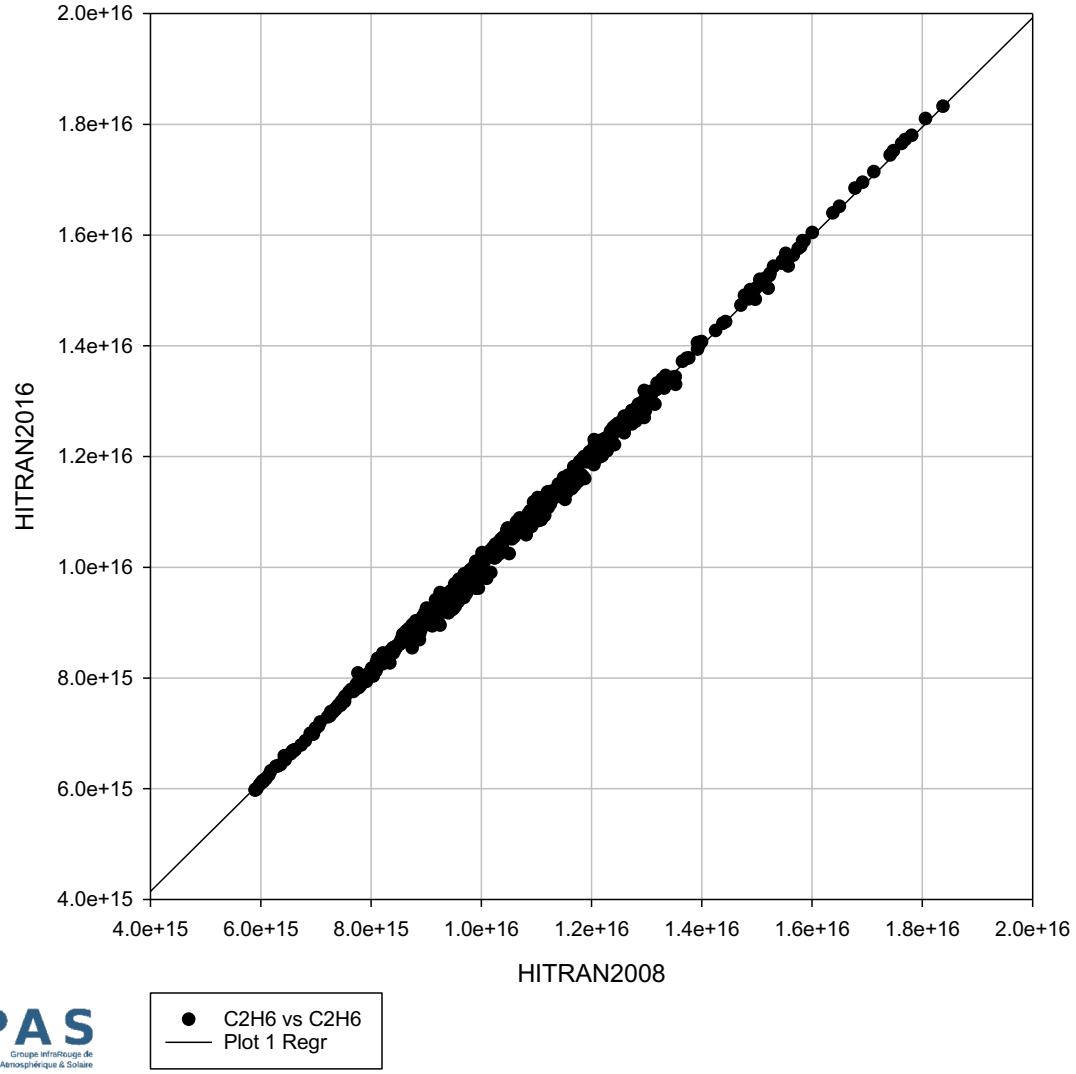
- Mean retrieved profiles
- No impact on the retrieved vertical distributions

Hydrogen chloride – HITRAN2016 vs HITRAN2008

- HITRAN 2016 provides similar results and quality of fits
- Information content is unchanged
- Similar tests have been conducted with ATM.20181101; again, we don’t see a significant impact on the HCl columns or on the fitting quality
- Changing the linelist will have no effect for the retrievals of HCl above Jungfraujoch

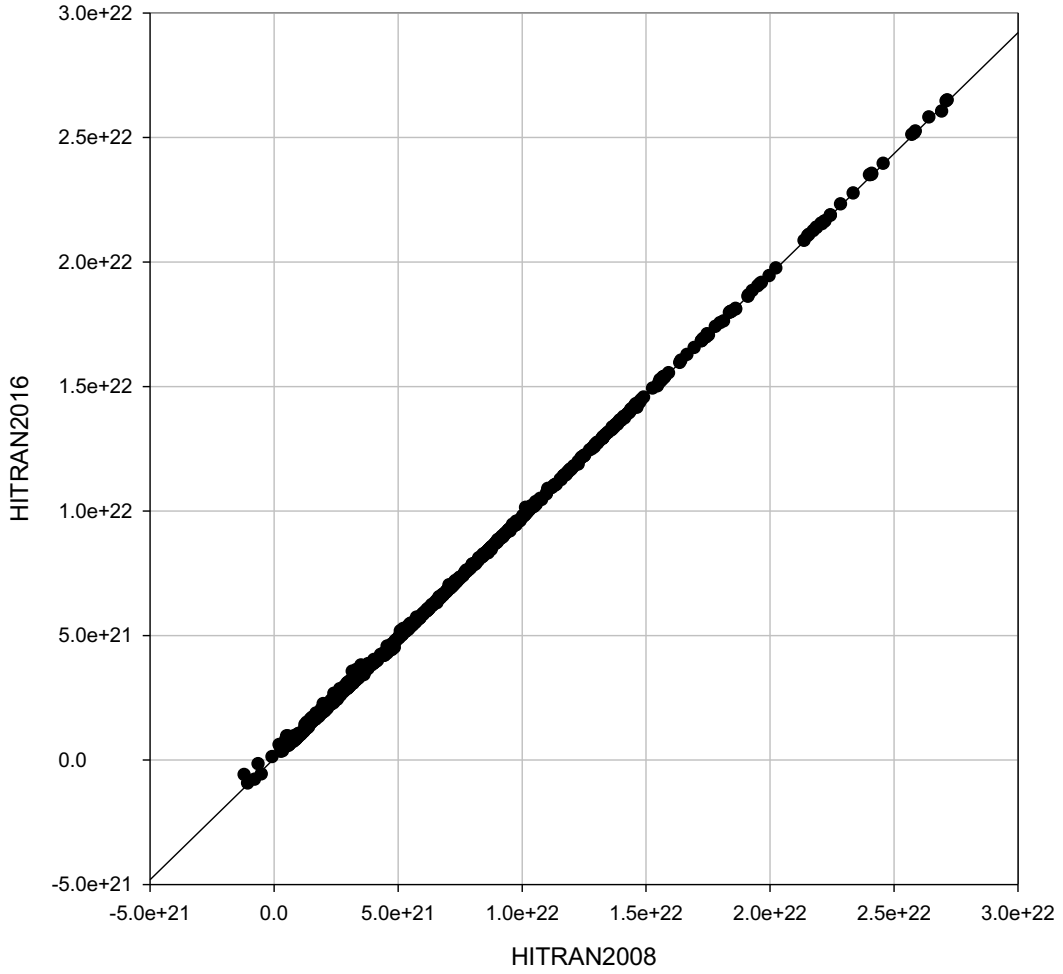
C2H6

Ethane – HITRAN2016 vs HITRAN2008+



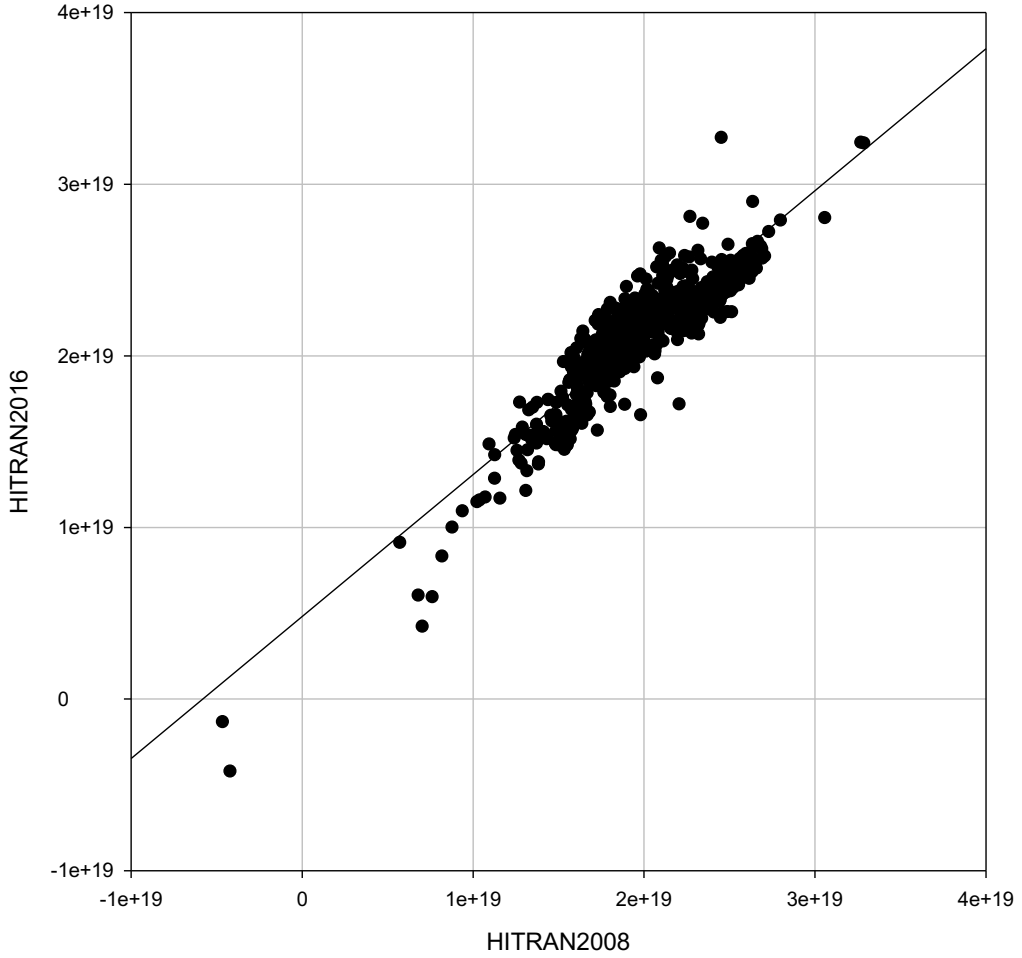
- All Jungfraujoch spectra for 2018
- Here we compared HITRAN2008+ (Franco et al., JQSRT, 2015), meaning that some improved line parameters are considered for O3 and CH3Cl
- C2H6 PLLs used in all cases!
- SFIT-4 v0.9.7.3 or v0.9.4.4
- Compact correlation
- No significant change in the total columns of ethane

Ethane – HITRAN2016 vs HITRAN2008+



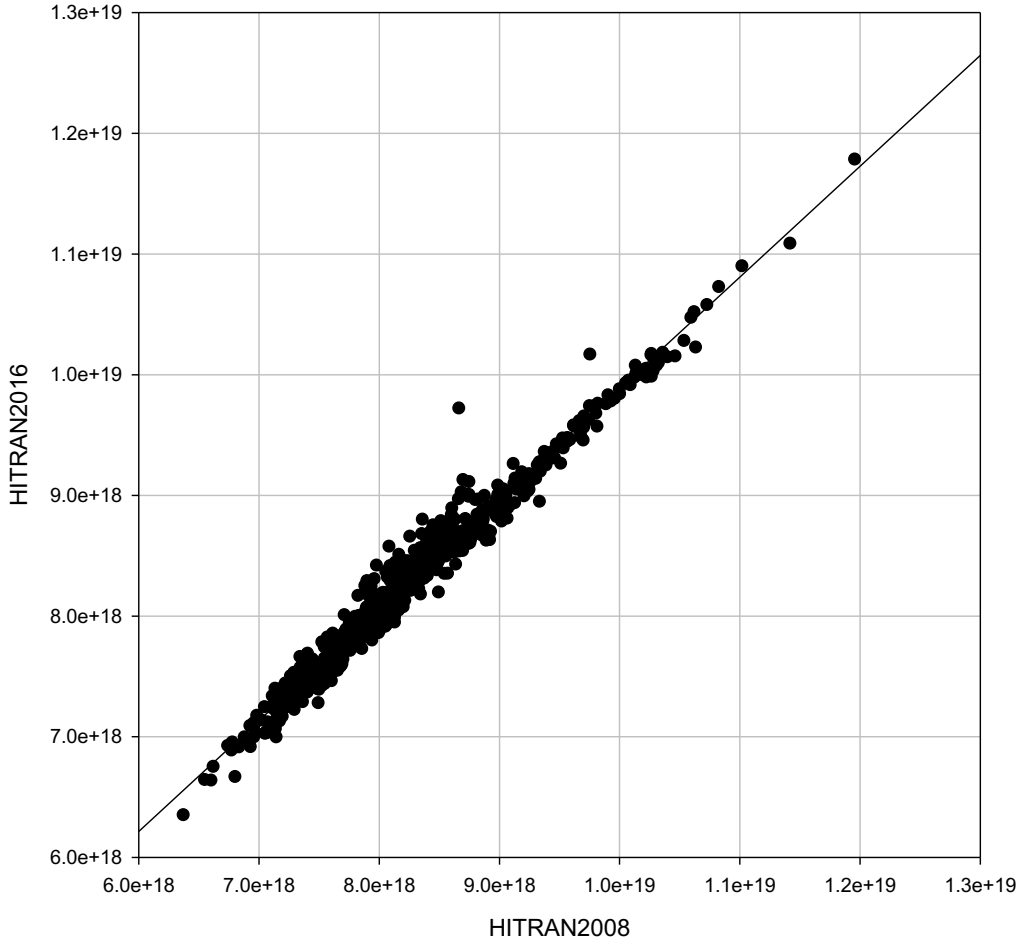
- All Jungfraujoch spectra for 2018
- Compact correlation for H2O
- No significant change in the total columns of the main interference for the C2H6 retrievals

Ethane – HITRAN2016 vs HITRAN2008+



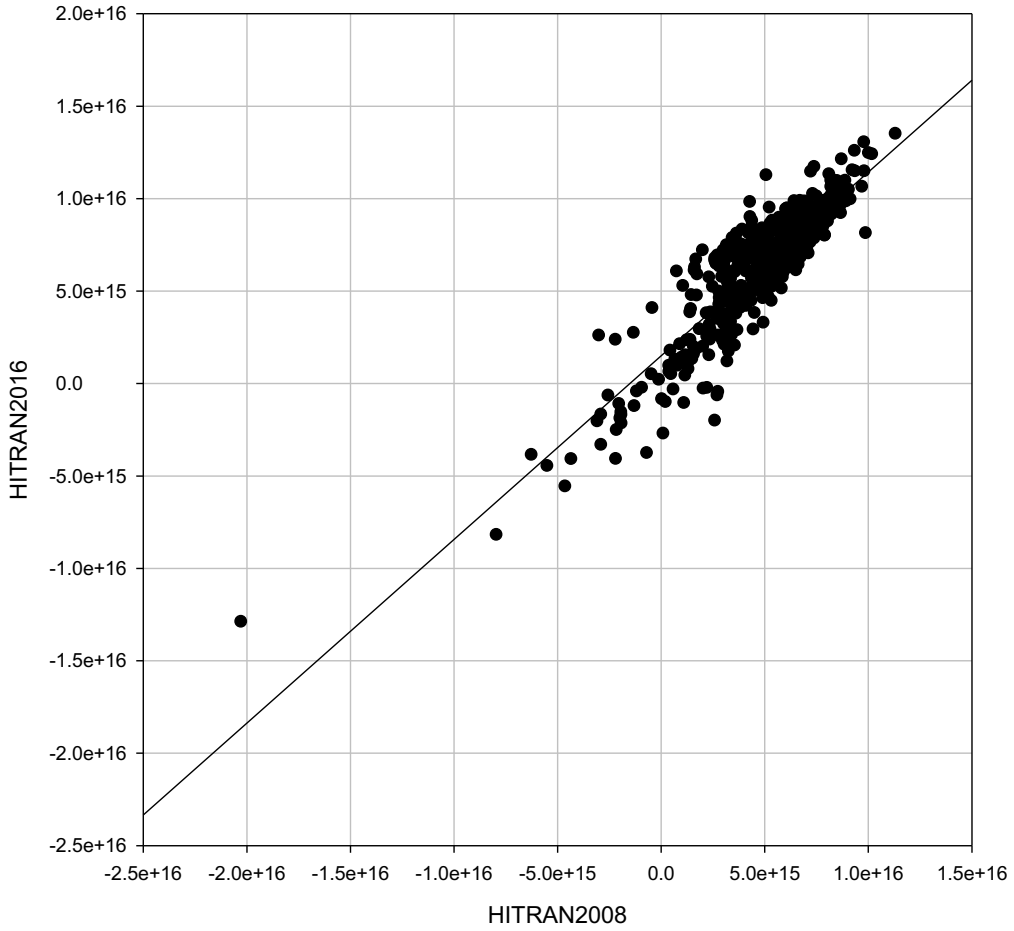
- All Jungfraujoch spectra for 2018
- Good correlation for the methane interference (r=0.90)

Ethane – HITRAN2016 vs HITRAN2008+



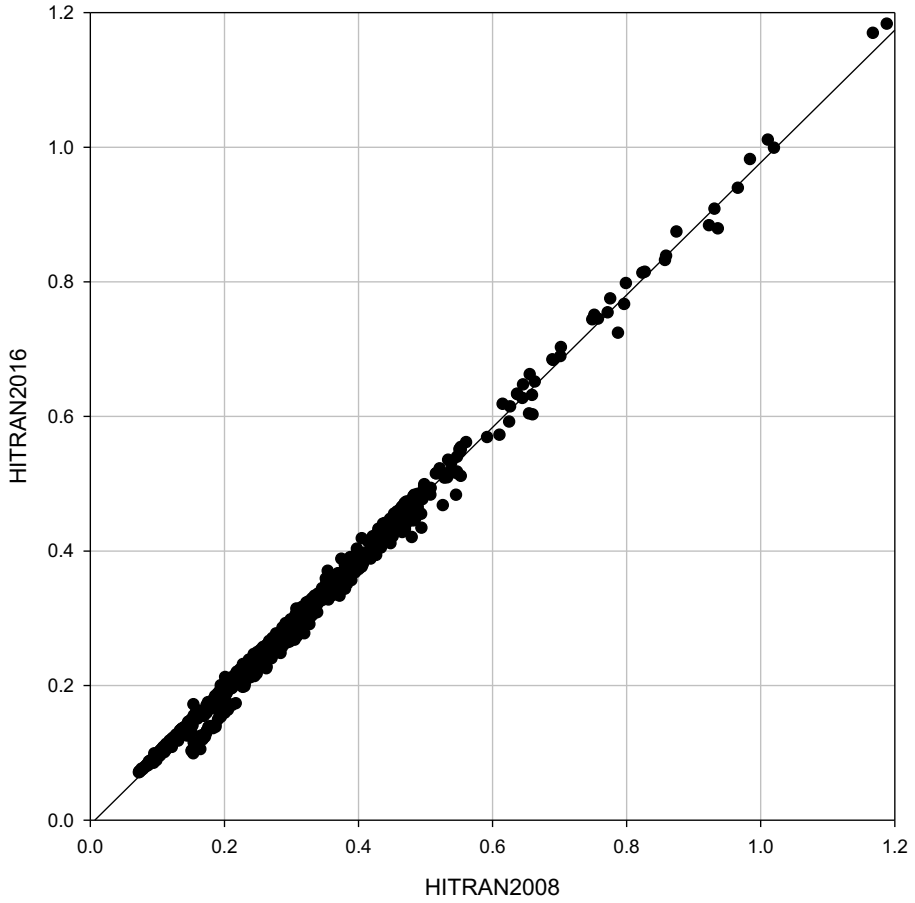
- All Jungfraujoch spectra for 2018
- Compact correlation for the ozone interference

Ethane – HITRAN2016 vs HITRAN2008+



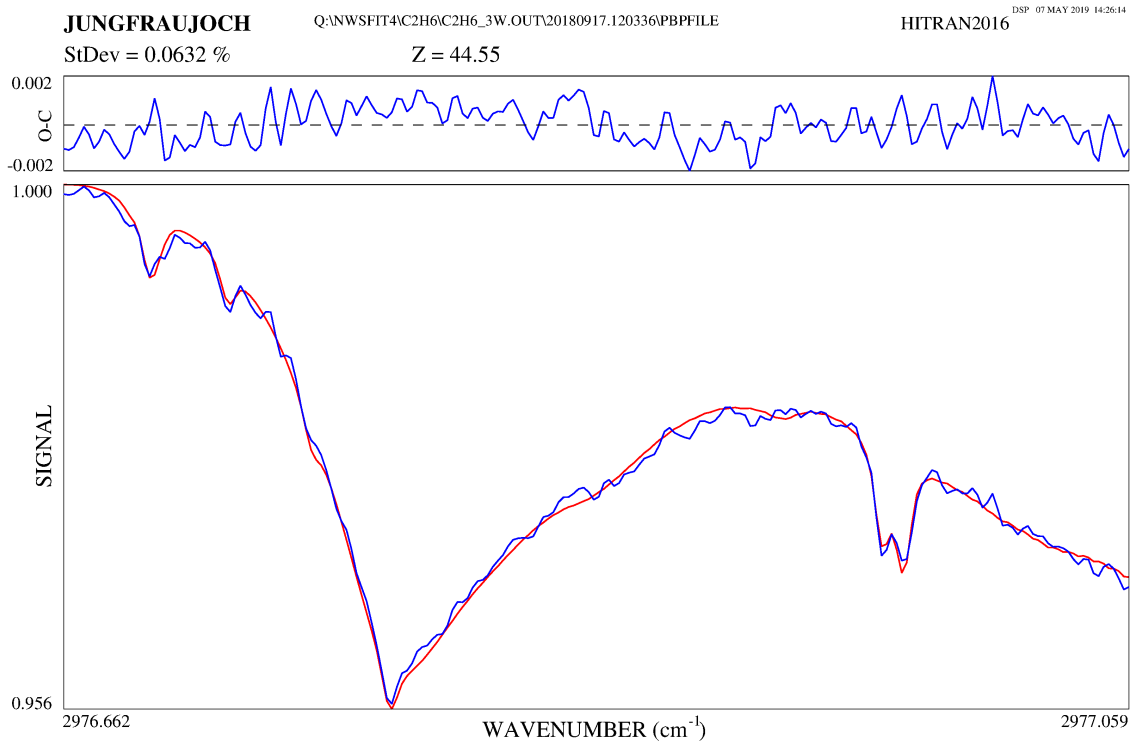
- All Jungfraujoch spectra for 2018
- Good correlation for the methyl chloride interference

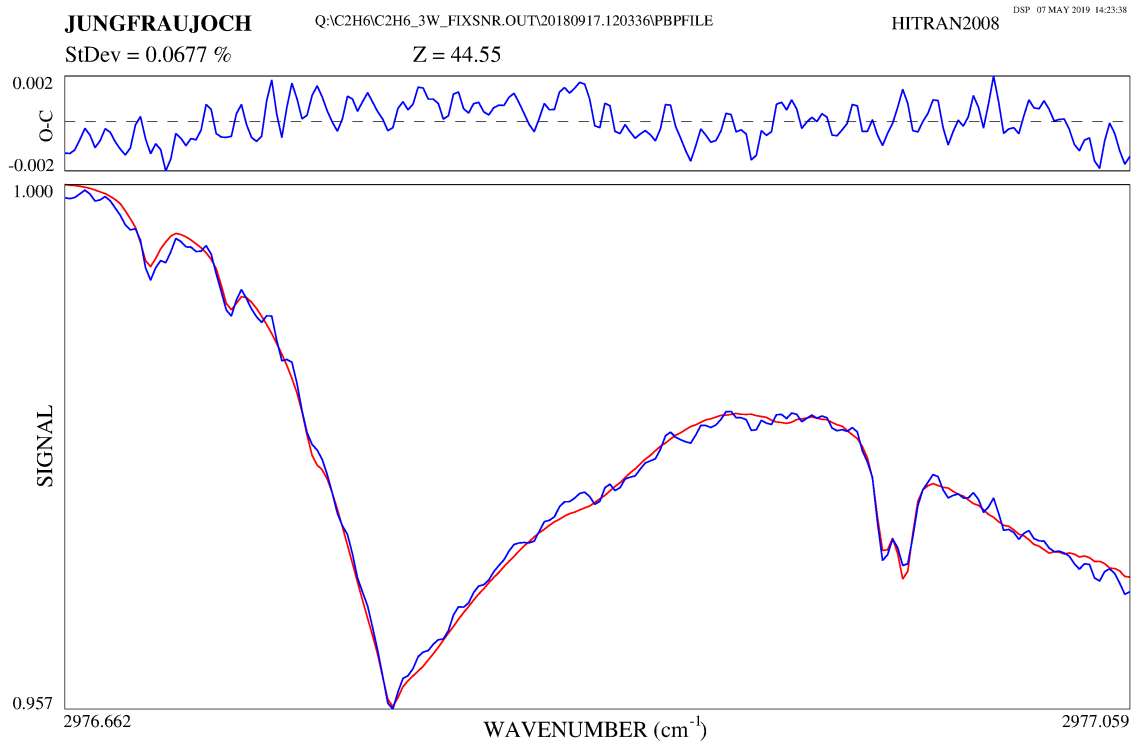
Ethane – HITRAN2016 vs HITRAN2008+



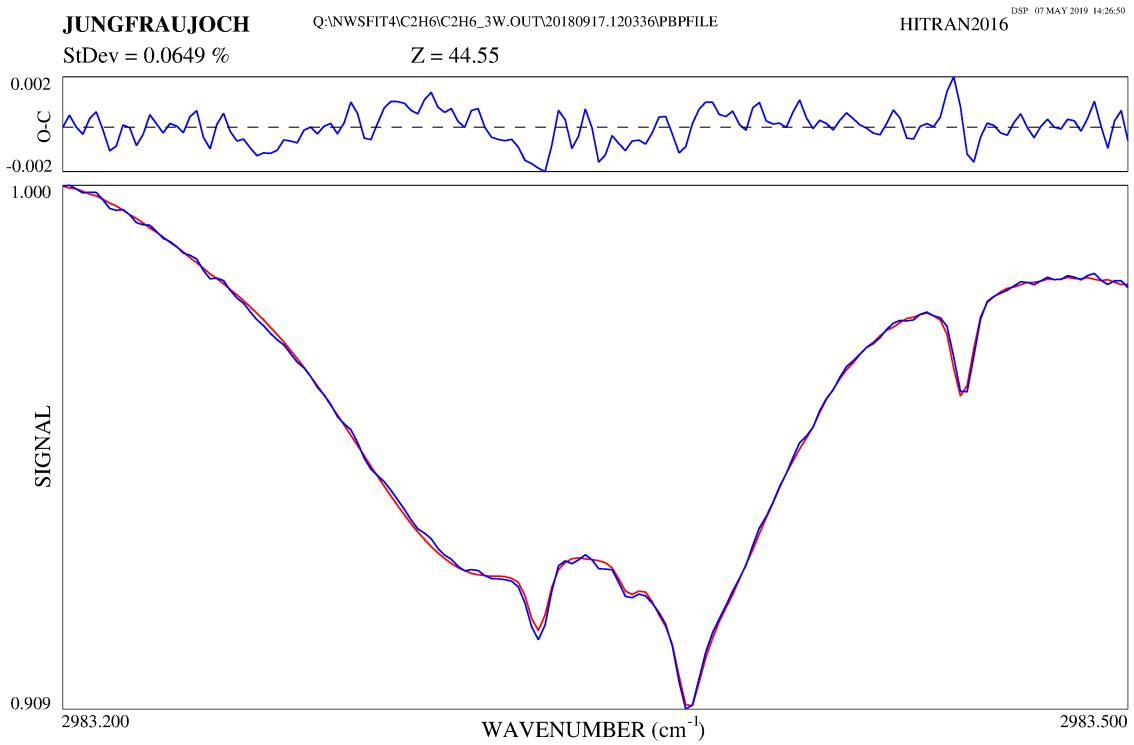
- All Jungfraujoch spectra for 2018
- Fitting residuals mostly unaffected

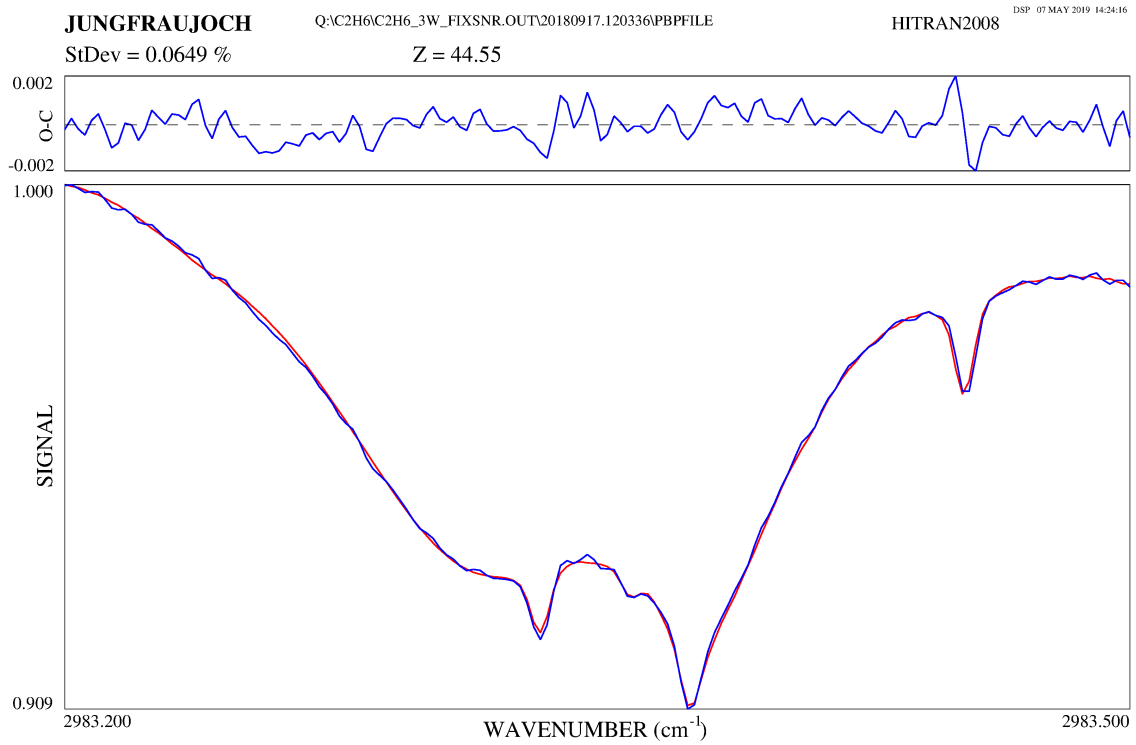
Ethane – HITRAN2016 vs HITRAN2008+



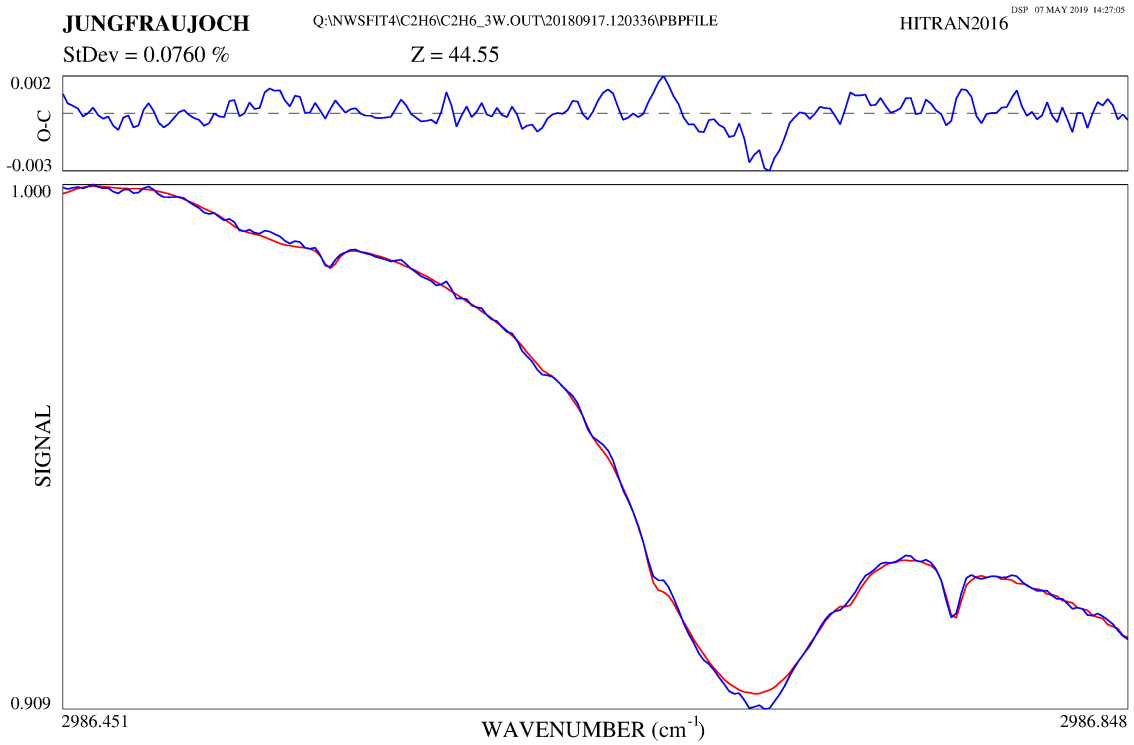


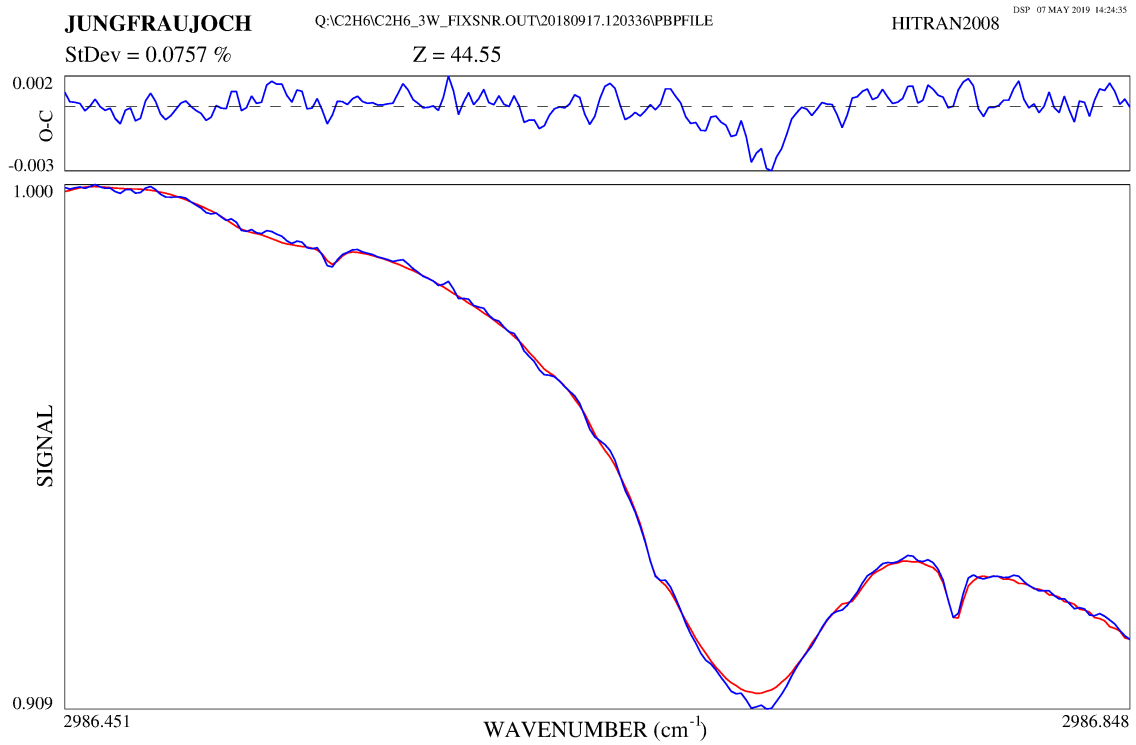
Ethane – HITRAN2016 vs HITRAN2008+



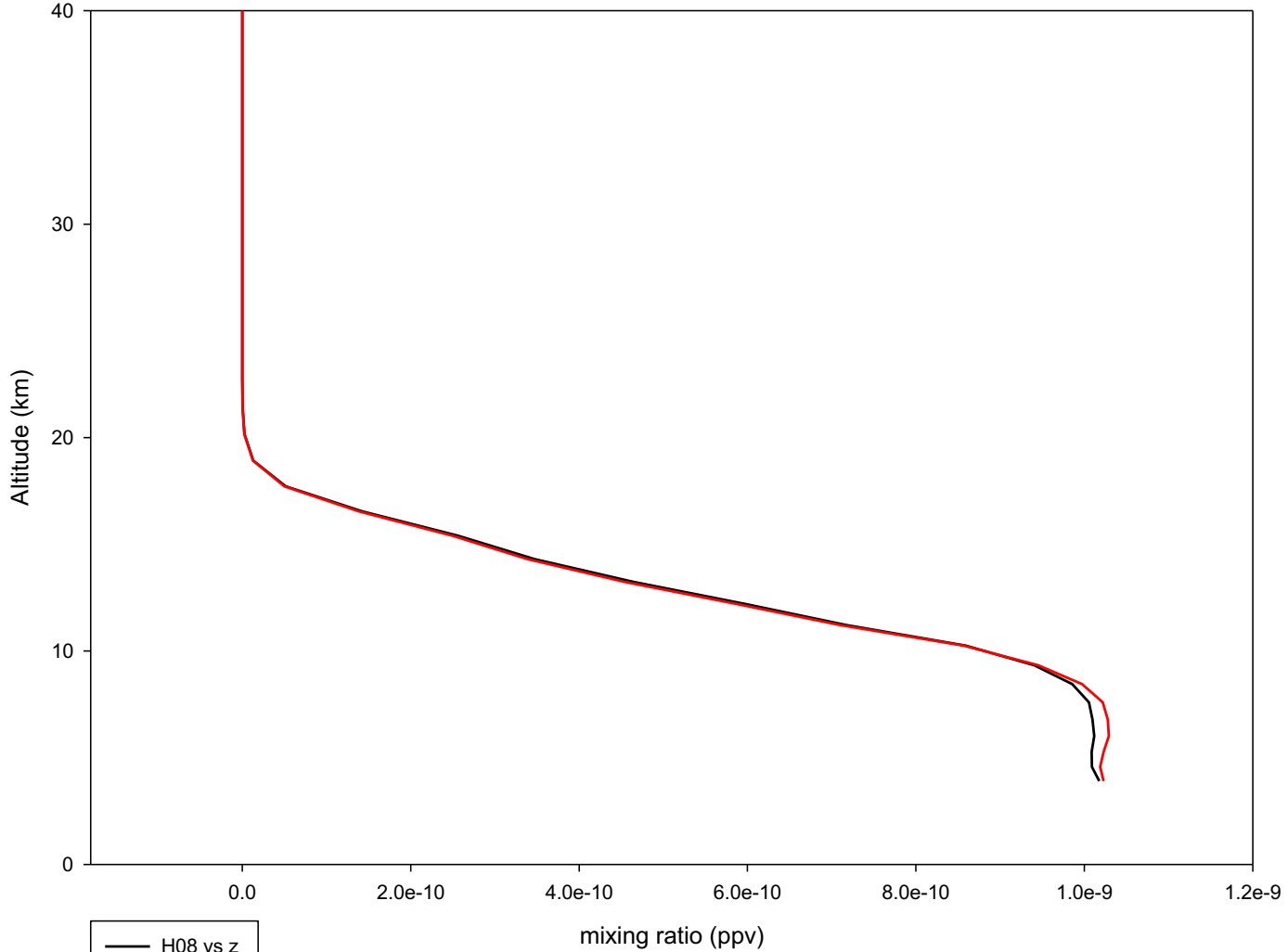


Ethane – HITRAN2016 vs HITRAN2008+





Ethane – HITRAN2016 vs HITRAN2008+



- Mean retrieved profiles

Ethane – HITRAN2016 vs HITRAN2008+

- HITRAN 2016 provides similar results and quality of fits when compared to HITRAN2008+
- Similar tests have been conducted with ATM.20181101; again, we don’t see a significant impact on the ethane total columns or on the fitting quality
- Changing the linelist(s) will have no effect for the retrievals of C2H6 above Jungfraujoch, but the use of a unified set of line parameters will ease the investigations, minimizing the risk of errors (no need for merging various sources of information for the spectroscopy)