A brief review of collocation uncertainty and results from comparison of GRUAN and IASI data

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GRUAN

1. GRUAN stands for GCOS Reference Upper-Air Network
2. Are providing uncertainties with the measurements
3. But, most importantly, they have made a great effort to reduce systematic errors from the measurements → Humidity measurements are very much bias free

IASI

1. IASI is a Reference for GSICS (Global Space-based Inter-calibration System)
2. “Very stable” and “highly accurate” instrument

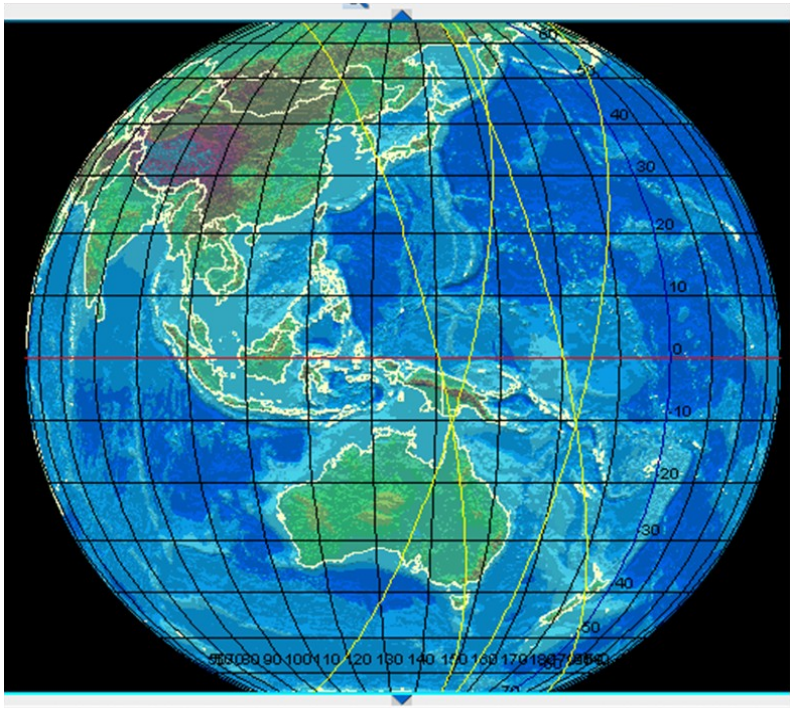
GCOS Requirements

Variable/ Parameter	Horizontal Resolution	Vertical Resolution	Temporal Resolution	Accuracy	Stability
Total column-water vapour	25km	N/A	4h	2%	0.3%
Tropospheric and lower-stratospheric profiles of water vapour	25km (troposphere) 100-200km (stratosphere)	2km	4h (troposphere) daily (stratosphere)	5%	0.3%
Upper-tropospheric humidity	25km	N/A	1h	5%	0.3%

From GCOS-154: Accuracy for WV 5%

GRUAN and IASI Collocation

- Orbits close to 00Z and 12Z
  - IASI FOVs less than 25 km and 30 min (Pugatchev et al. 2009 ACP) apart for Manus Island 2011-2013: 76 Clear Sky cases found



Instr/Category	Product Type	Start Date	Stop Date
HIRS	HIRxxx1B	2011/06/04 22:45:53	2011/06/05 00:27:58
HIRS	HIRxxx1B	2011/06/05 00:27:58	2011/06/05 02:09:56
HIRS	HIRxxx1B	2011/06/05 02:09:56	2011/06/05 03:54:54
HIRS	HIRxxx1B	2011/06/05 03:54:54	2011/06/05 05:36:59

Consistency check

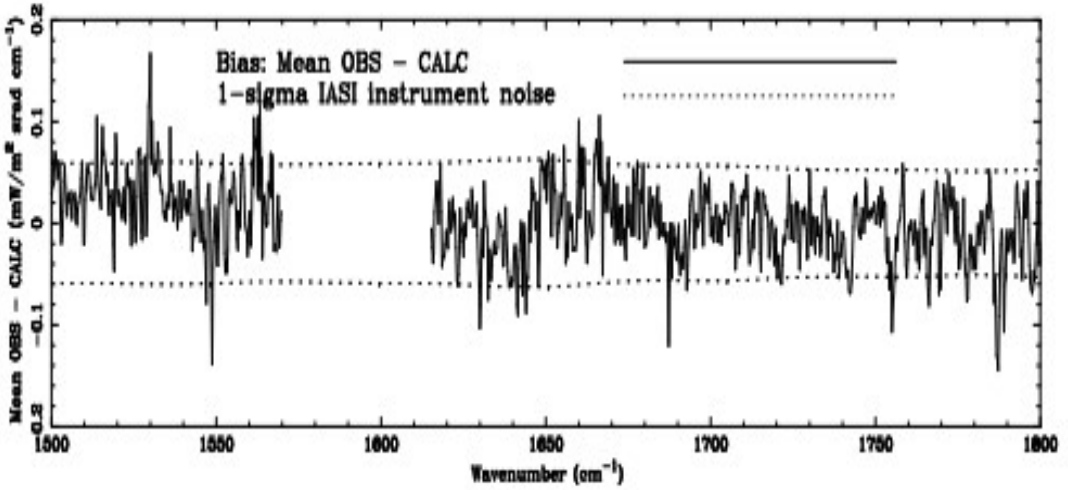
- Observed IASI radiances (OBS) are compared to
- Calculated radiances (CALC) using GRUAN Sonde profile + Radiative Transfer Model (LBLRTM 12.2)
- OBS-CALC should fall within ±3σ IASI instrument noise

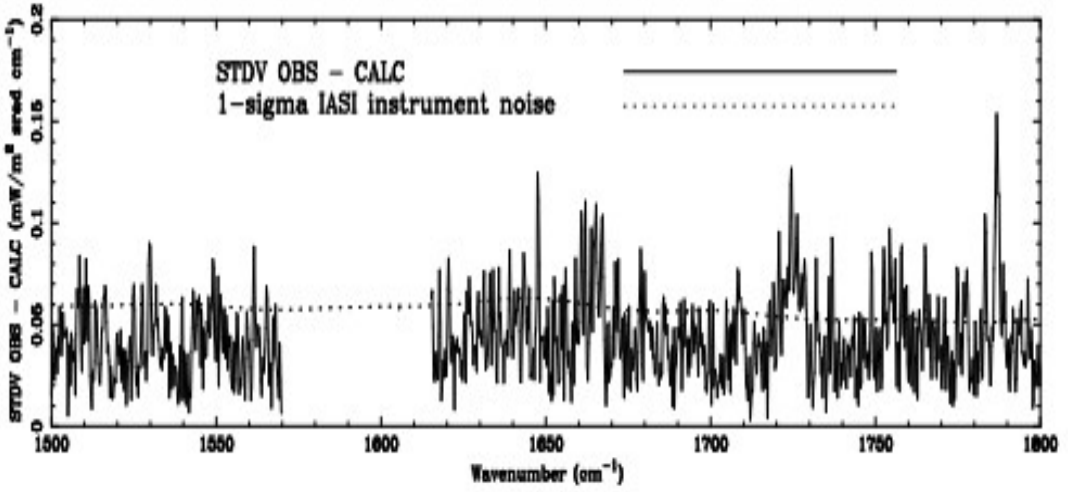
Consistency check: is this even possible?

OBS-CALC should fall within ±3σ IASI instrument noise: is this even possible?

Yes! With two RS92 Sondes and a CFH Sonde. Sodankyla EPS/MetOp Campaign 2007

Calbet et al. AMT 2011





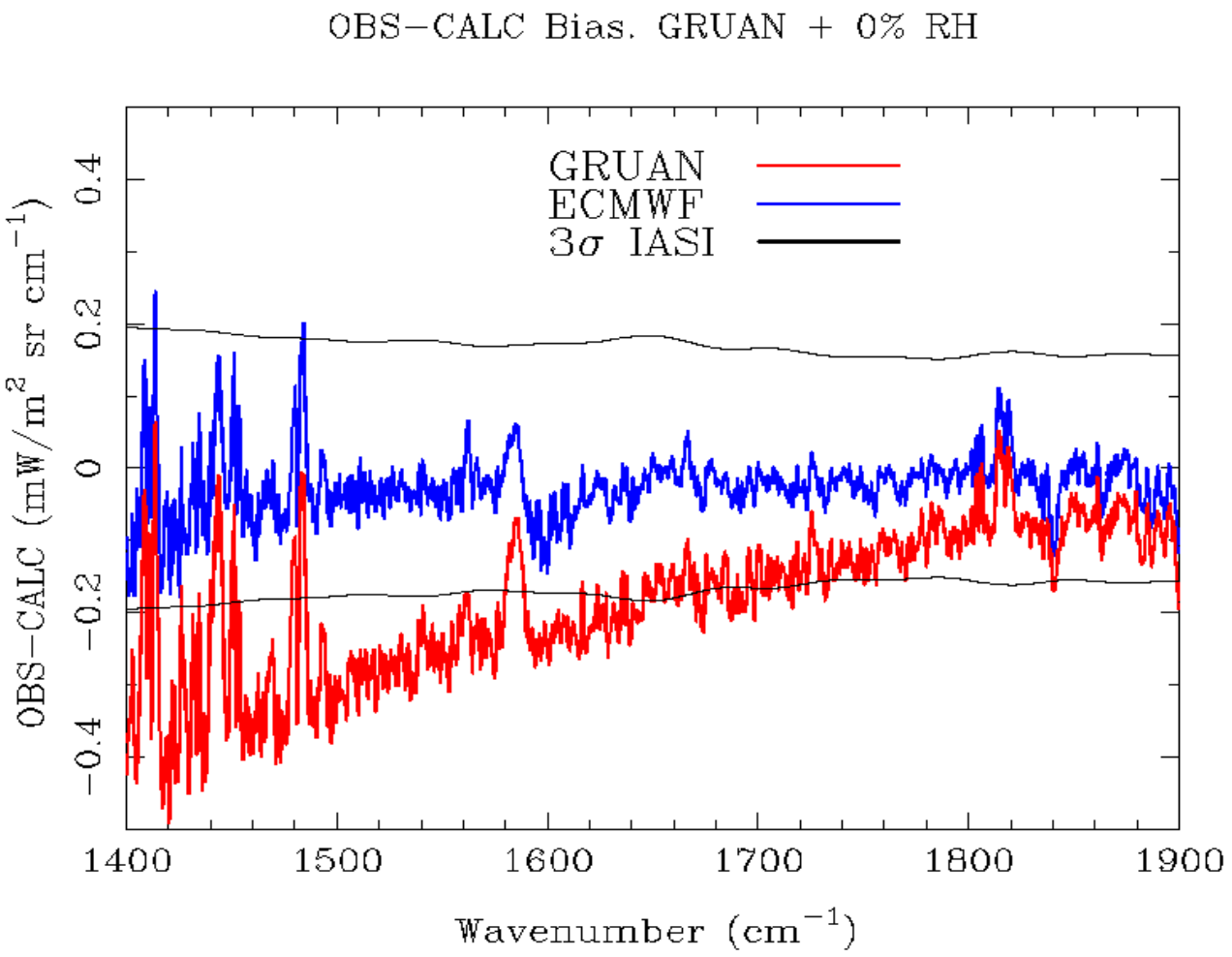
Consistency check: is this even possible?

OBS-CALC should fall within ±3σ IASI instrument noise:

is this possible with GRUAN?

GRUAN: one RS92 sonde very well processed

Radiation Bias: GRUAN + 0% RH



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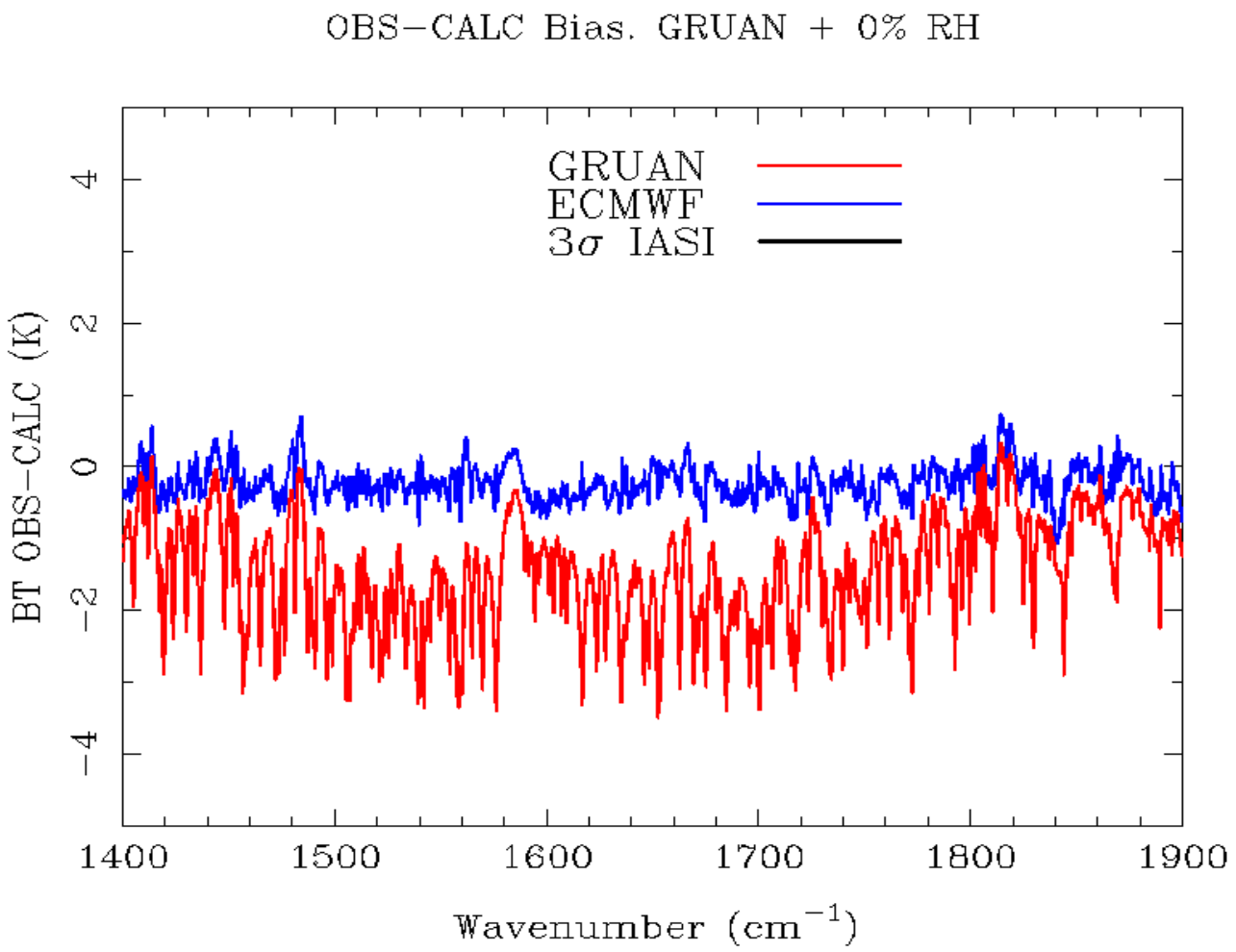
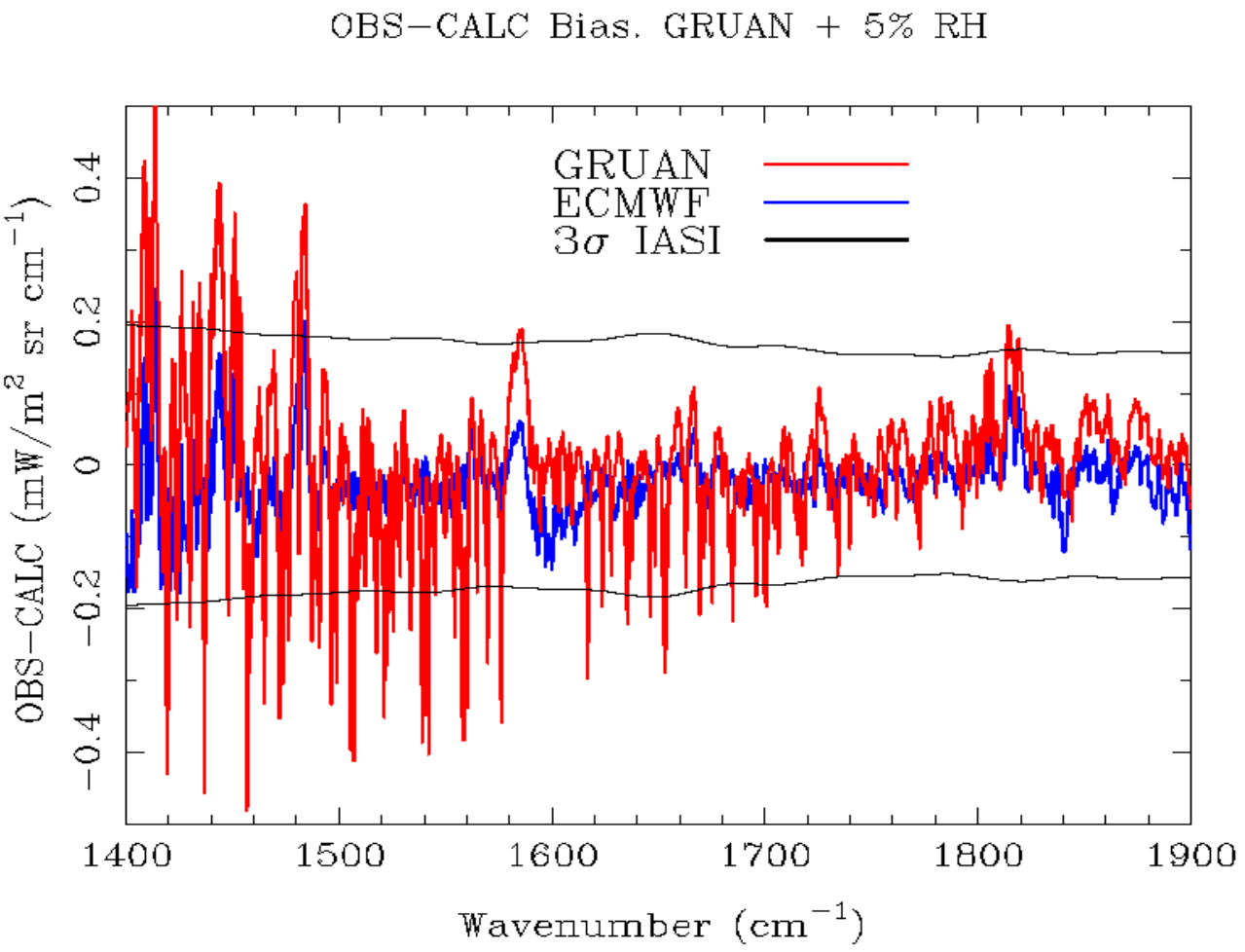
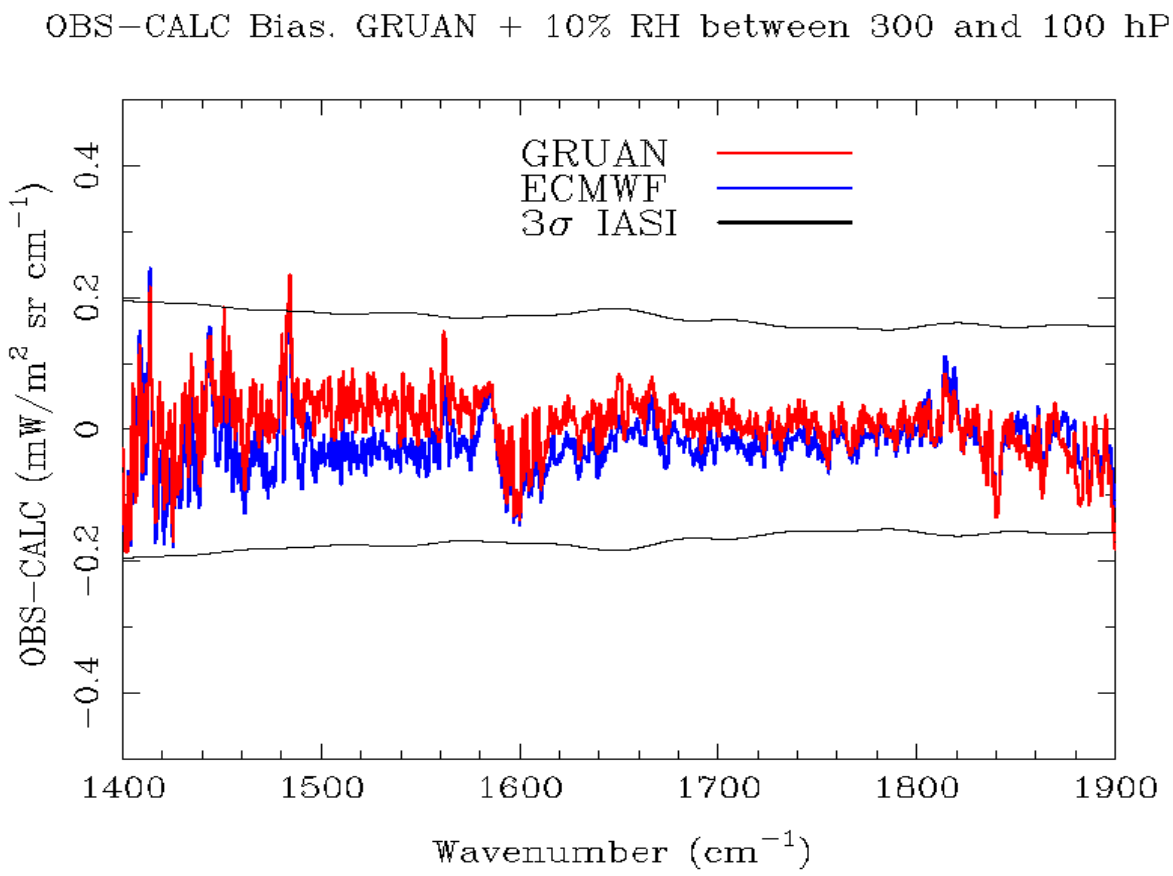


Radiation Bias: GRUAN + 5% RH



GRUAN sondes + LBLRTM 12.2 vs IASI INCONSISTENCY!!!!!

Radiation Bias: GRUAN + 10% RH (300-100 hPa)



GRUAN sondes + LBLRTM 12.2 vs IASI INCONSISTENCY!!!!!

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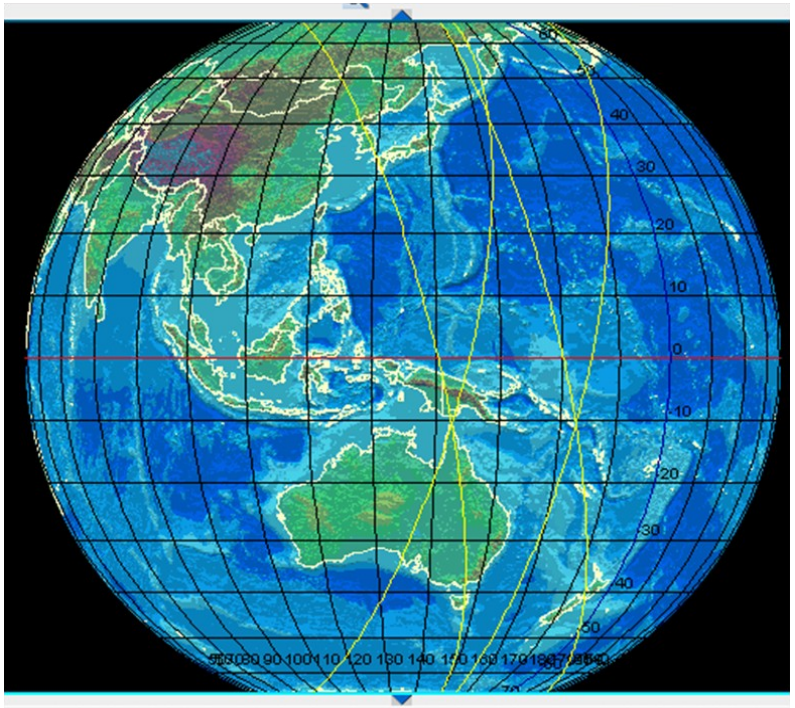
Extended IASI FOVs Collocation

1. Collocation

- Orbits close to 00Z and 12Z
  - IASI FOVs less than 25 km and 30 min (Pugatchev et al. 2009 ACP) apart for Manus Island 2011-2013: 76 Clear Sky cases found
- With above criteria met, searched for IASI FOVs 500 km away: 15200 Clear Cases found



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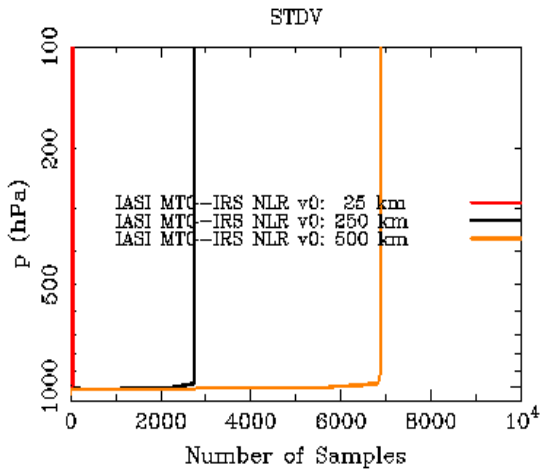
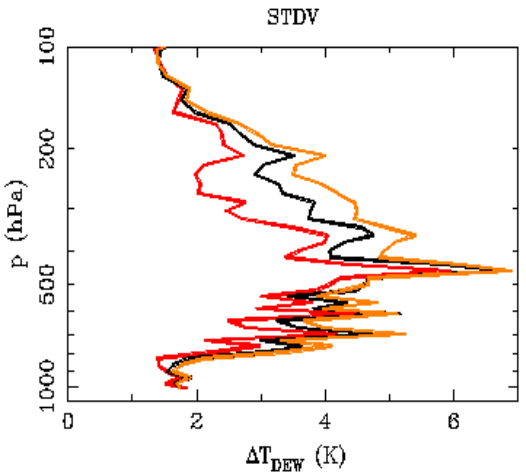
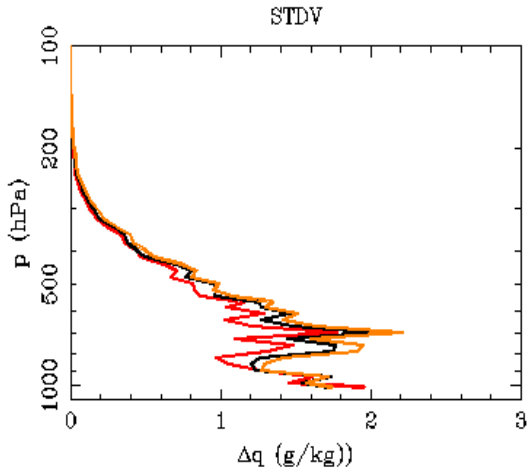
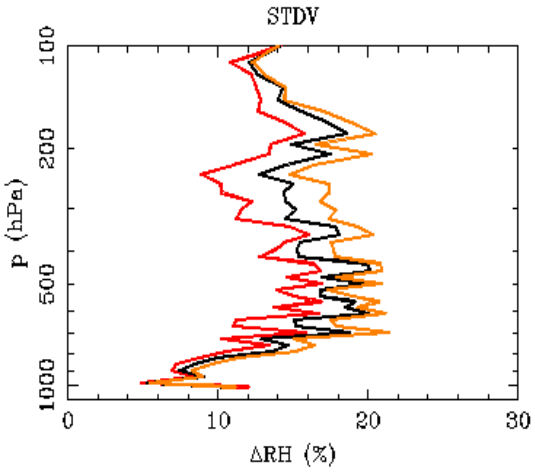
Dependency of Statistics with Maximum Collocation Radius









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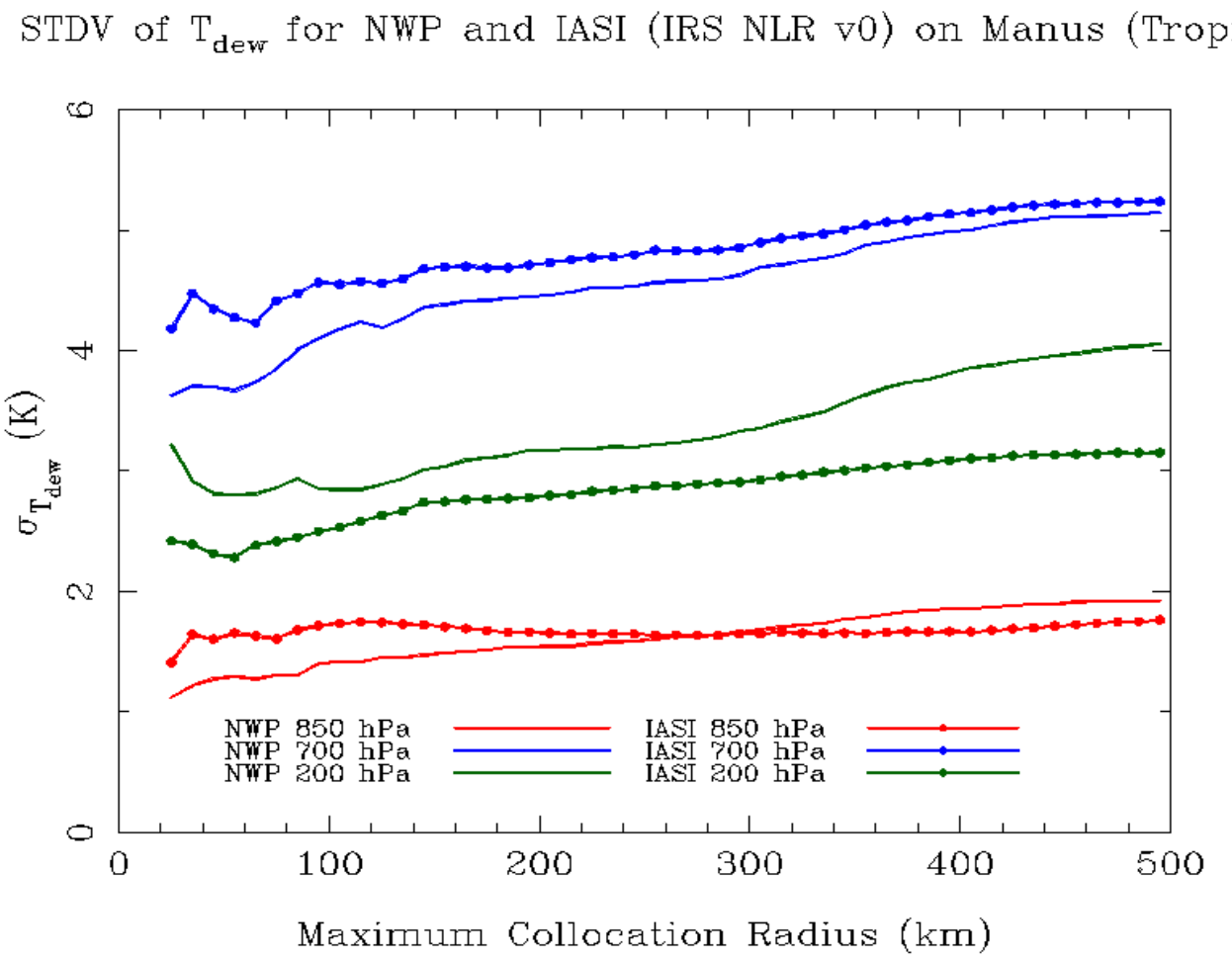

Possibility to estimate the collocation uncertainty

Collocation uncertainty determination project

- GRUAN + GSICS IR Hyperpsectral (AIRS,IASI,CriS) + GNSSRO (3G) community joining forces to estimate the collocation uncertainty
- Collocation uncertainty is by far the largest source of errors when intercomparing satellite and ground based (sonde) measurements
- Collocation uncertainty should be taken into account when inercomparisons are made

Collocation uncertainty determination project: Phases

- Collocation of a limited sample to estimate the time and space window for collocation of all 3G to obtain 2-3 examples per site
- Exact determination of time/space collocation window
- Collection of datasets (GRUAN, IASI, CriS, AIRS, COSMIC, GRAS, ECMWF)
- Collocation uncertainty determination using available data
- First results should be available mid 2015: description of algorithms

CONCLUSIONS

- ECMWF + LBLRTM 12.2 vs IASI Consistent
- GRUAN Sonde + LBLRTM 12.2 vs IASI Inconsistent (GRUAN + 5% RH is consistent, GRUAN+10% RH in 300-100 hPa even better)
- Large inconsistency for climate purposes
- Reason unknown: Correction of GRUAN or LBLRTM?
- Collaboration between different communities (Satellite and GRUAN) essential to provide a coherent picture of the atmosphere → improve accuracy → provide an adequate picture for climate purposes

CONCLUSIONS

- 3G Collocation Uncertainty Determination project:

PARTNERS WELCOME!!