HCN

HCN mws (IRWG)

Interfered species: **H2O (H217O, H218O), CO2, N2O, C2H2**

Standard	Optional
3268.05 – 3268.40 cm-1	**3277.775 – 3277.950 cm-1**
3287.10 – 3287.35* cm-1	**3286.168 – 3288.482* cm-1**
3299.40 – 3299.60 cm-1	**3301.030 – 3301.300 cm-1**
	3304.825 – 3305.600 cm-1
	3331.400 – 3331.800 cm-1

* not recommended for humid sites (Vigouroux et al. 2012)

HCN

HITRAN 2008 vs 2016

Gas name	Number of spectral lines in 3260 – 3340 cm-1*	
	HIT08	HIT16
HCN	**370 identical lines****	
H2O	511	1748
CO2	3080	5003
N2O	1327	4098
C2H2	991 no diff in spectral line positions and intensities	

**** all changes in HCN retrievals will be only due to interfering species**

* this spectral band covers all standard and optional mws using for the HCN retrievals

HCN

Retrieval setup

Tests were made on spectra acquired at the St.Petersburg site during **2015** (totally, 471 spectra)

WACCM V6 HCN apriori profile and Sa

OE regularization for HCN

Prefitted H2O profile

SNR=300

HCN

3mws standard set

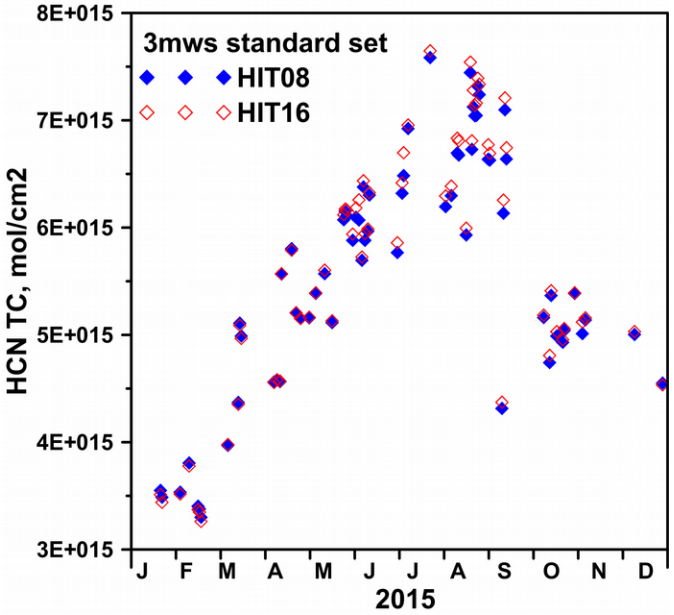
HIT08 => HIT16: no significant benefits
HIT 16 a little bit better in HCN TC daily variability

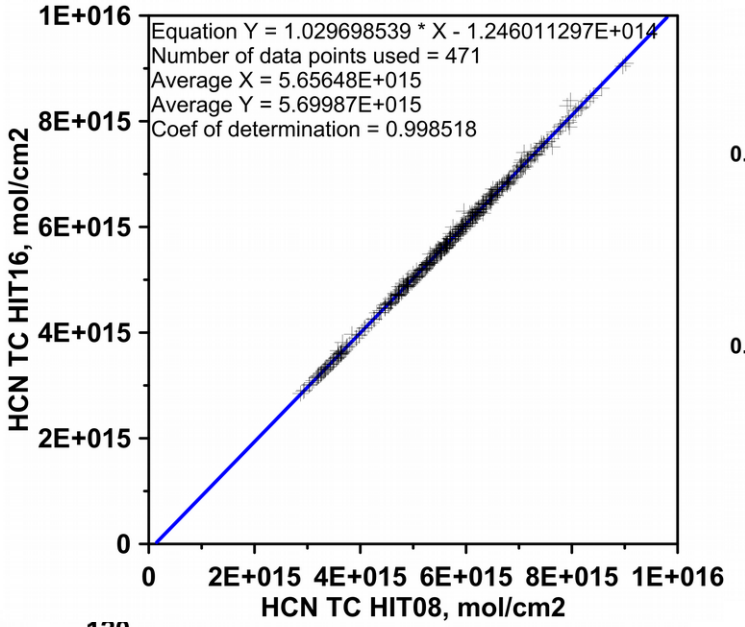
HIT	HCN TC, *10^{15} mol/cm2	Daily variab. HCN TC, %	Errors, % (rand/smo/syst)	RMS, %	DOFS
2008	5.66	8	6,6,6	0.44	1.46
2016	5.70	7	6,6,6	0.44	1.46

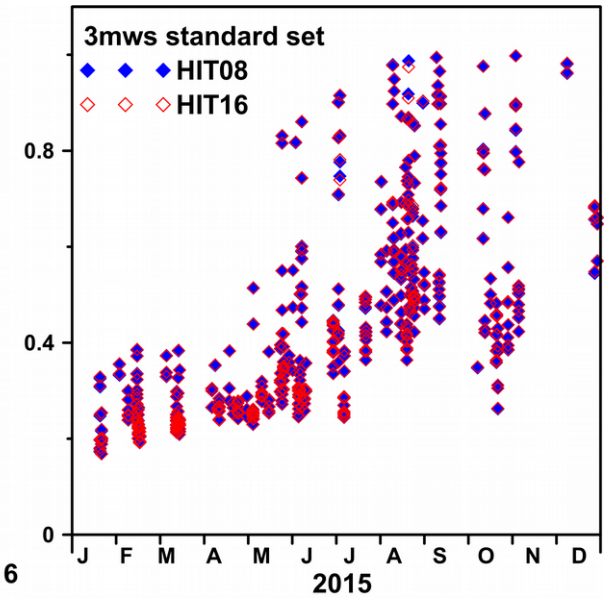
Standard mws set: RMS values increase for warm season (May-October) together with H2O TCs.

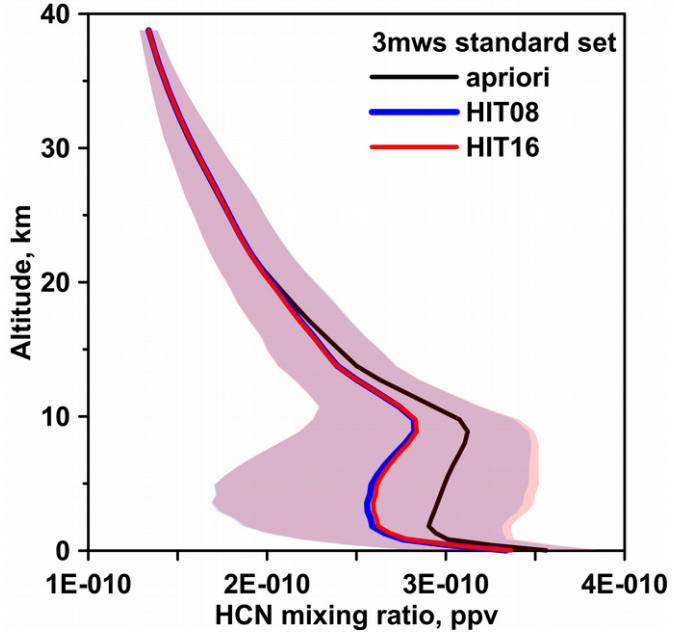
HCN

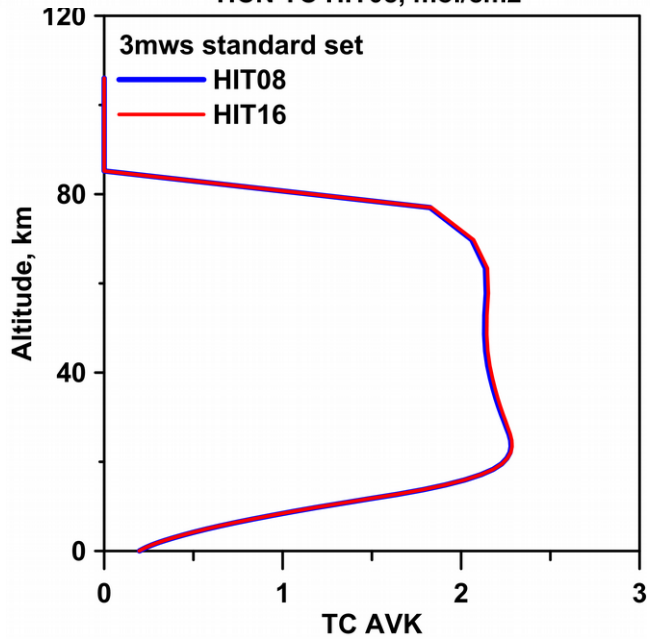
3mws standard set

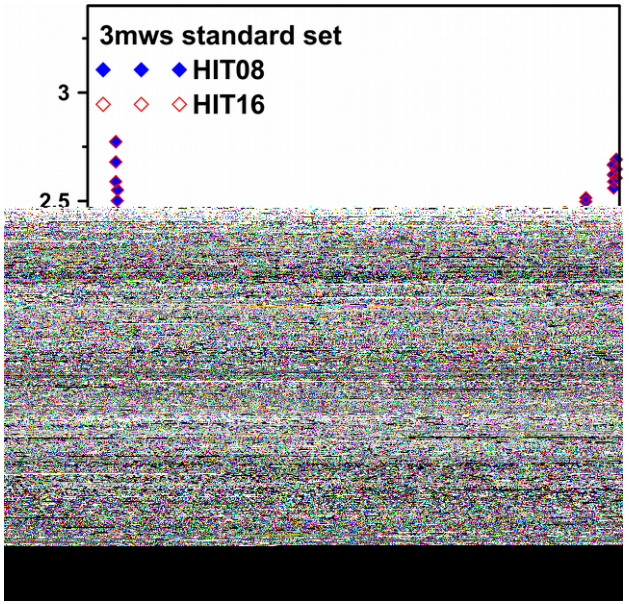












Pink - retrieved profiles area for HIT16; blue – same but for HIT08

HCN

Papers on HCN FTIR retrievals

E. Mahieu et al.: Observed trends in total vertical column abundances of atmospheric gases from IR solar spectra recorded at the Jungfraujoch, J. Atmos. Chem., **1997**.

C. Rinsland et al.: Infrared solar spectroscopic measurements of free tropospheric CO, C2H6, and HCN above Mauna Loa, Hawaii: seasonal variations and evidence for enhanced emissions from the Southeast Asian tropical fires of 1997–1998, J. Geophys. Res., **1999**.

J. Notholt er al.: Latitudinal variations of trace gas concentrations measured by solar absorption spectroscopy during a ship cruise,J. Geophys. Res., **2000**.

C. Rinsland et al.: Ground-based measurements of tropospheric CO, C2H6, and HCN from Australia at 34º S latitude during 1997–1998, J. Geophys. Res., **2001**.

Y. Zhao et al.: Spectroscopic measurements of tropospheric CO, C2H6, C2H2, and HCN in Northern Japan, J. Geophys. Res., **2002**.

C. Paton-Walsh et al.: Trace gas emissions from savanna fires in Northern Australia, J. Geophys. Res., **2010**.

C. Vigouroux et al.: FTIR time-series of biomass burning products (HCN, C2H6, C2H2, CH3OH, and HCOOH) at Reunion Island (21º S, 55º E) and comparisons with model data. Atmos. Chem. Phys., **2012.**

C. Viatte et al.: Five years of CO, HCN, C2H6 , C2H2 , CH3OH, HCOOH and H2CO total columns measured in the Canadian high Arctic. Atmos. Meas. Tech., **2014**.

Sorry if I forgot sombody's paper! Please let me know!

HCN

2mws*

3268.050 – 3268.350 cm-1 - truncated mw from the standard set
3331.400 – 3331.800 cm-1 - mw from the optional set

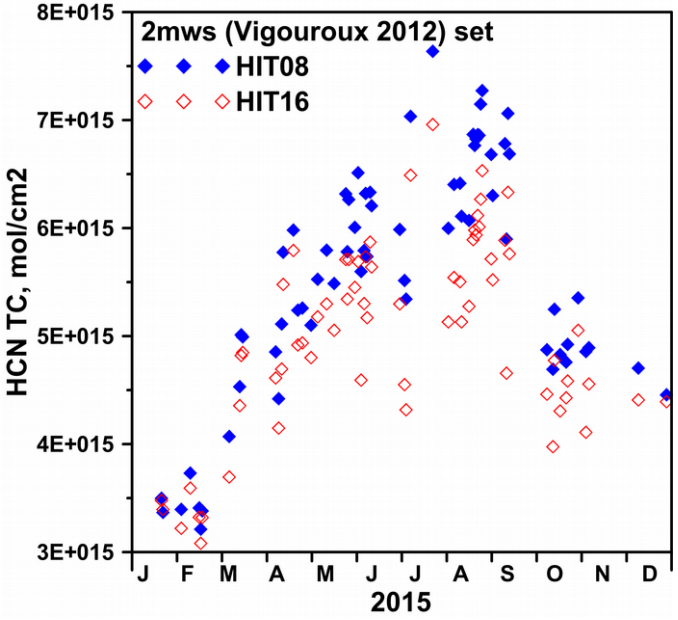
Most of criteria: HIT08 is better than HIT16

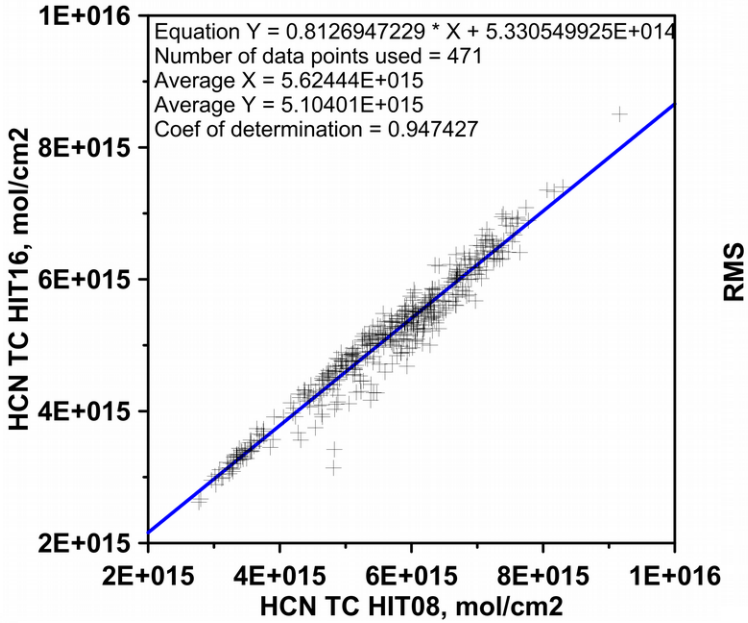
HIT	HCN TC, mol/cm2	Daily variab. HCN TC, %	Errors, % (rand/smo/syst)	RMS, %	DOFS
2008	5.62	4	6,6,6	0.29	1.38
2016	5.10	5	7,7,6	0.30	1.37

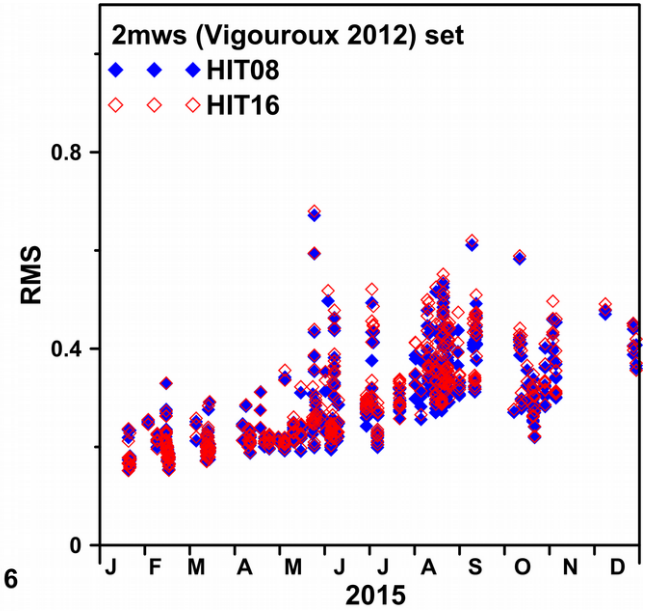
* **2mws** (**Paton-Walsh 2010 and Vigouroux et al. 2012**) could be offered for the further tests as a new IRWG standard set of mws for HCN retrievals.

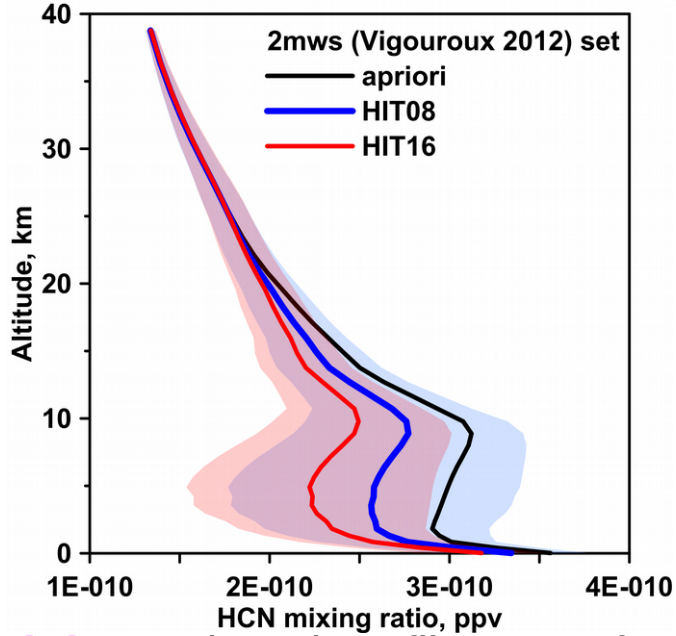
HCN

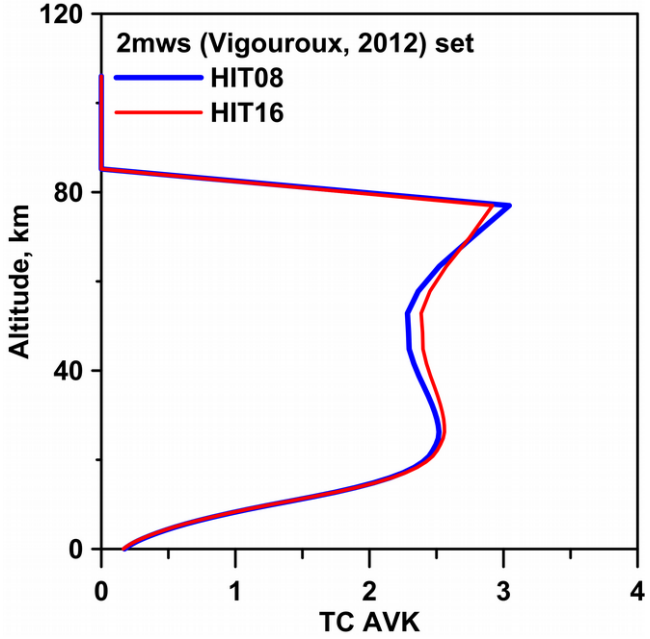
2mws

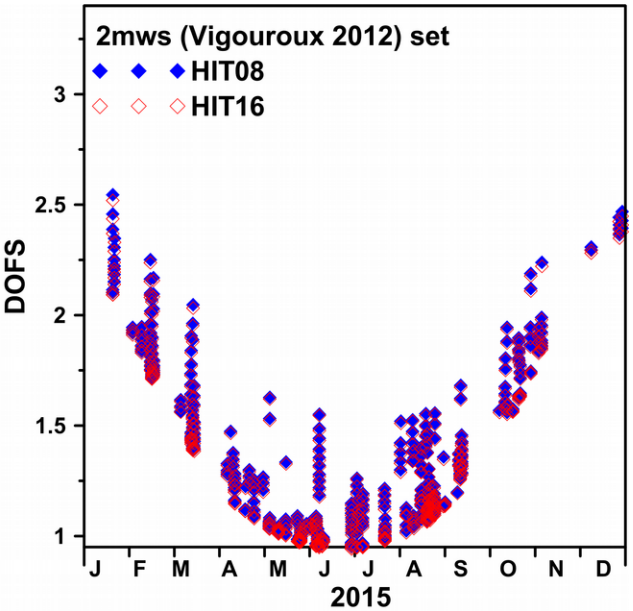












Pink - retrieved profiles area for HIT16; blue – same but for HIT08

HCN

Summary

- HIT08 = HIT16 for HCN in 3260-3340 cm-1 => changes in HCN retrievals are due to differences in the spectroscopy of interfering species (H2O and isotopes, CO2, N2O and C2H2);

- **3mws** standard set: **HIT16 - no significant benefits in comparison with HIT08;**

- 2mws set (Paton-Walsh 2010 and Vigouroux et al. 2012): **HIT08.**

<u>For discussion:</u>

Do we need to optimize HCN standard retrieval strategy?

Further detailed consideration/tests of 2mws set (Paton-Walsh 2010 and Vigouroux et al. 2012) over the IRWG sites with the different atmospheric conditions are desirable.
Testing other combinations of mws?