

SMILES-2 観測精度の検討

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1. SMILES-2 ミッション概要
2. **SMILES-2 観測精度の検討**
3. SMILES-2 機器検討状況
4. アンテナ開発状況
5. SMILES-2 の科学目標詳細

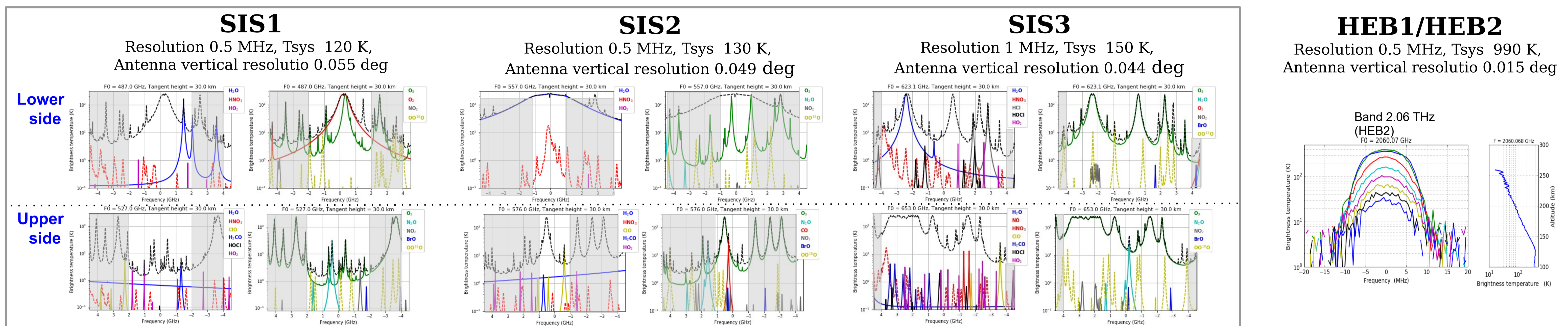
Abstract

SMILES-2 is proposition of a submillimeter/THz limb sounder for observing the whole atmosphere above the tropopause. It will provide global measurements with high-sensitivity of temperature, wind and molecules. In particular the diurnal variations of the atmosphere will be measured, the measurement of horizontal-winds will close the altitude gap 30–70 km in the current observation system, and those of the atomic oxygen will be the first ones of its ground-state.

This poster goes with 4 other ones for describing the mission. It focuses on a sensitivity study to assess the measurement performances.

Spectral bands

Ochiai et al., SOLA, 2017, doi.org/10.2151/sola.13A-003. The antenna diameter is 0.75 m.



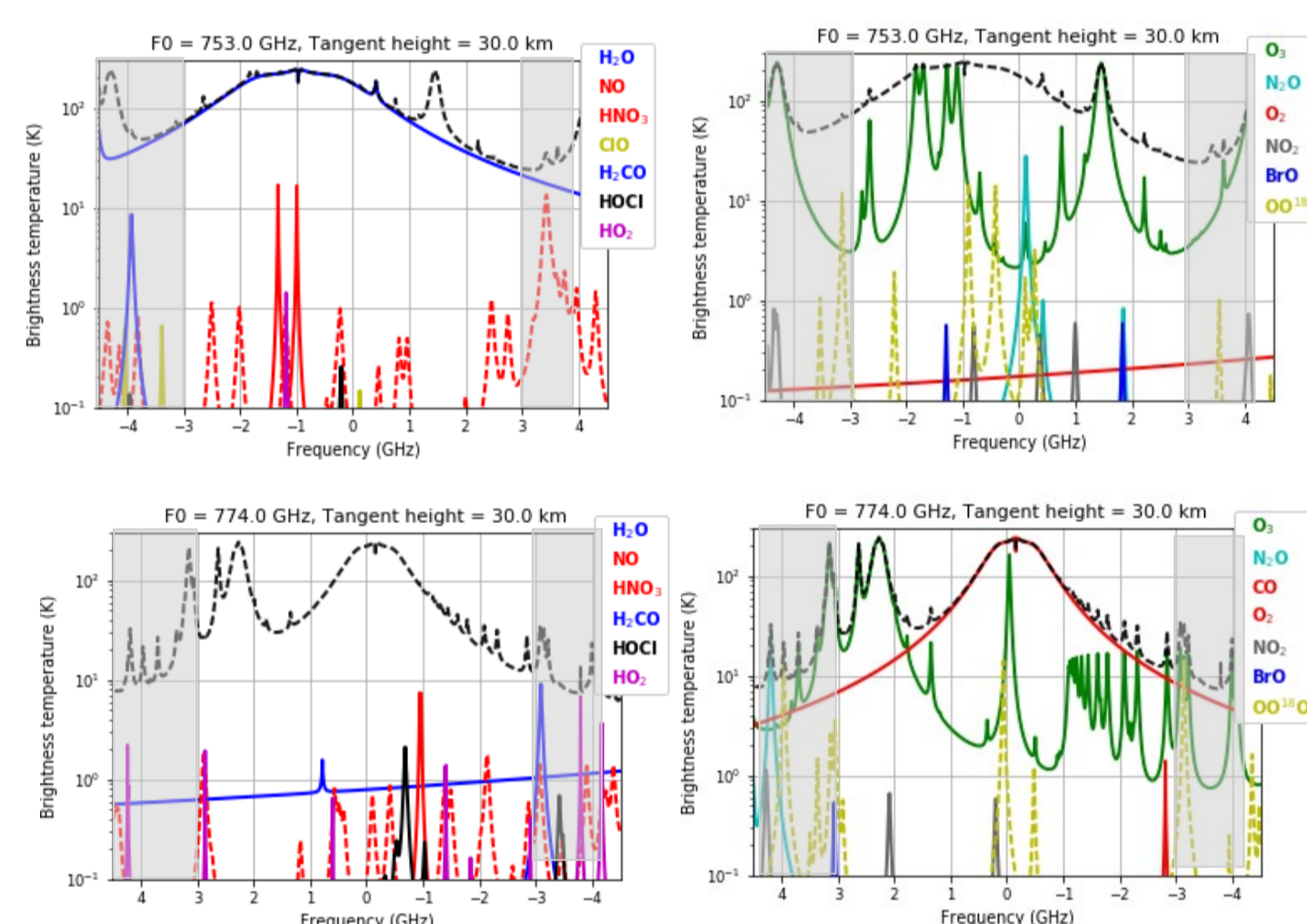
An alternative setting compared to Ochiai et al. (2017):

SISa: single band at 760 GHz instead of SIS1 and SIS2.

SISb: SIS3 with 2 MHz resolution instead of 1 MHz.

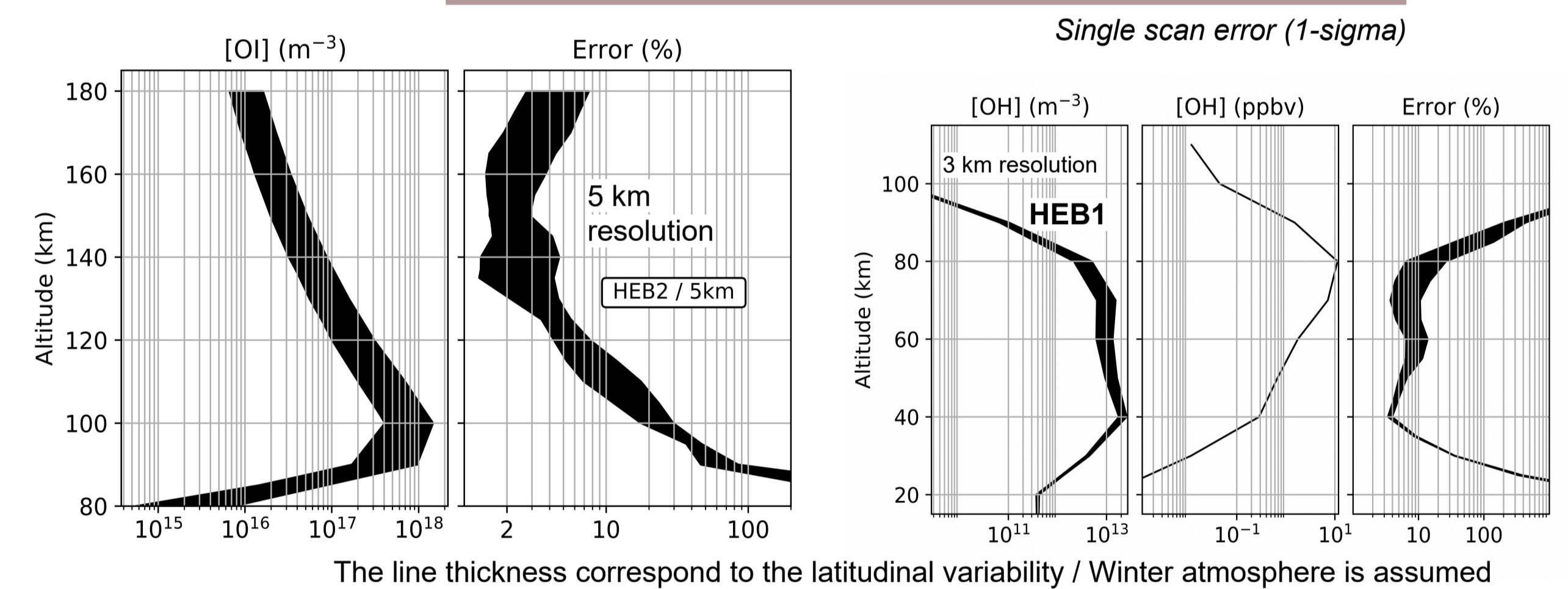
SISa

Resolution 1 MHz, Tsys 180 K, Antenna vertical resolution 0.036 deg



OI and OH retrieval errors (THz bands)

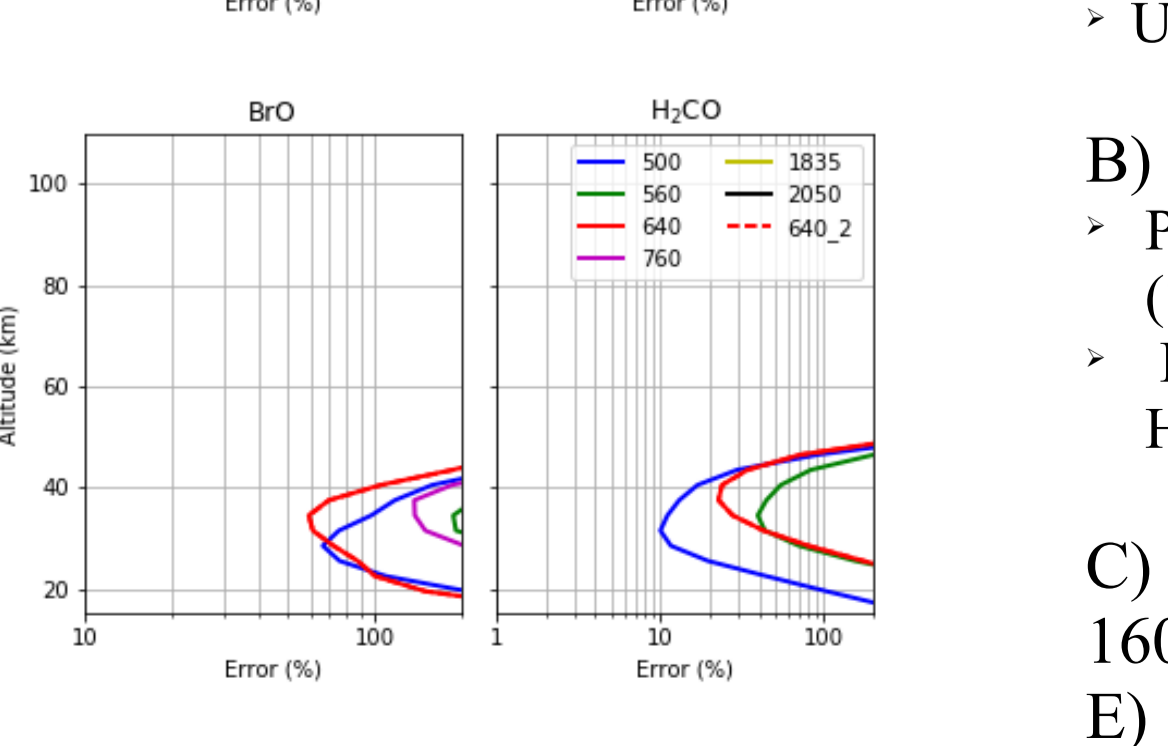
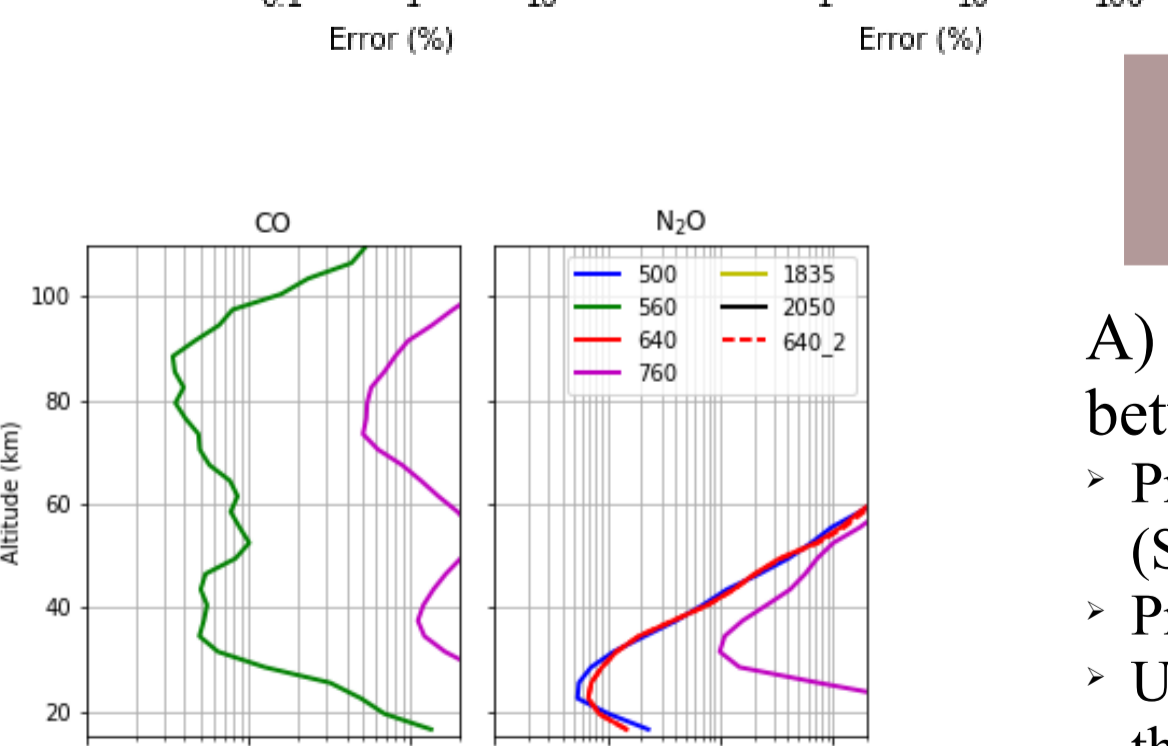
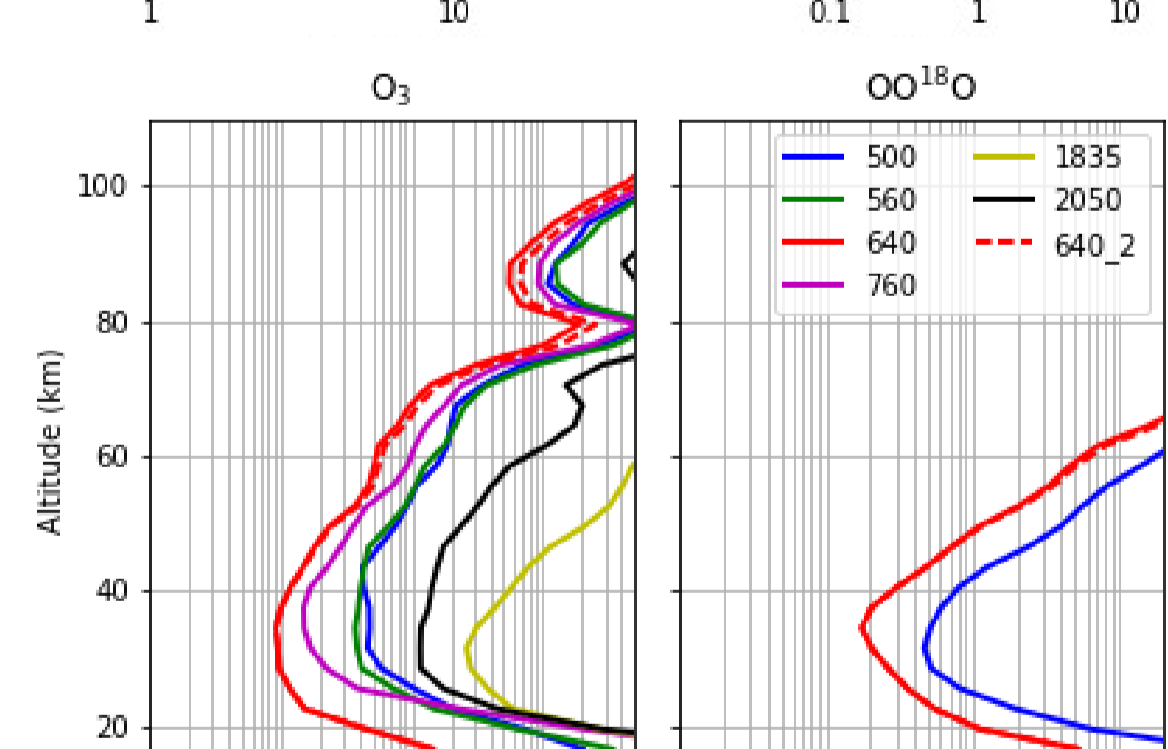
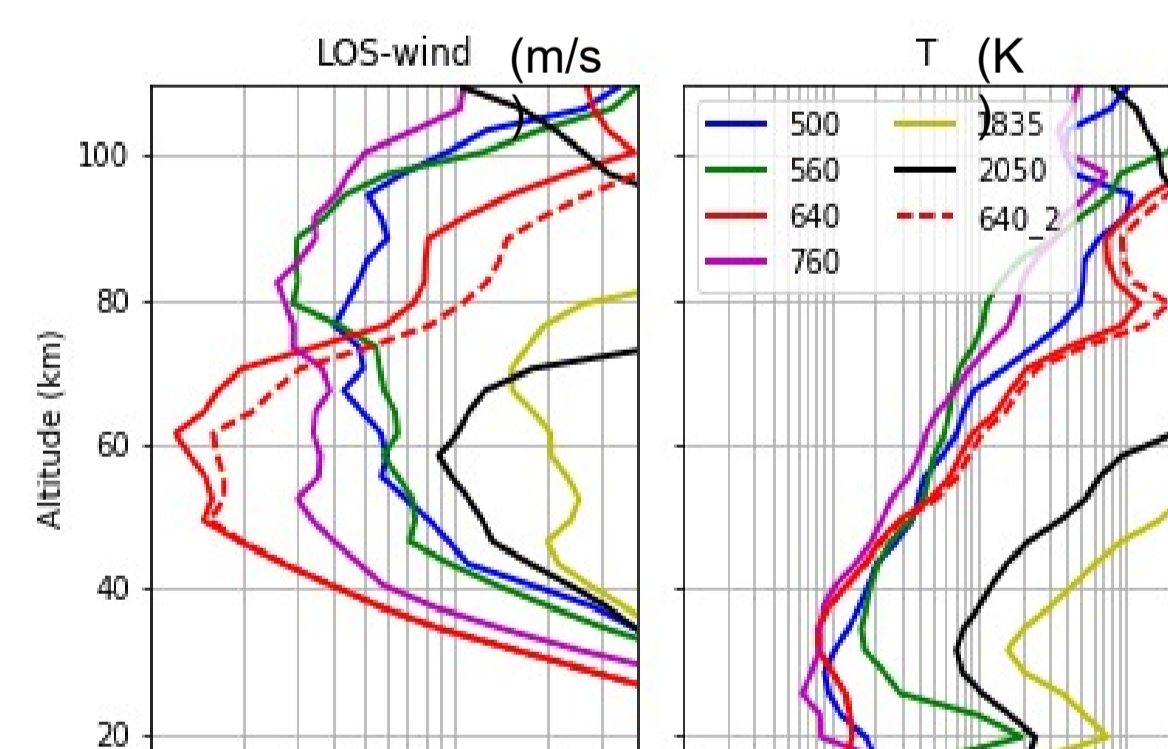
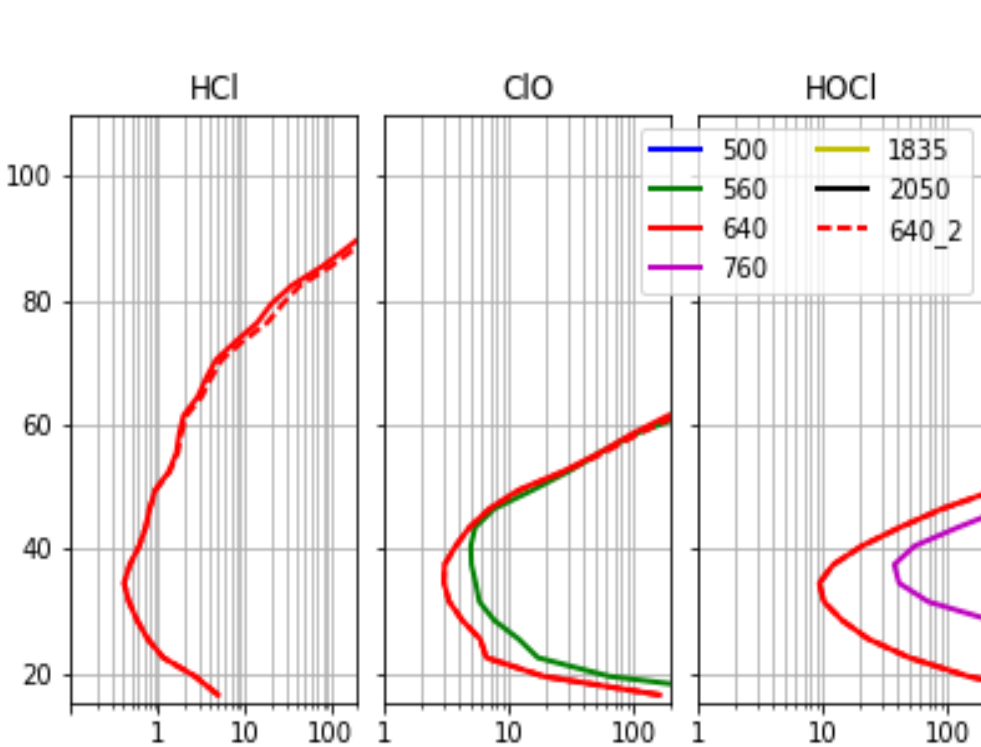
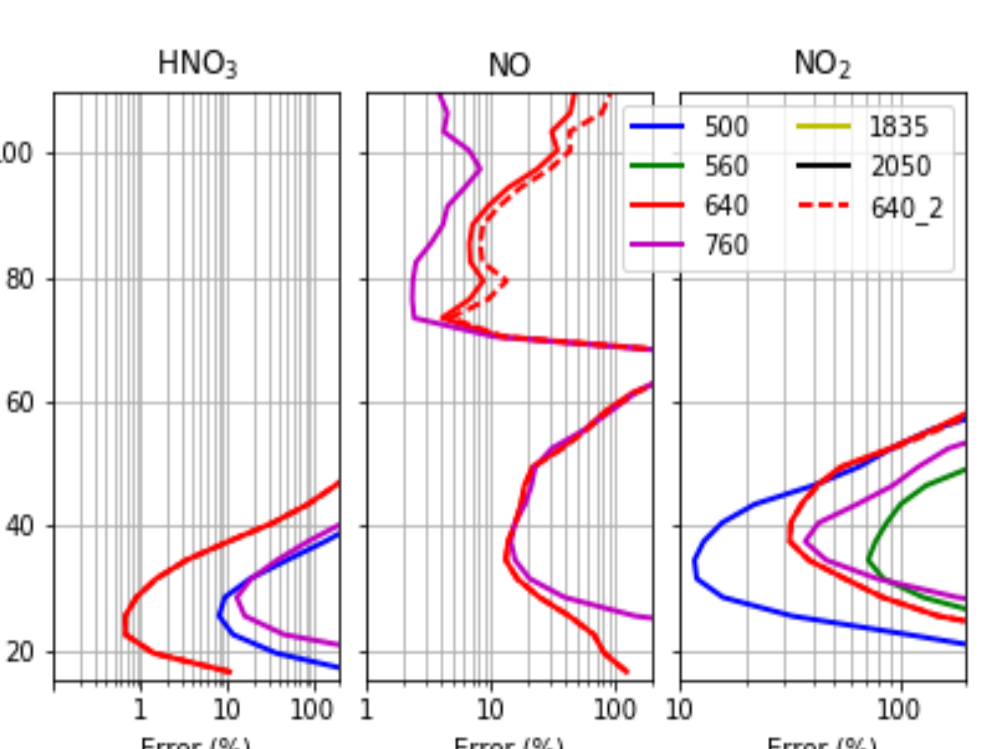
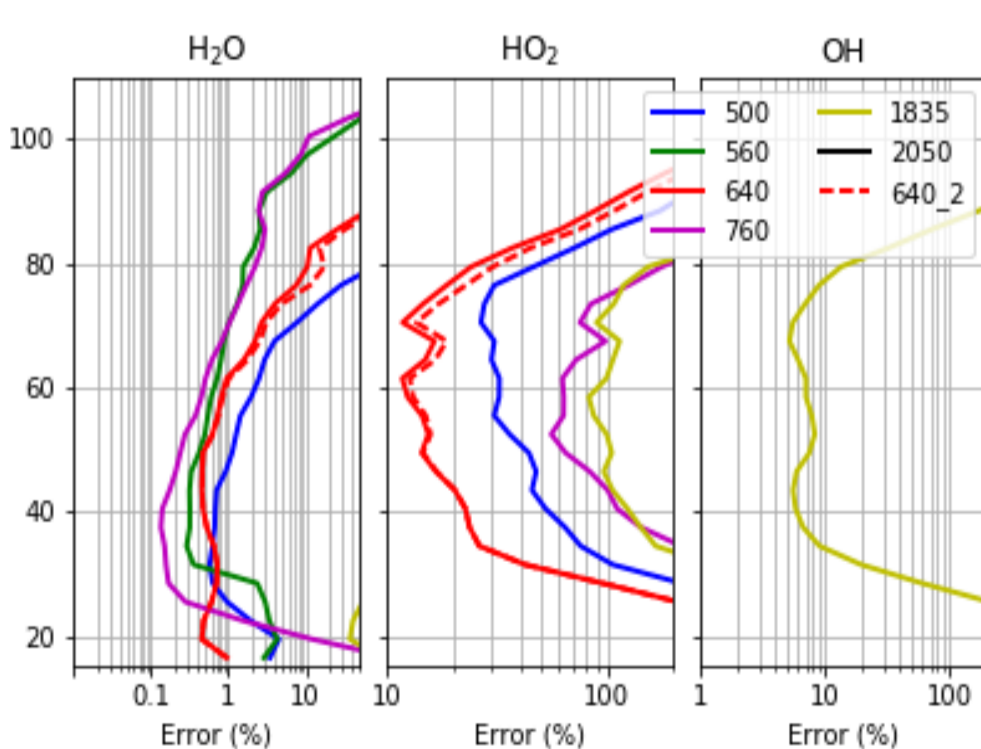
Ochiai et al., SOLA, 2017, doi.org/10.2151/sola.13A-003



Retrieval errors Between 20 and 110 km Band comparison

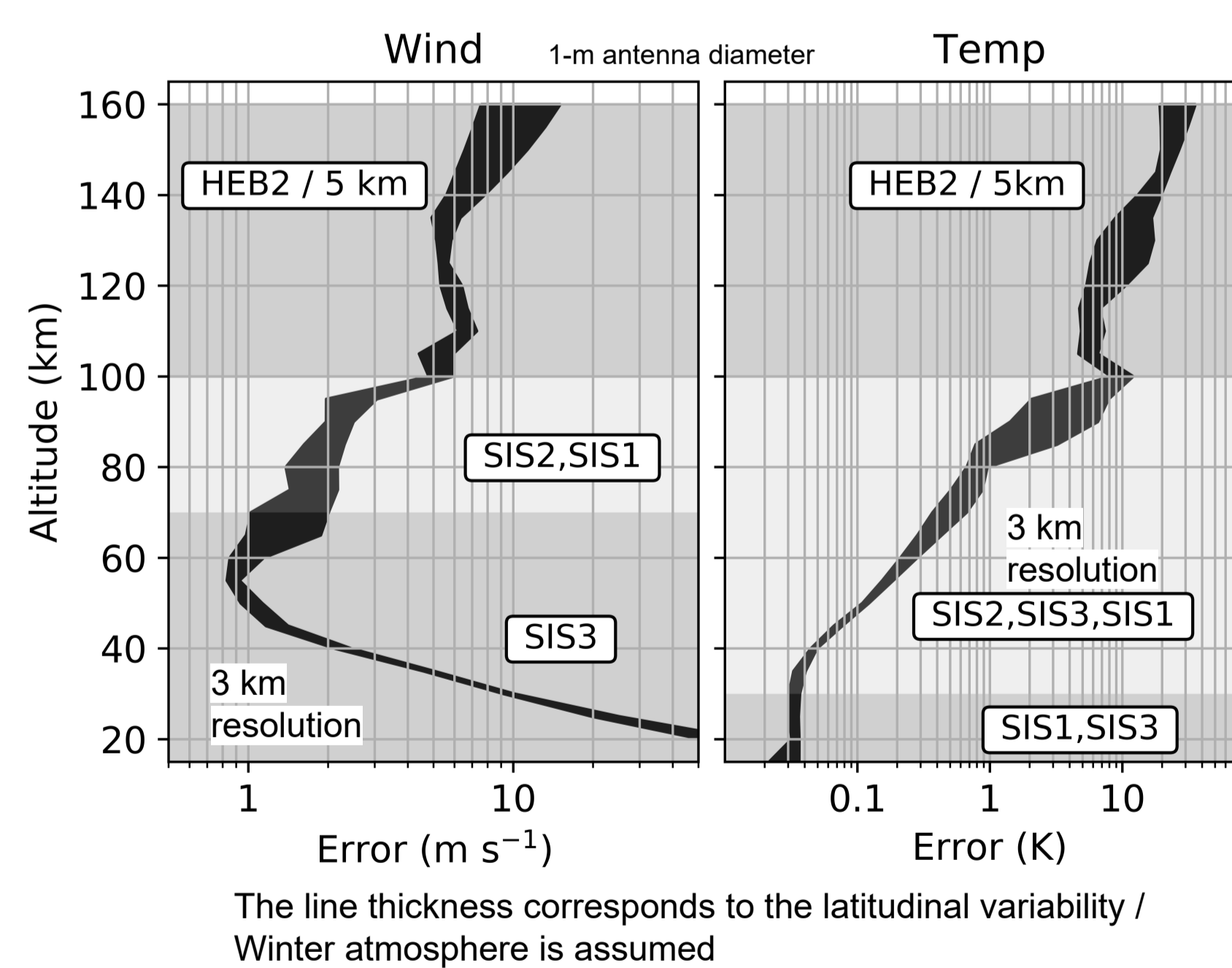
Antenna diameter of 75 cm / Retrieval resolution of 3 km

Labels **500**, **560** and **640** are the three SIS1, 2, and 3
Label **760** is SISa
Label **640_2** is SISb
Labels **1800** and **2005** are HEB1 and HEB2
Single-scan error (1-sigma)



Wind and Temperature Composite retrieval errors using SIS1, 2, 3 and HEB2

Ochiai et al., SOLA, 2017, doi.org/10.2151/sola.13A-003

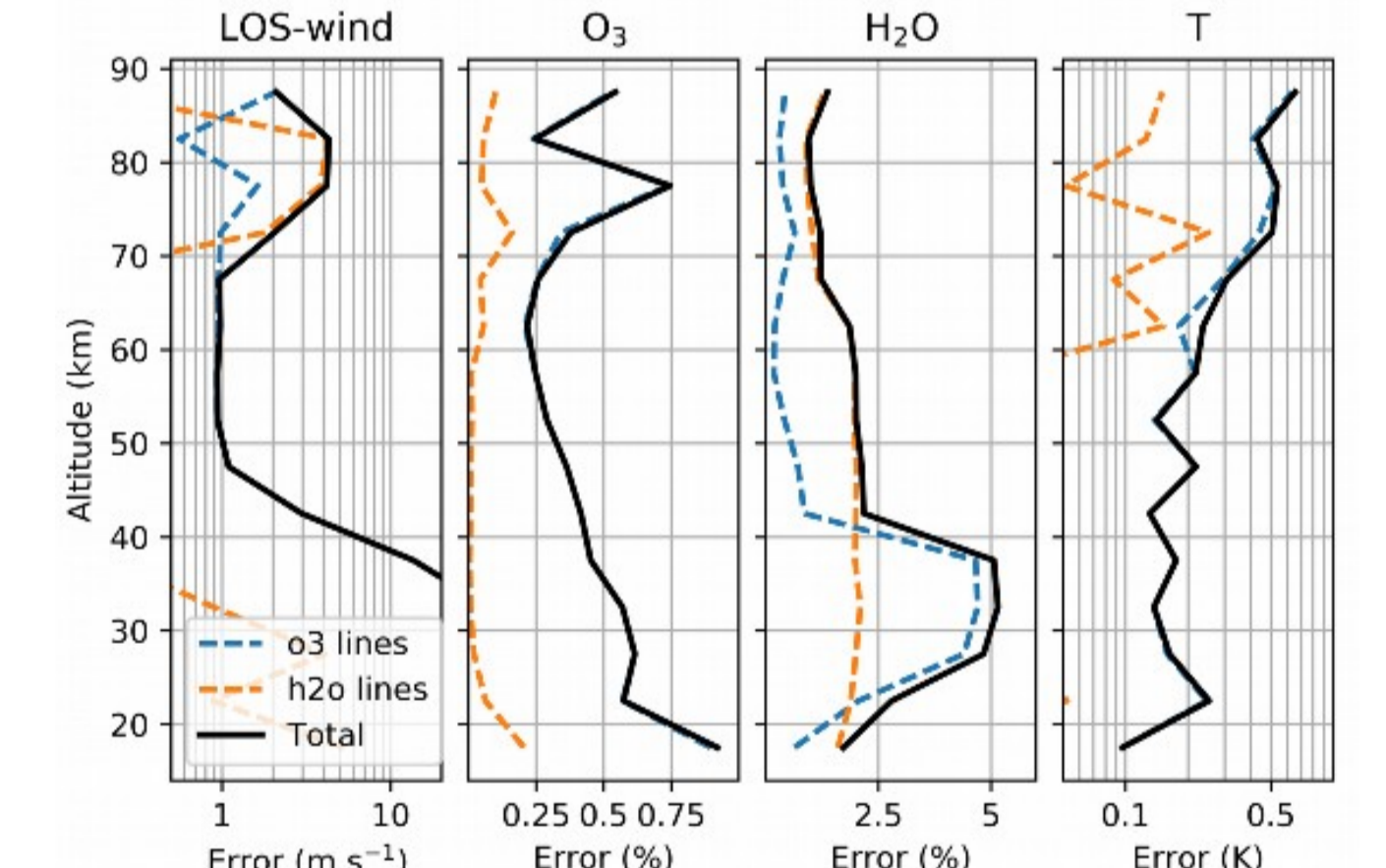


Results / Conclusions

- A) The two components of the **horizontal wind** can be measured between 30 and 160 km
 > Precision <5 m/s with vertical resolution of 3 km between 30–90 km (SIS1,SIS2,SIS3)
 > Precision <10 m/s between 120–160 km (HEB2) (vertical resolution 5km)
 > Using SISa improves the total sensitivity between 90–110 km and it is better than SIS1+SIS2 below 60 km.
 > Using SISb decreases the sensitivity by 20% between 50–70 km.
- B) **Temperature** can be measured between 15–160 km
 > Precision <1 K with vertical resolution of 3 km below 80 km (SIS1,SIS2,SIS3,SISa)
 > Precision <10 K above 80 km with vertical resolution <5 km (SIS1,SIS2,SISa, HEB2)
- C) The ground-state of **atomic oxygen** can be measured between 80–160 km
- E) Some species can be measured up to 120 km with high precision: H2O, O3, O2, NO (better with SISa) and CO (if SIS2 is kept).

Further studies

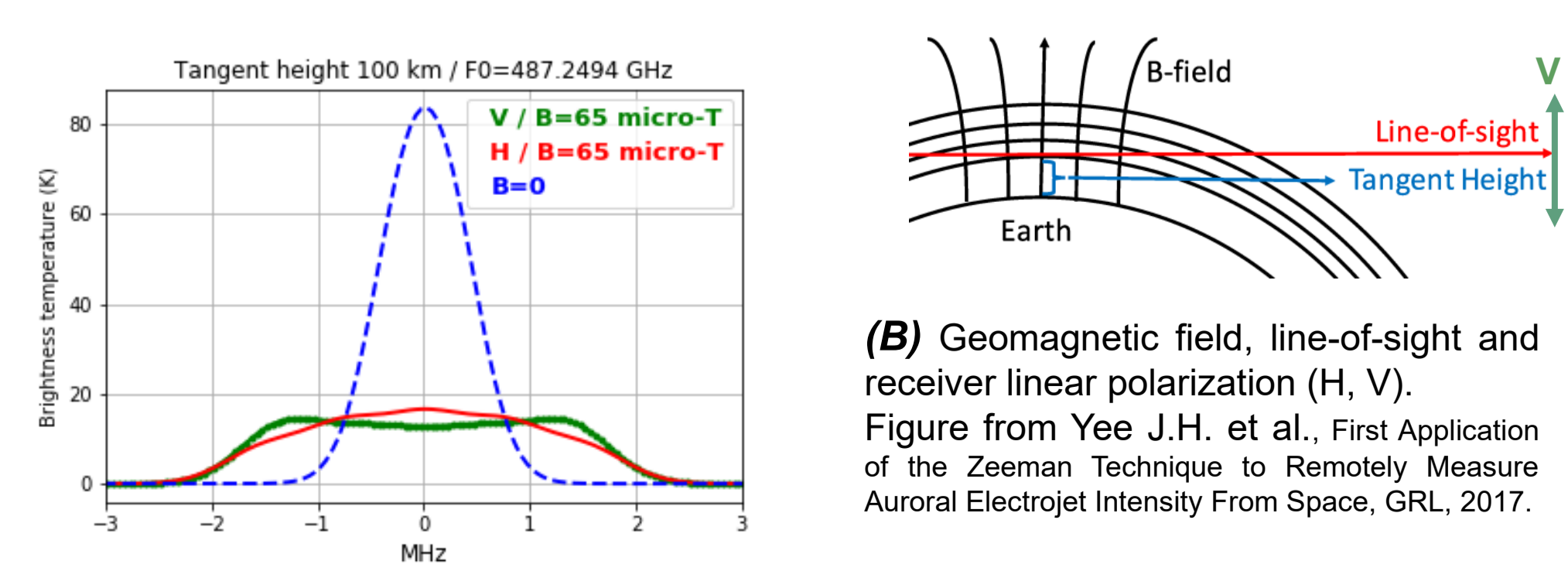
Systematic errors induced by spectroscopic parameters for SIS3.



1) Systematic errors induced by spectroscopic parameters, calibration processes and uncertainties on instrumental functions are being estimated. (see figure here-above)

2) The Splitting of the OI and O2 lines by the geomagnetic field will be taken into account for a better estimation of the retrieval errors and the impact of the receiver polarization. (see figure here below).

Inferring information on the geomagnetic field from the measurement will also be studied.



(A): O2-line at 488 GHz computed with a geomagnetic field B perpendicular to the LOS. The radiance measured with a linear polarized receiver aligned with B is shown in green (V) and that perpendicular to B in red (H). The blue line is for $B=0$ (no Zeeman splitting).