Preliminary Results of φ-IASI radiative transfer and retrieval product evaluation

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Summary

- φ-IASI
- IASI spectra used in the analysis
- Inversion Results
- Conclusions

Study Objective

Check the quality and consistency of IASI data with the φ-IASI package

Forward/Inverse Tools

The φ-IASI package

- **σ-IASI**: forward model

  σ-IASI deals with cloudy and clear sky (also allows to deal with semi-transparent clouds)
- **δ-IASI**: physical inverse scheme
- **ν^2-IASI**: neural network inversion scheme
- **ε-IASI**: EOF based regression scheme
- **γδσ-IASI**: Cloud Detection Scheme

Validation

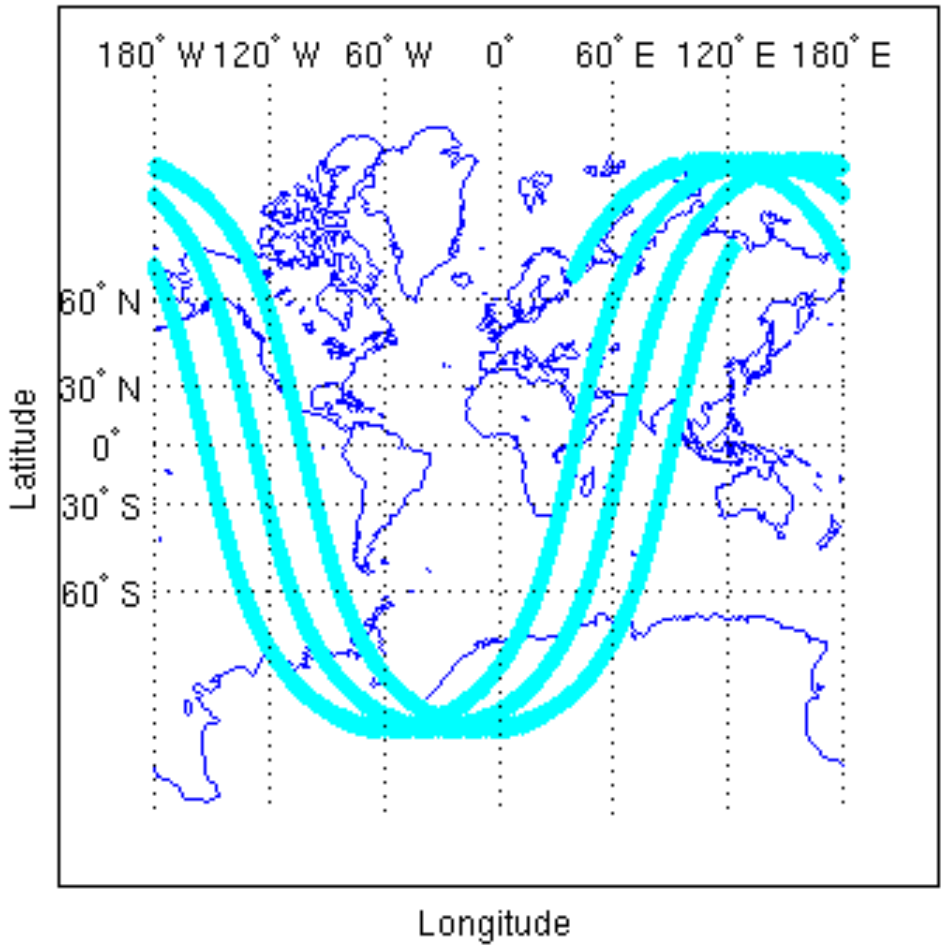
The φ-IASI package

- IMG on board ADEOS/1
- TOMS on board ADEOS/1
- AIRS on board EOS/Aqua
- NAST-I ER-2 and Proteus

1. Grieco et al. *QJ*, manuscript Ref. QJ #06/174, in press, (2007)
2. Carissimo et al. *EMS*, Vol. *20, 1111-1126, (2005)*
3. Grieco et al. *JQSRT*, Vol. 95/3, 221-248, (2005).
4. Masiello and Serio *GRL* Vol. 31, pp. L1105, . (2004)
5. Masiello et al *APPL. OPT.* Vol. 43/11, pp. 2305-2315, (2004).
6. Lubrano et al., *TELLUS B* Vol. 56B, pp. 249-261, (2004)
7. Masiello et al. *JQSRT*, Vol 77/2, 131-148, (2003)
8. Amato et al., *EMS* Vol. 17, pp. 651-667, (2002)
9. Lubrano et al. *JQSRT* Vol. 72/5, pp. 623-635, (2002)
10. Masiello et al. *APPL. OPT.* Vol. 41/6, pp. 965-973, (2002)
11. Lubrano et al. *GRL* Vol. 27, pp. 2533-2536 (2000)
12. Serio et al. *APPL. OPT.* Vol. 29, pp. 3565-3572 (2000)

A few φ-IASI package publications

22 July 2007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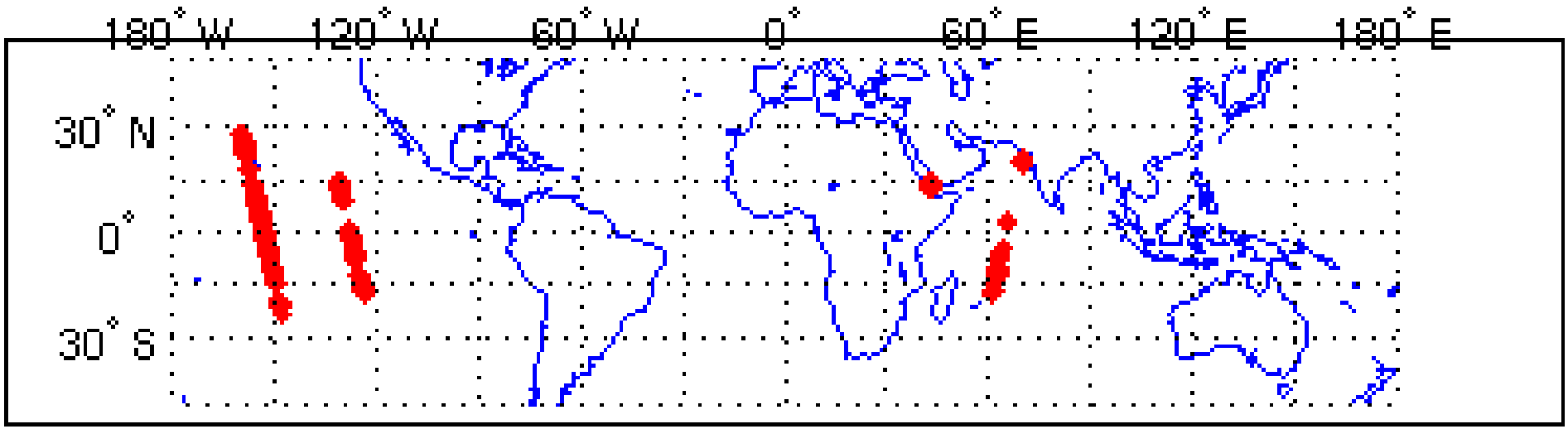
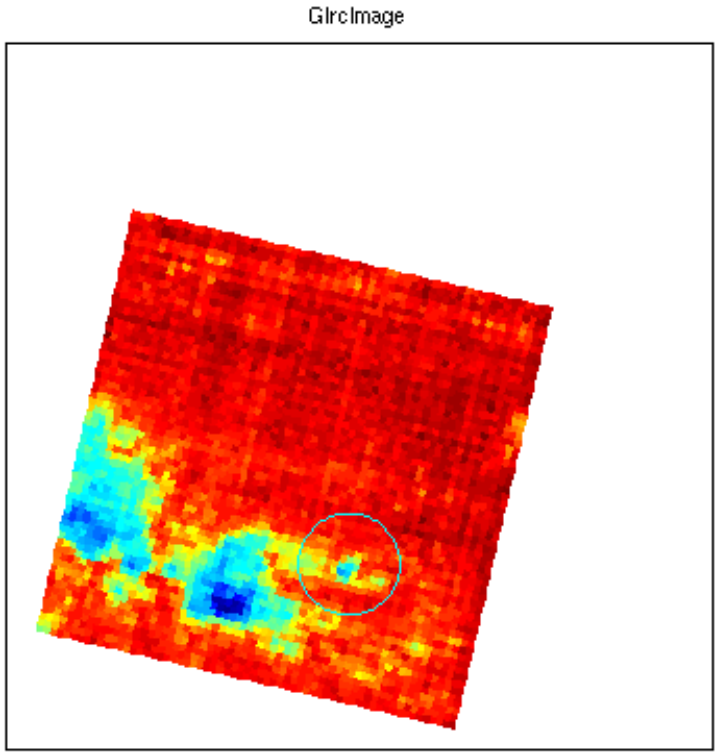
60° N
30° N
0°
30° S
60° S
Latitude
Longitude

Region of interest

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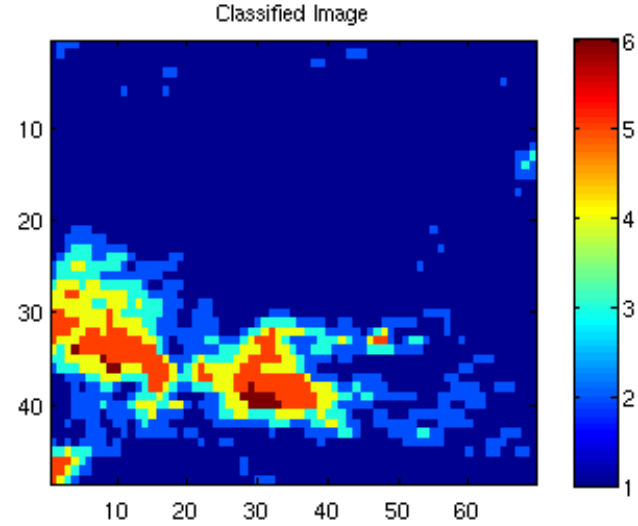
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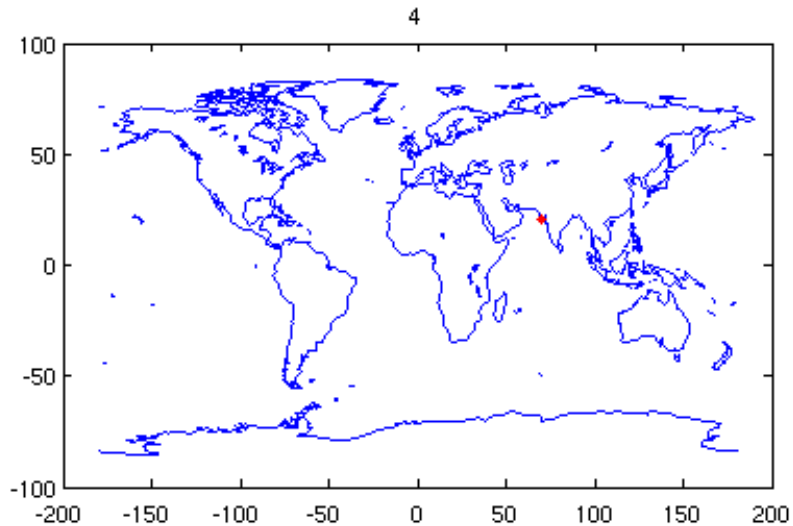
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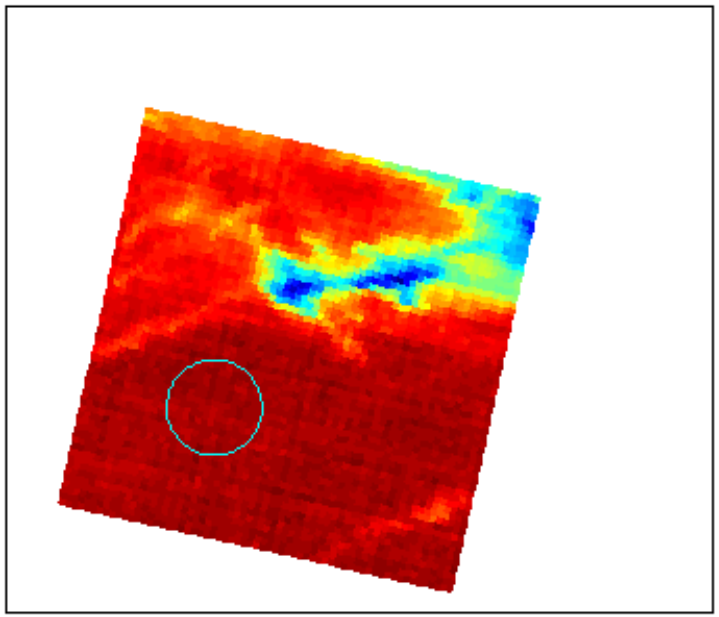

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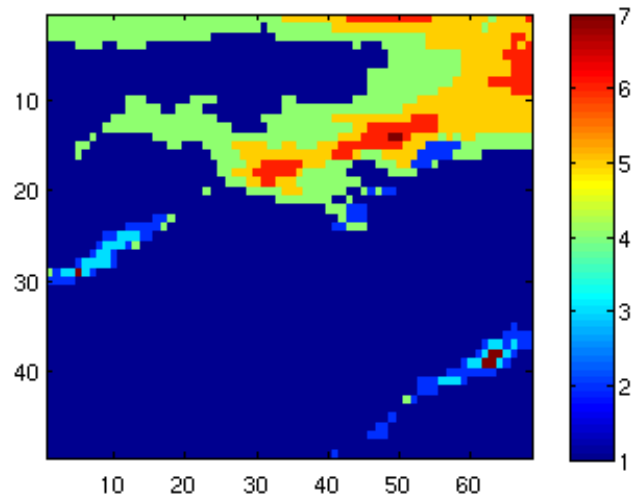

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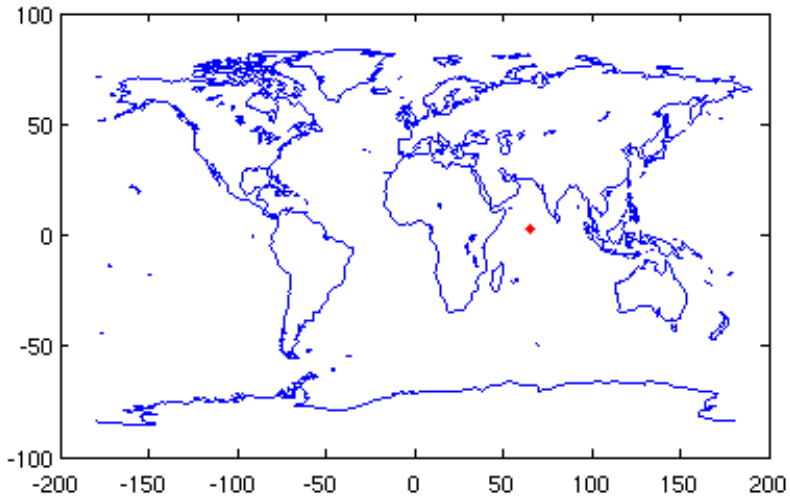


Results

Iversion for:

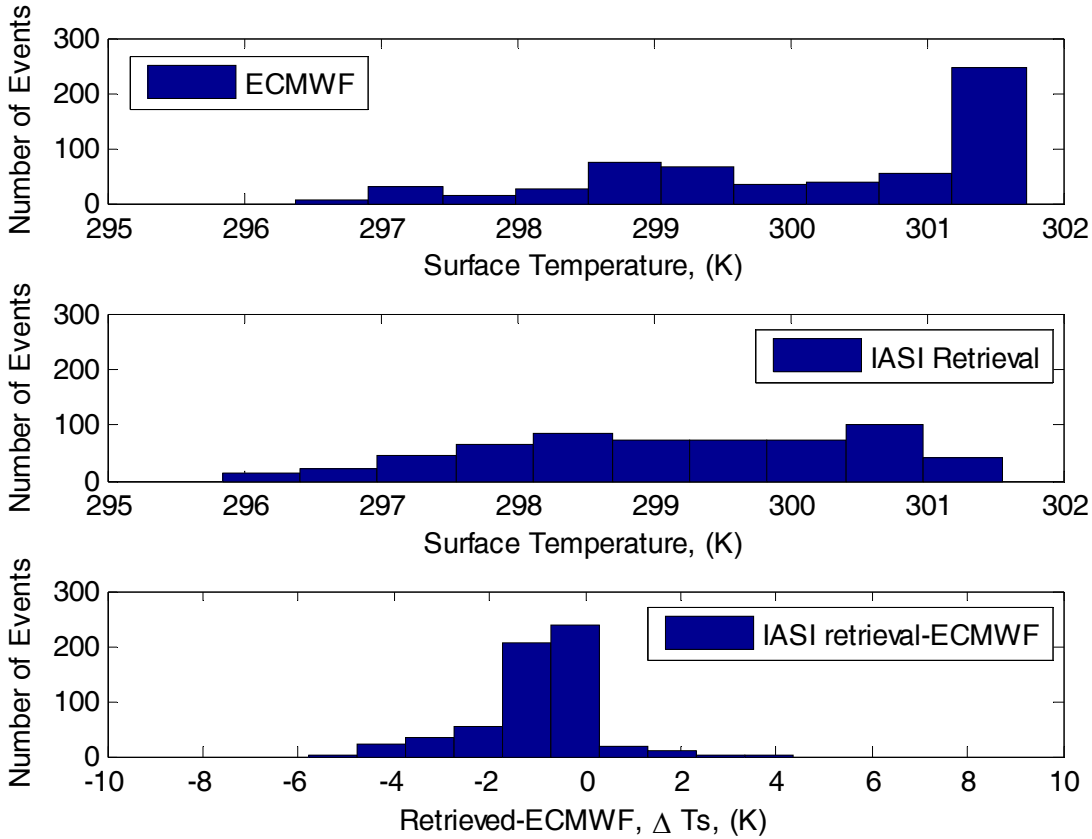
- Ts
- T profile
- H_2O profile
- O_3 profile

Consistency of the results checked by comparison with

ECMWF analysis

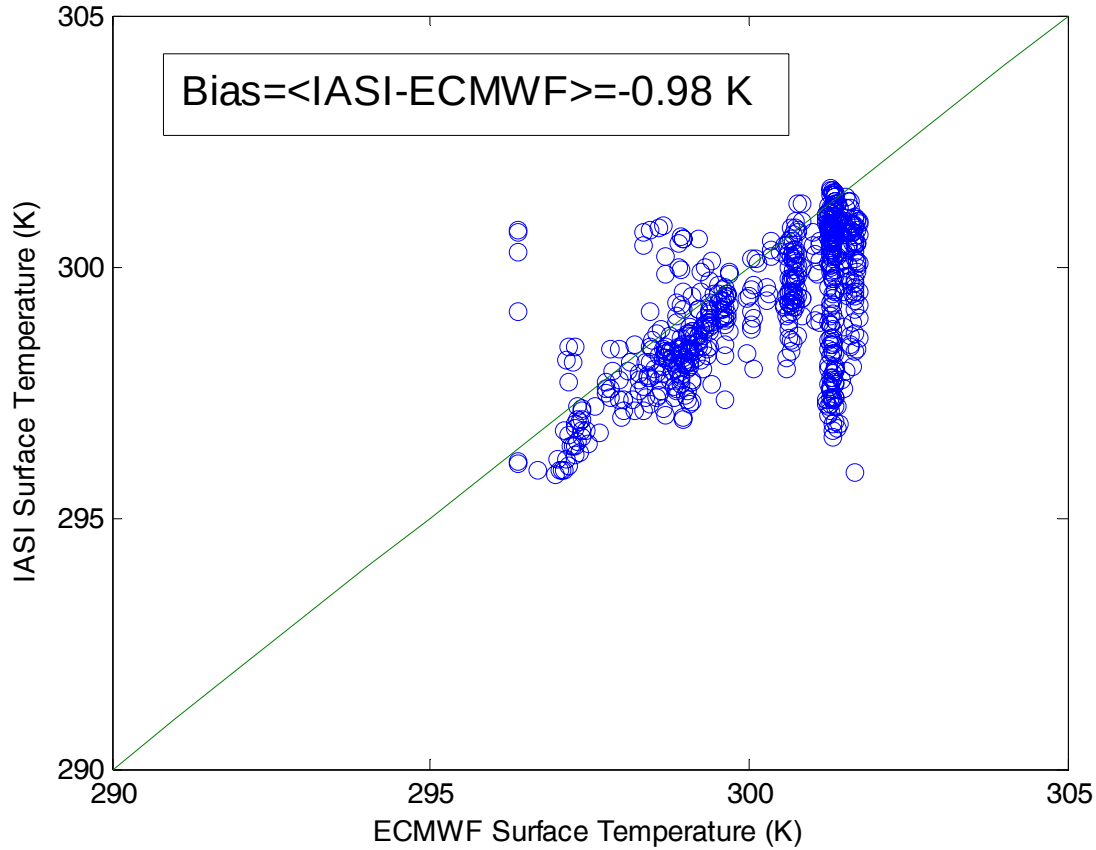
Comparing ECMWF Surface Temperature to the IASI retrieval

(Total of 603 Tropical IASI soundings)



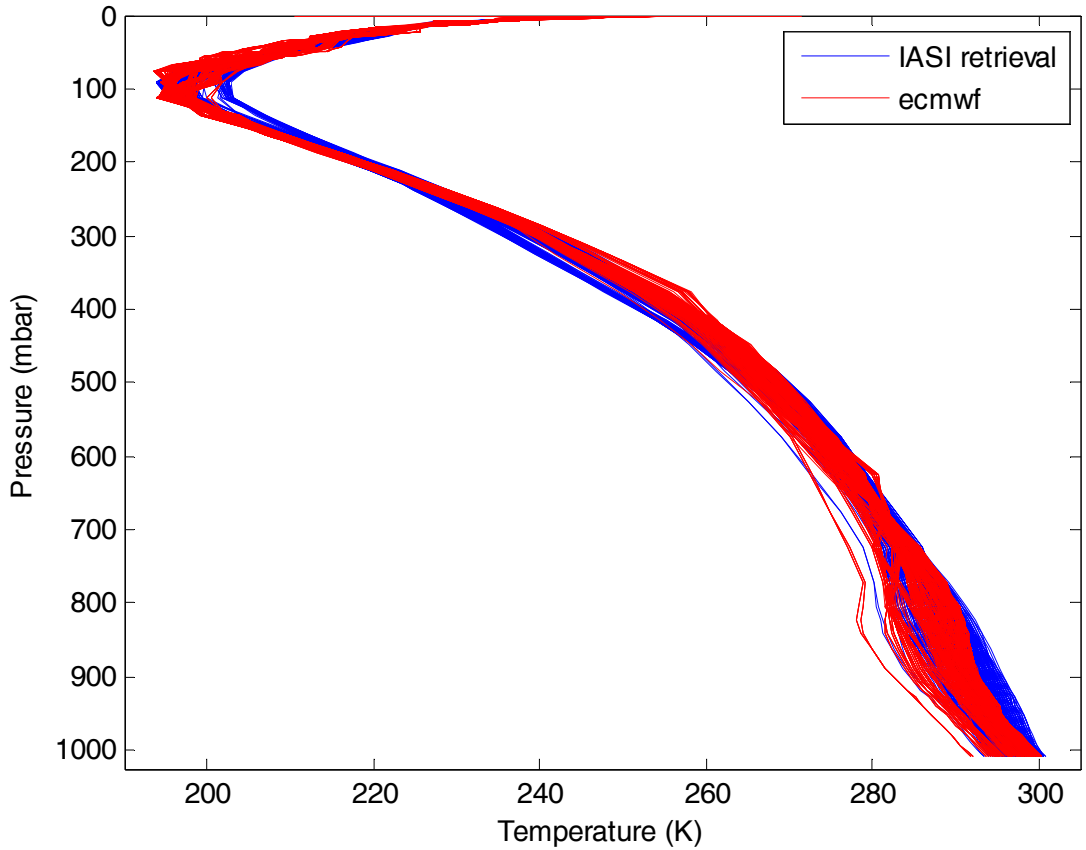
Scatter plot for the Surface Temperature

IASI vs ECMWF



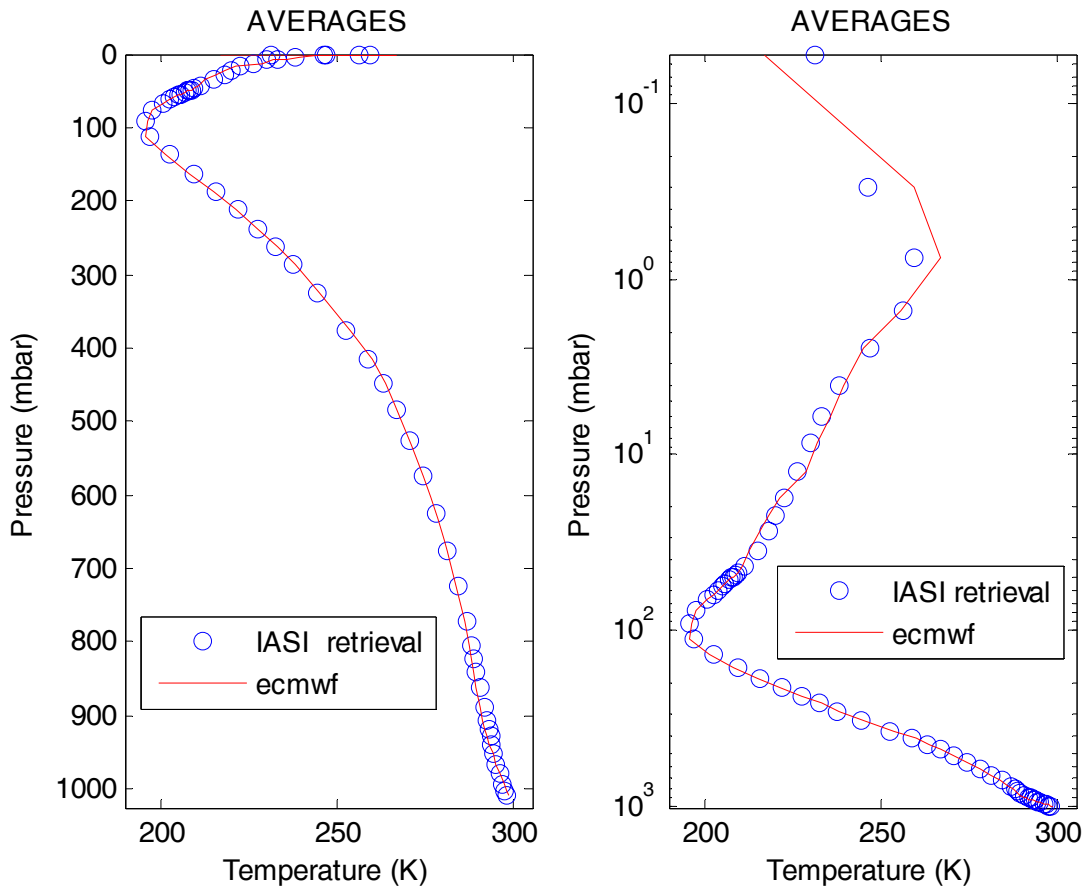
Comparing ECMWF Temperature profiles to the IASI retrieval

(Total of 603 Tropical IASI soundings)

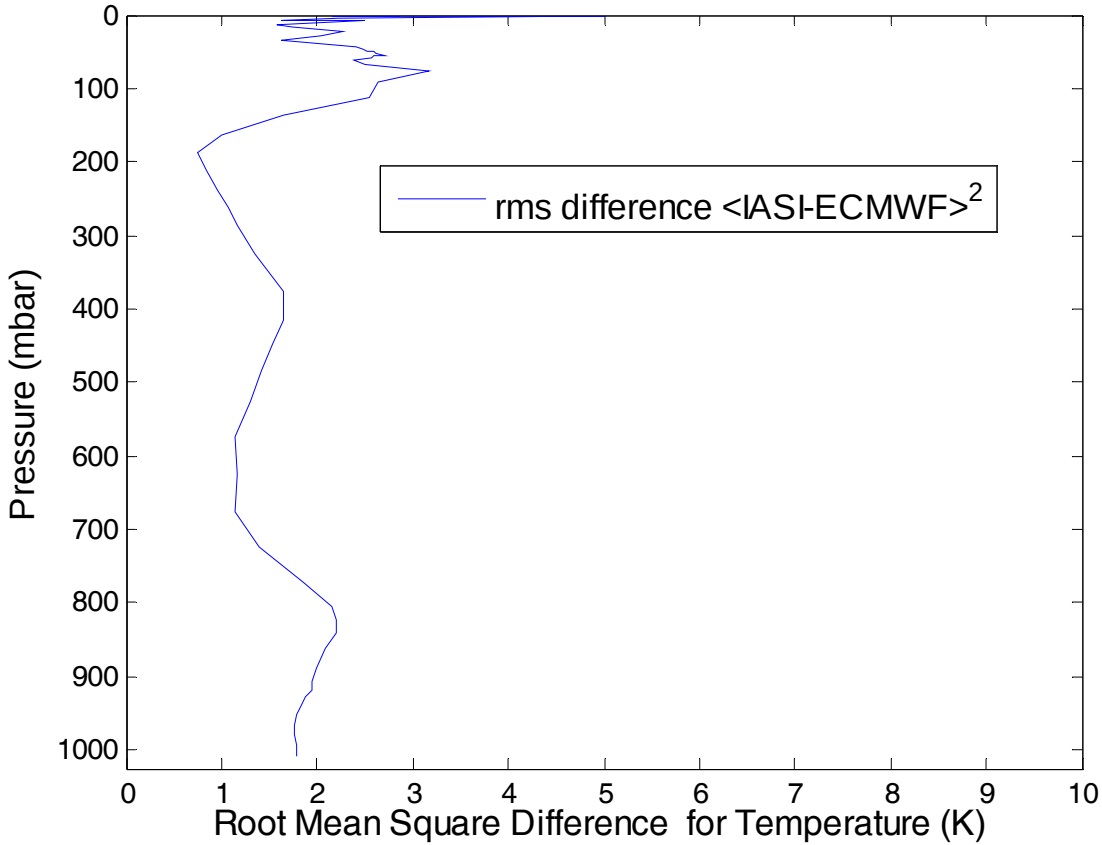


Comparing ECMWF Temperature profiles to the IASI retrieval (Averages over a total of 603 Tropical IASI soundings).

Right panel, y-axis linear scale; Left panel, y-axis log scale



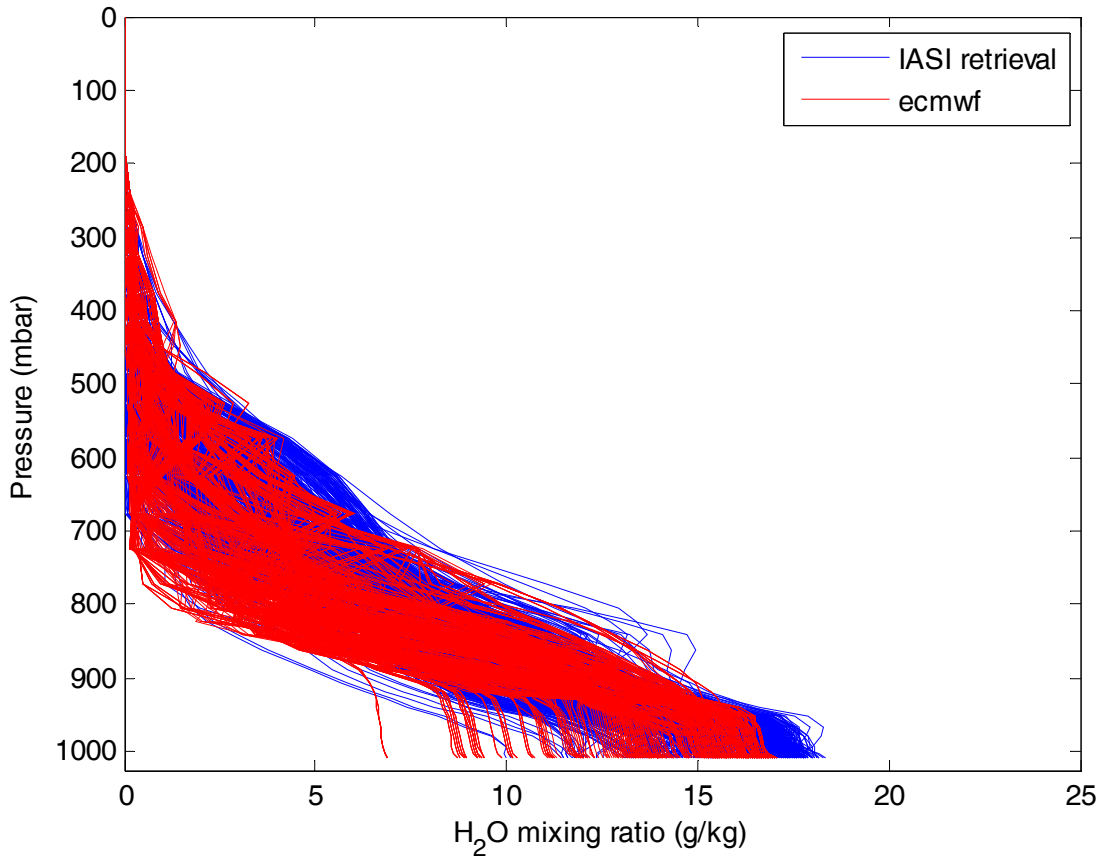
Comparing ECMWF Temperature profiles to the IASI retrieval (root mean square difference computed over a total of 603 Tropical IASI soundings).



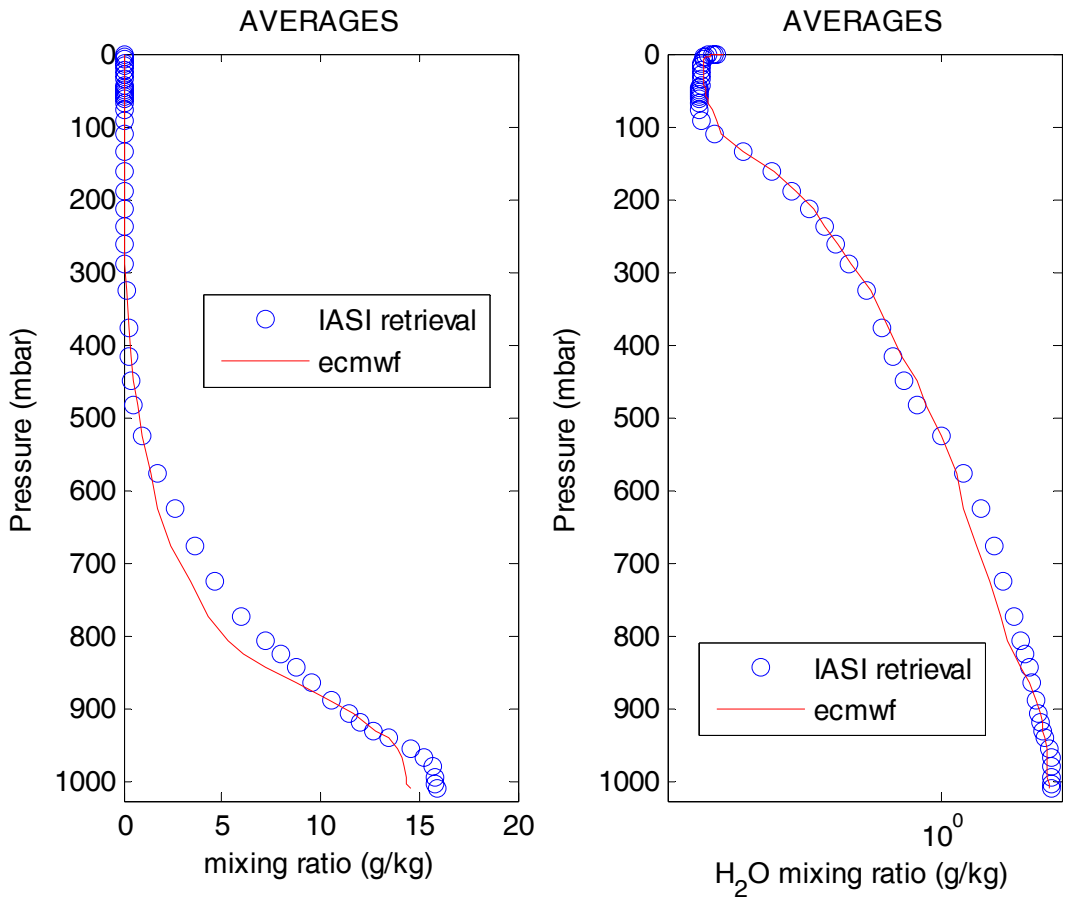
Include ECMWF and IASI retrieval accuracy

Comparing ECMWF H_2O profiles to the IASI retrieval

(Total of 603 Tropical IASI soundings)

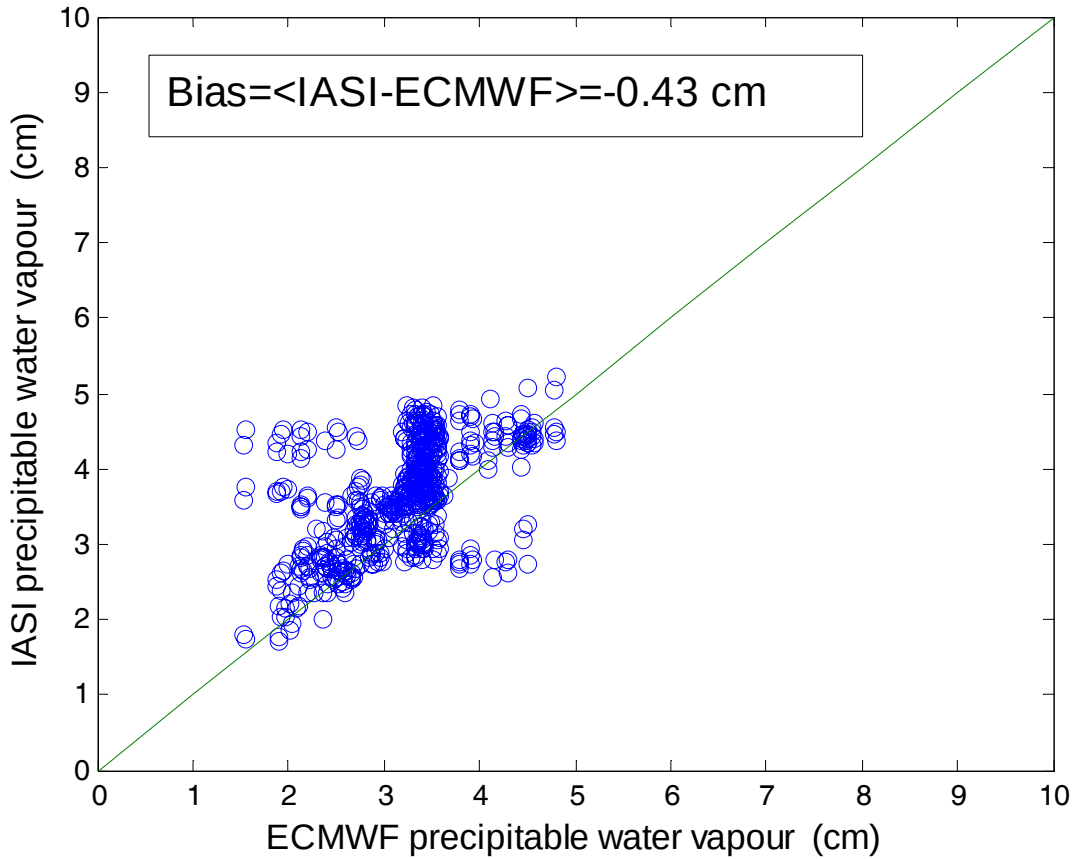


Comparing ECMWF H_2O profiles to the IASI retrieval (Averages over a total of 603 Tropical IASI soundings). Right panel, linear scale; Left panel, x-axis log scale

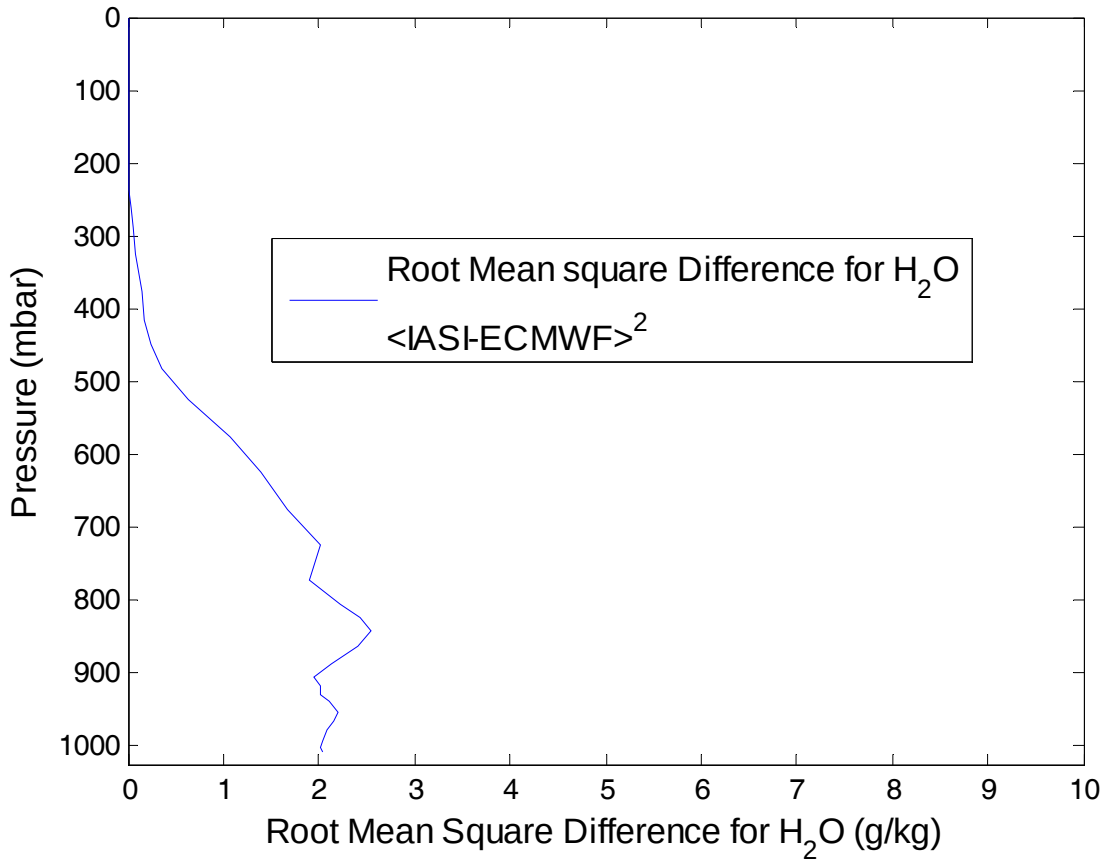


Scatter plot for PWV

IASI vs ECMWF



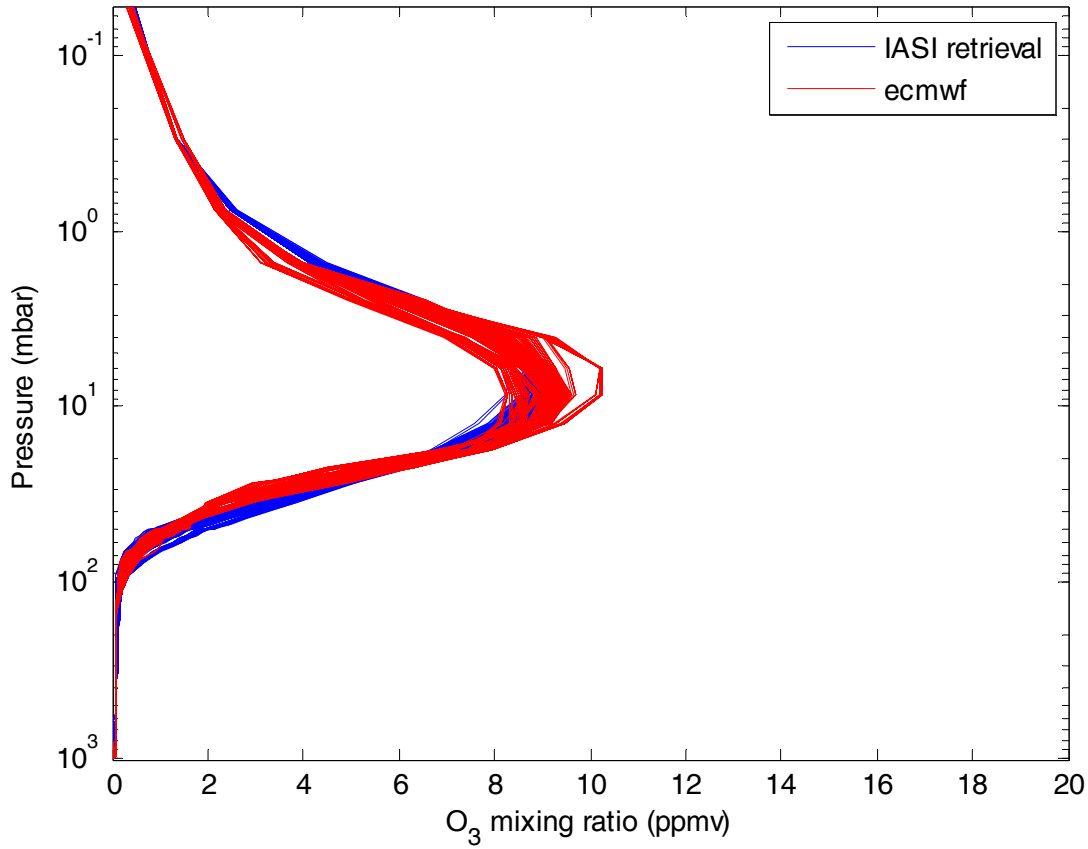
Comparing ECMWF H_2O profiles to the IASI retrieval (root mean square difference computed over a total of 603 Tropical IASI soundings).



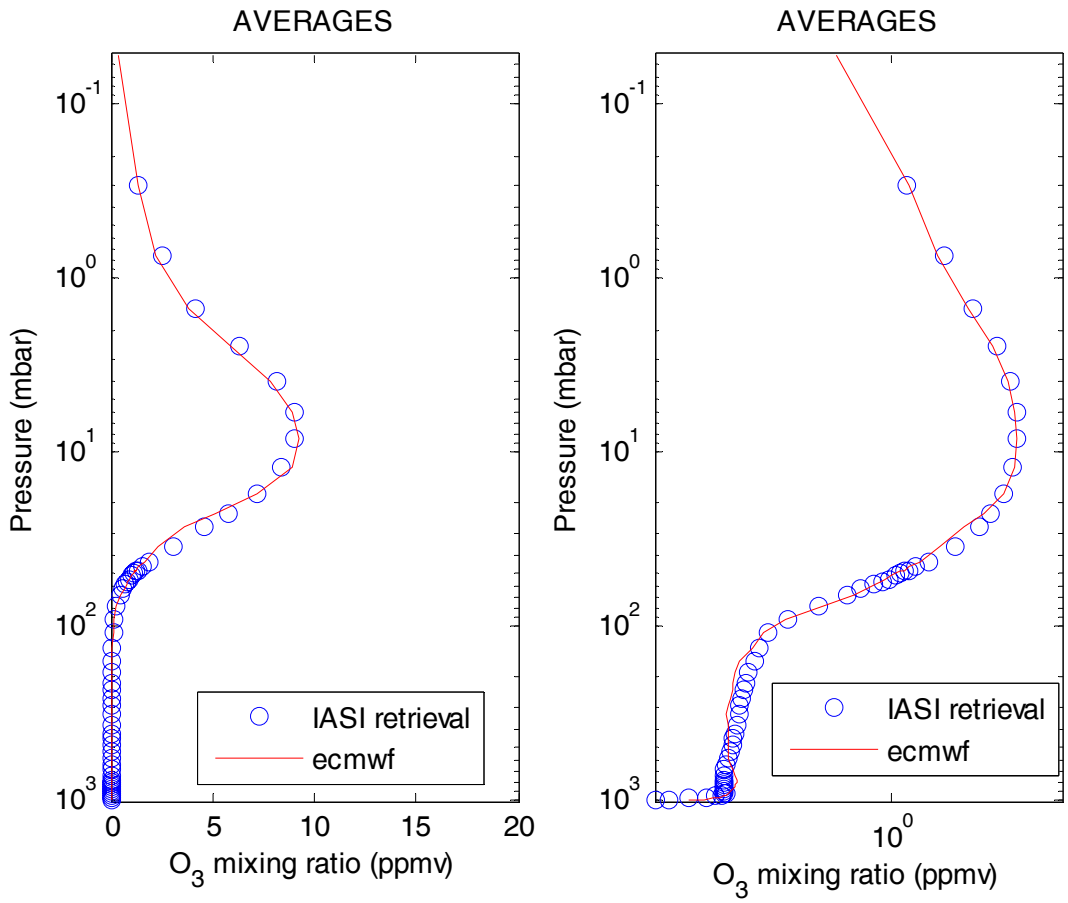
Include ECMWF and IASI retrieval variability

Comparing ECMWF O_3 profiles to the IASI retrieval

(Total of 603 Tropical IASI soundings)

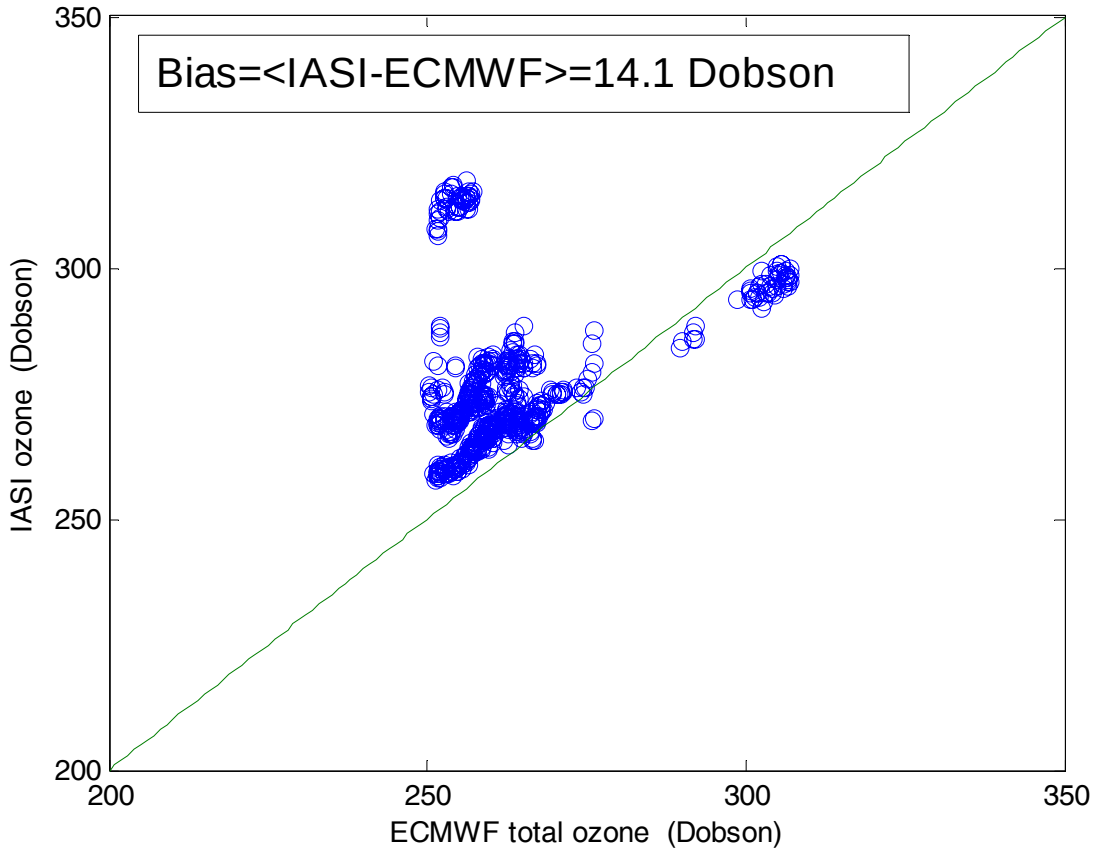


Comparing ECMWF O_3 profiles to the IASI retrieval (Averages over a total of 603 Tropical IASI soundings). Right panel, y-axis log scale; Left panel, log-log scale

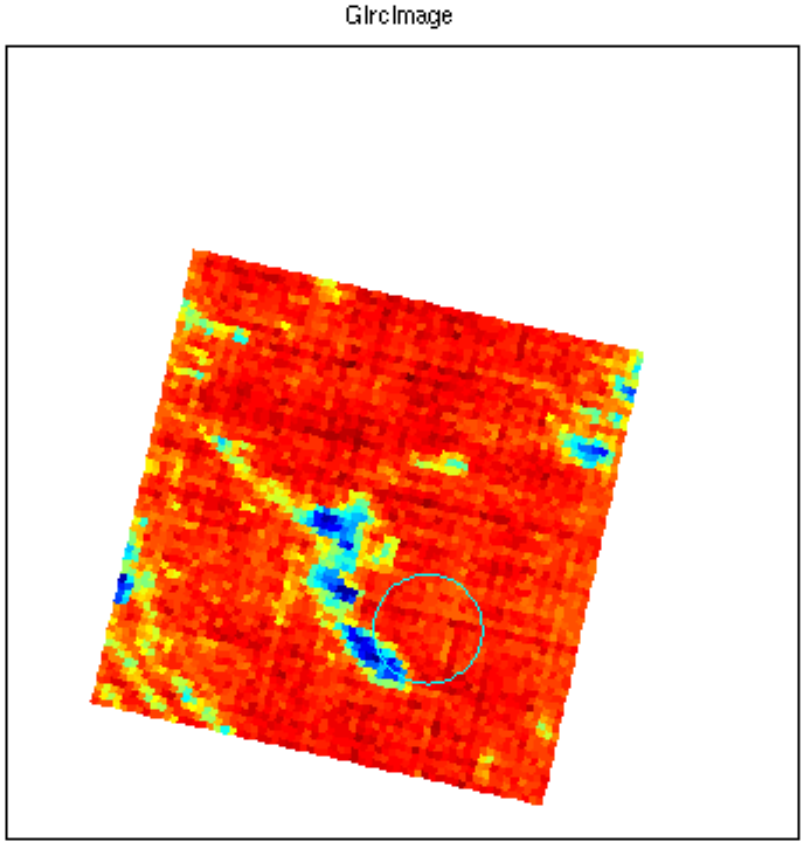


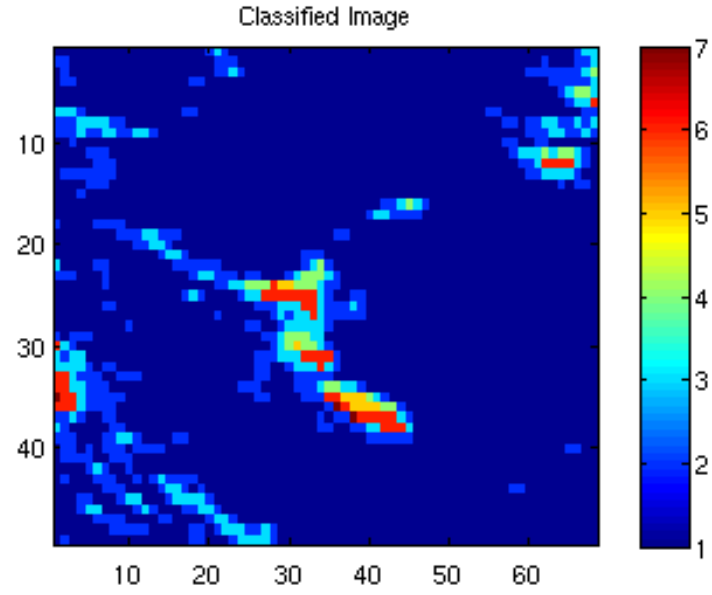
Scatter plot for Total Ozone

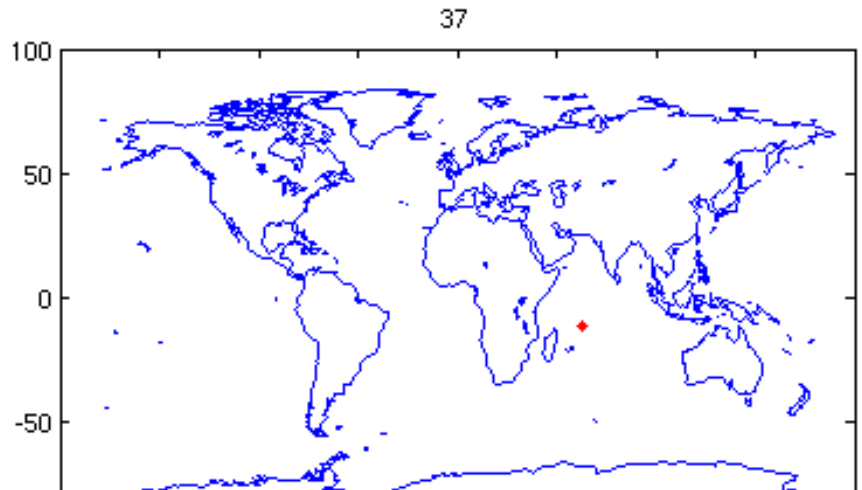
IASI vs ECMWF



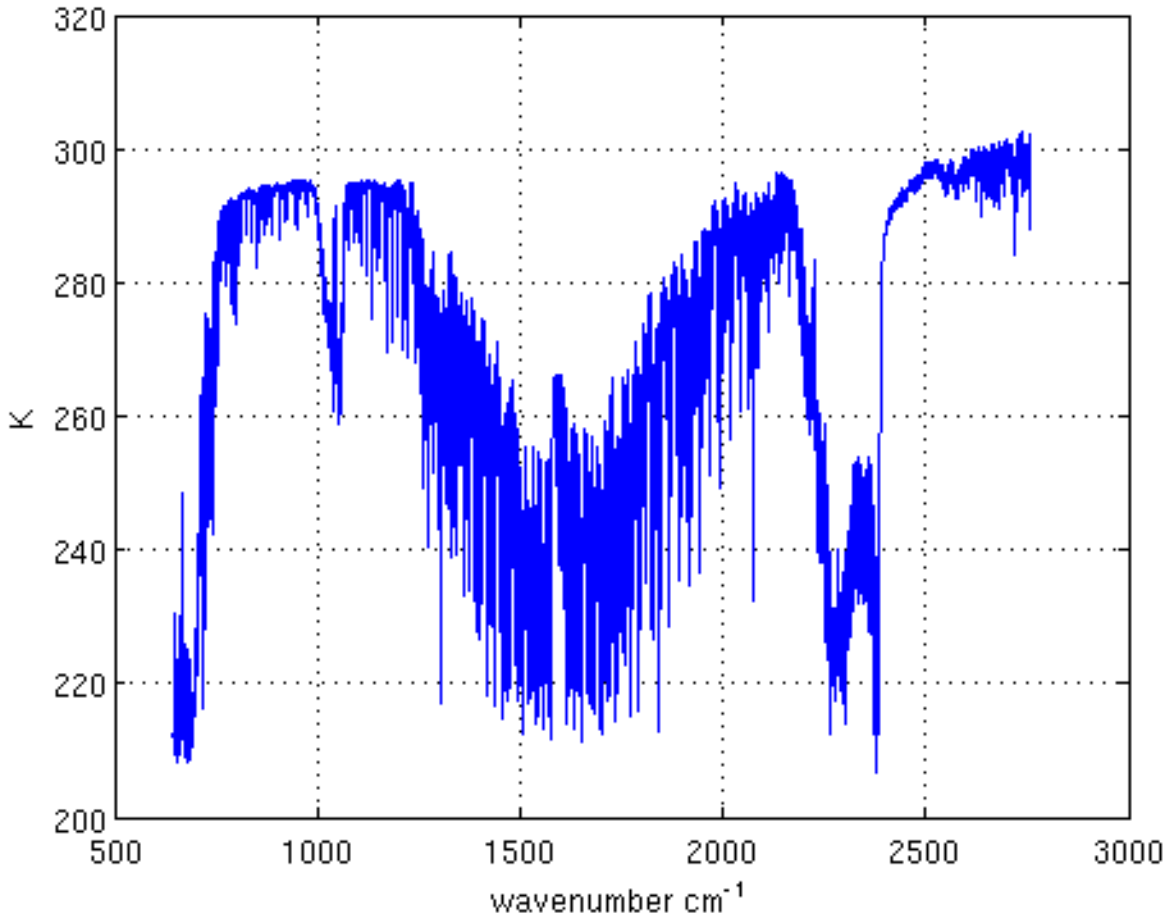
An example of slightly cloudy spectrum







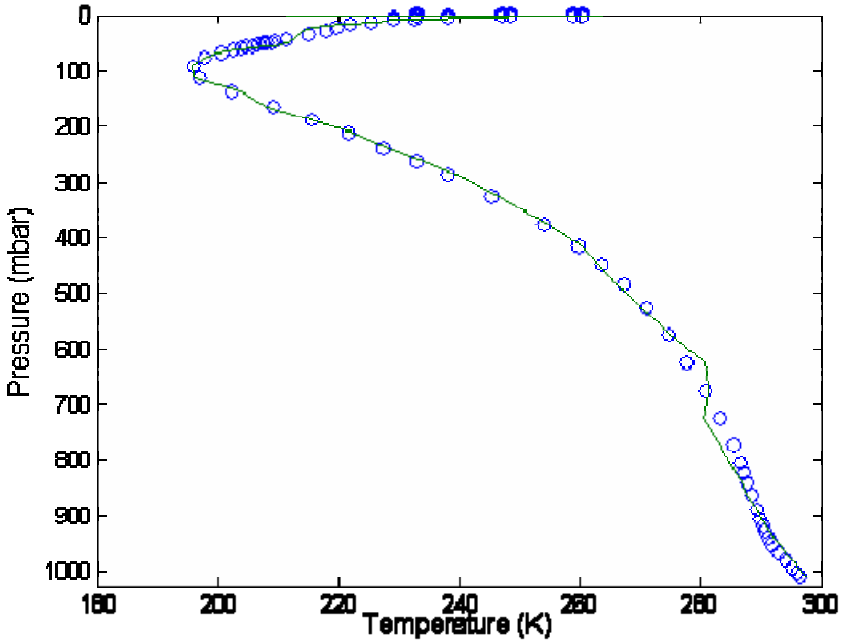
An example of slightly cloudy spectrum



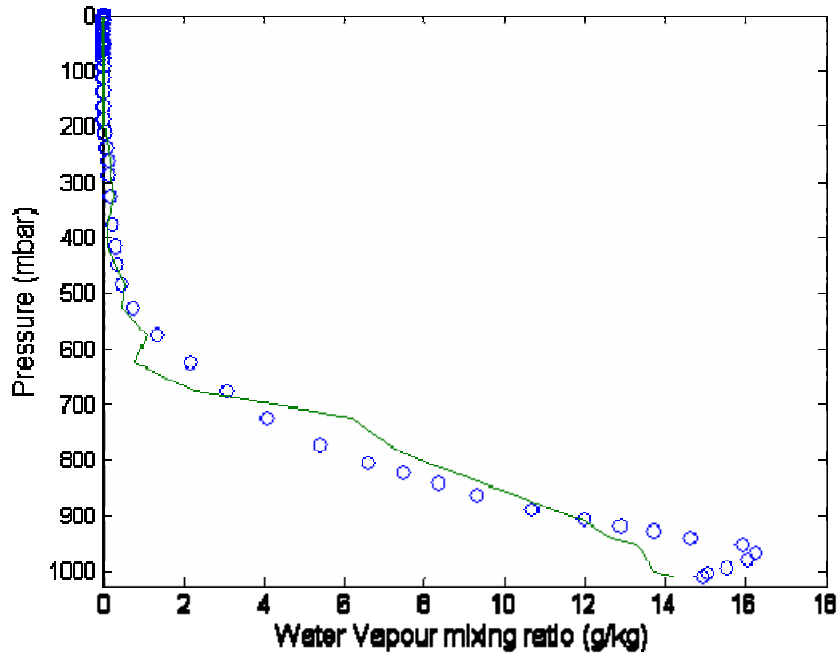
IASI sounding at

Lat. -11.0623° N, Lon. 62.4207 ° E

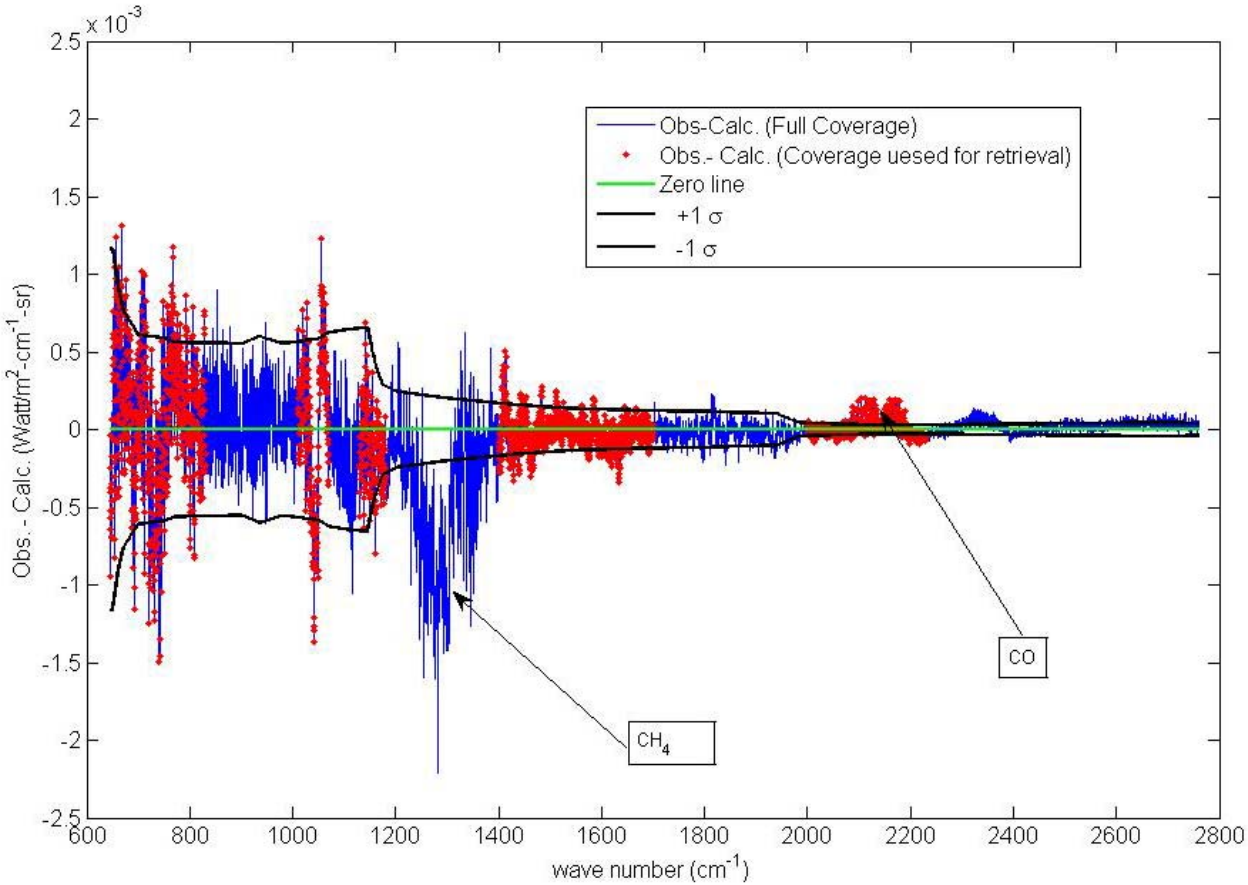
Temperature Retrieval



Water Vapour Retrieval



Green is ECMWF and
blue is IASI retrieval



σ-IASI consistency assessed on the basis of a tropical IASI sounding

The spectral ranges in red correspond to the radiances used in the inversion process. The ranges in blue have not been fitted. The χ^2 normalized to the data points, χ^2/N is equal to 1.015 (only red radiances)

Conclusions

- Although our analysis is still preliminary, we have demonstrated the capability of the end-to-end φ-IASI package to process High Spectral Resolution Infrared Observations
- This preliminary analysis shows a very nice consistency and quality of IASI data.
- Temperature is retrieved with no important bias, once compared to ECMWF
- Water vapour and ozone compare well to ECMWF products.
- IASI spectra show a very high sensitivity to Methane and CO.
- We congratulate engineers for having built up an instrument according to the design and requirements issued and defined in a close to twenty years ISSWG group activities.