

Using IASI Retrieved CO Measurements to Characterise CO Emissions from Local African Fires

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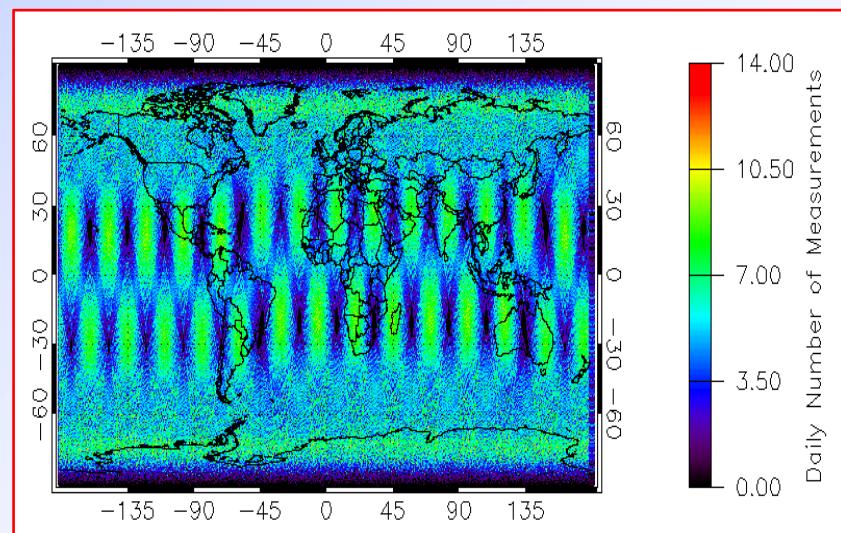
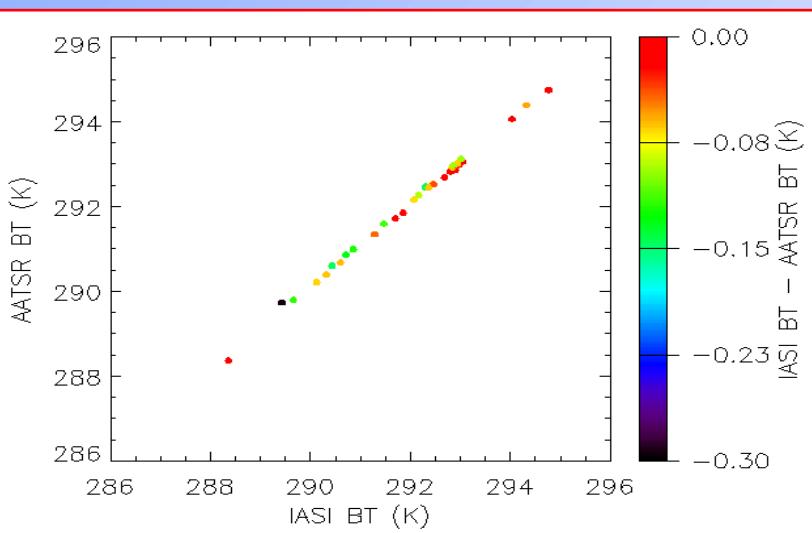
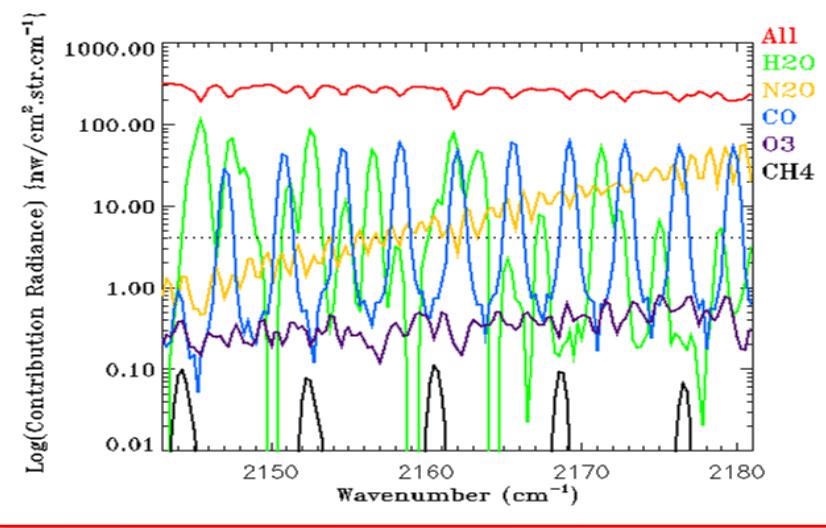
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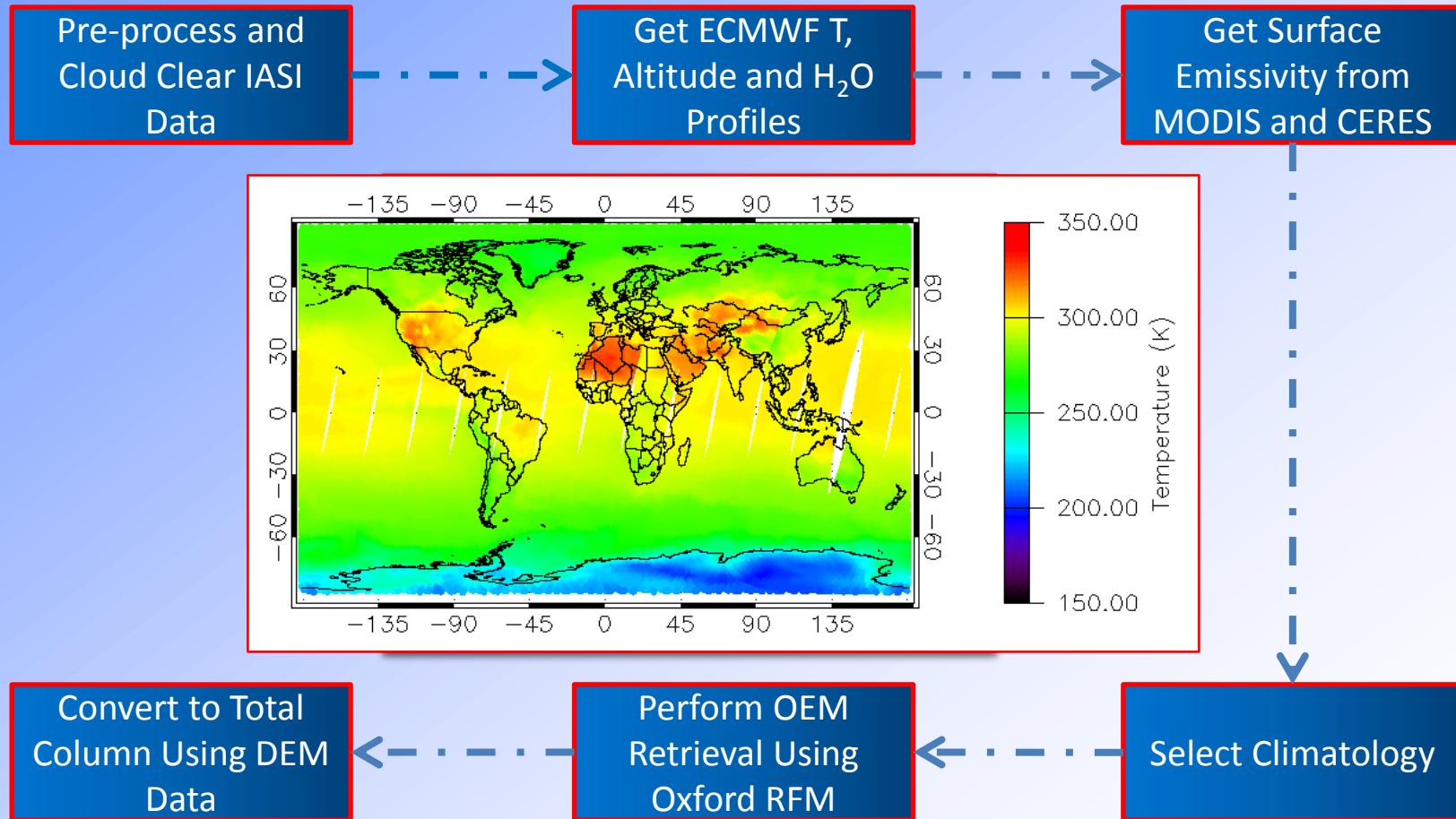
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IASI

- Ideal for measuring CO because:
 - Good spectral resolution and low noise in 4.7 μm region.
 - High Radiometric Accuracy (Better than 0.5K: Illingworth et al, 2009).
 - High Temporal Frequency (Twice daily global coverage).

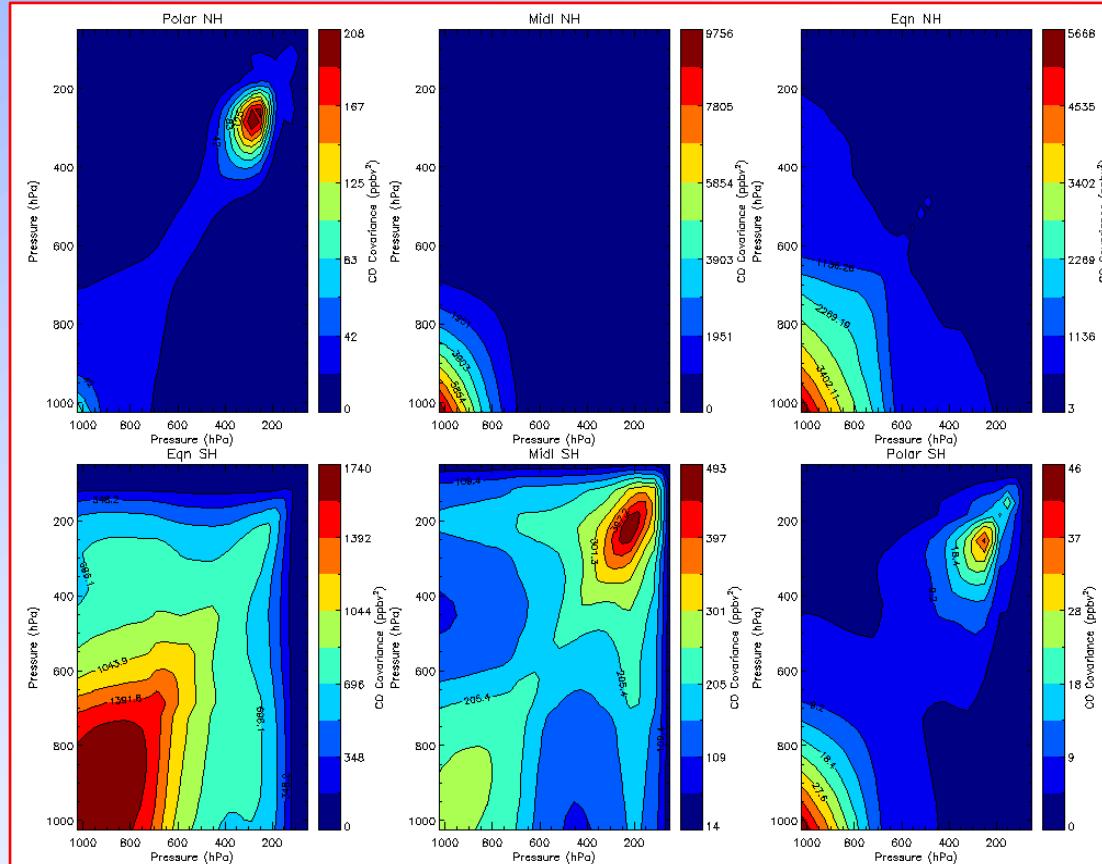
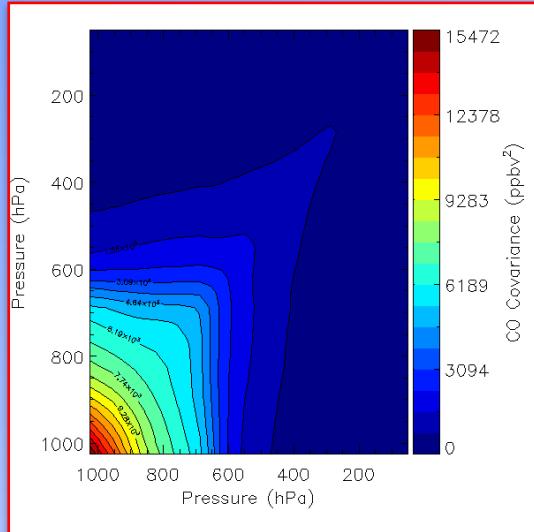


ULIRS



Computing the CO A Priori

- Calculated from TOMCAT data.
- Region that was chosen is -20° to 50° longitude and -30° to 30° latitude, for 2004.
- Only profiles where surface CO VMR >100 ppbv were chosen, this equated to over 20000 profiles.
- Constant S_a and x_a chosen so any features in the retrievals can not be traced back to the a priori.

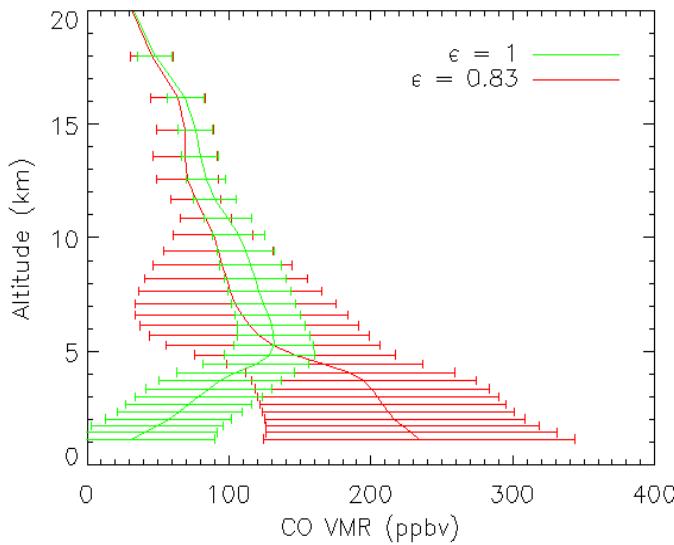


Above: S_a for ULIRS.
Right: S_a for NH Winter and IG2 zones.

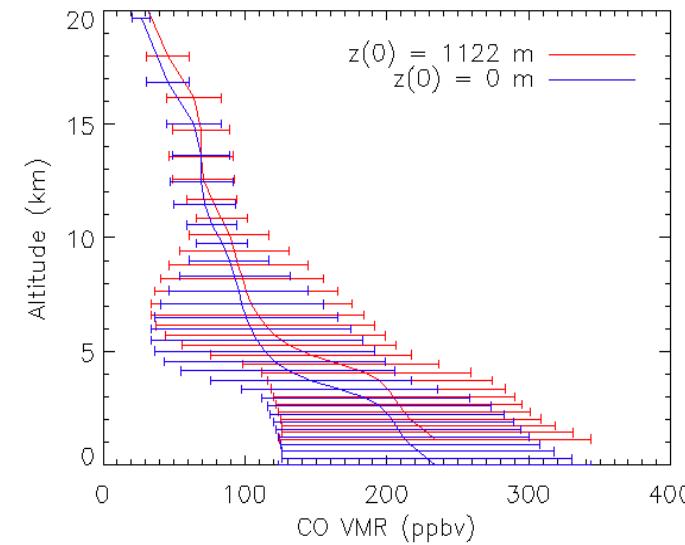


Importance of Auxiliary Data

Emissivity



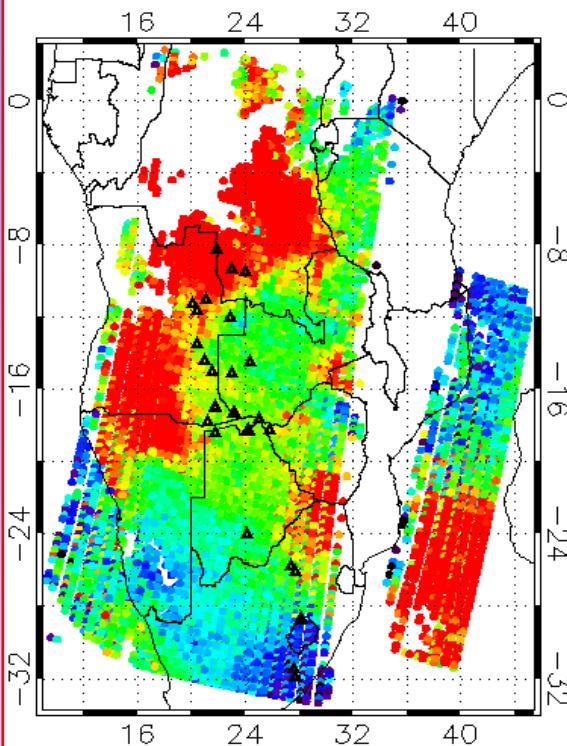
Topography



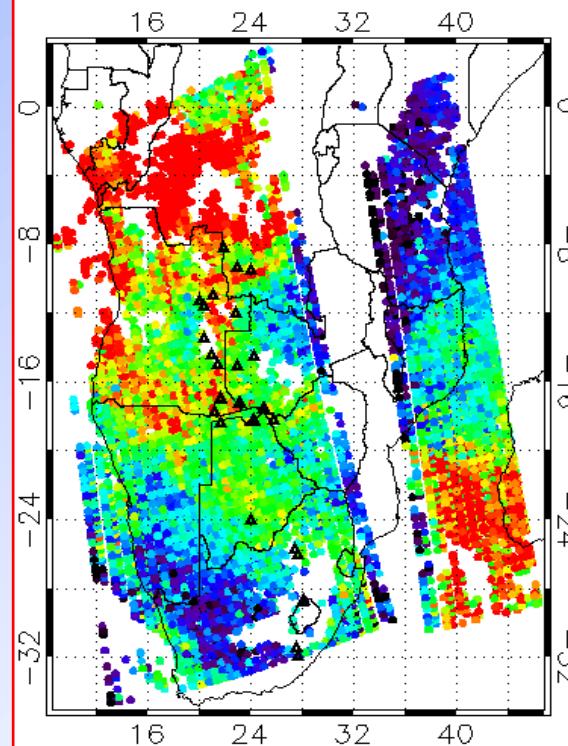


IASI CO Plots: 1st September 2007

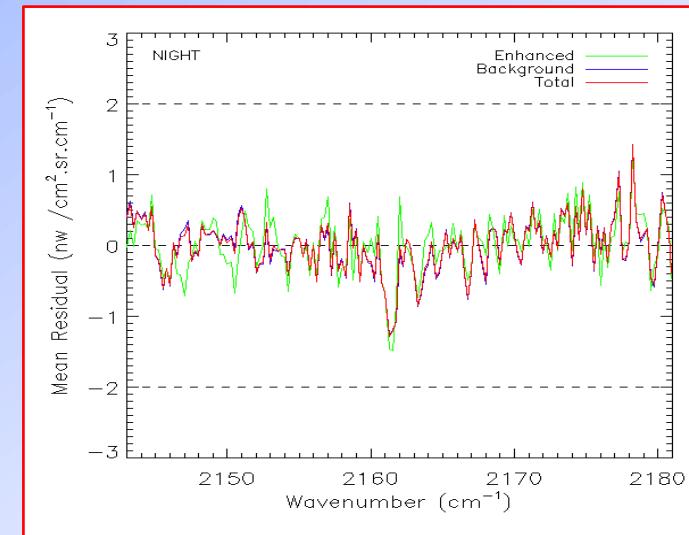
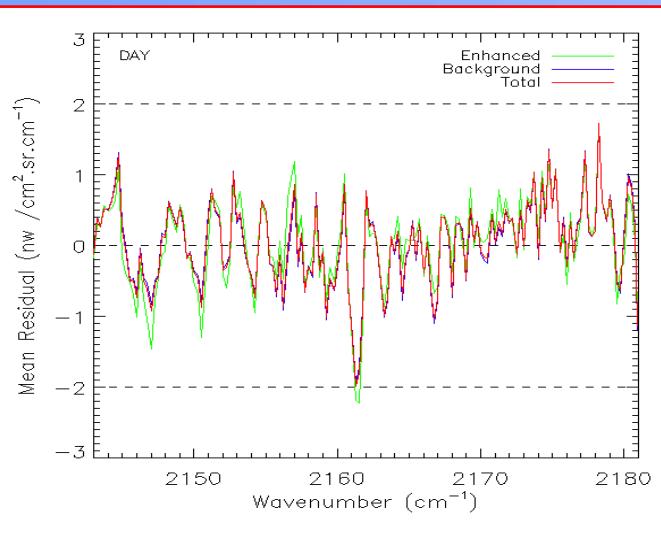
DAY



NIGHT



Residuals

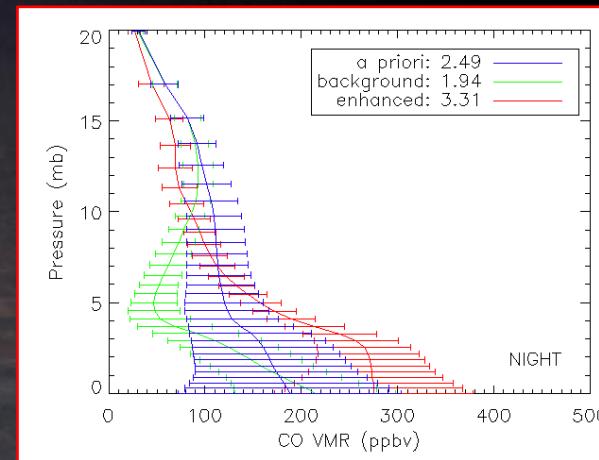
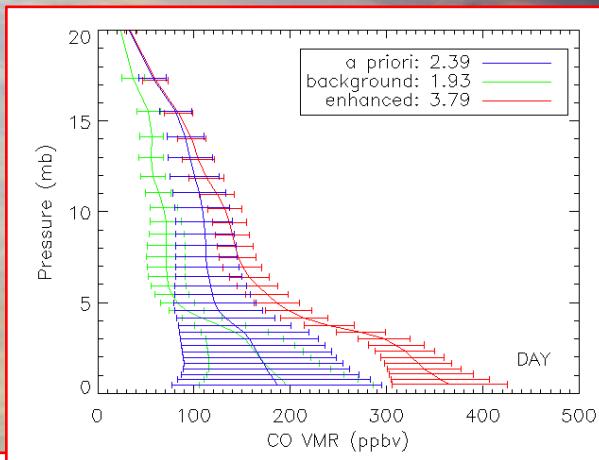
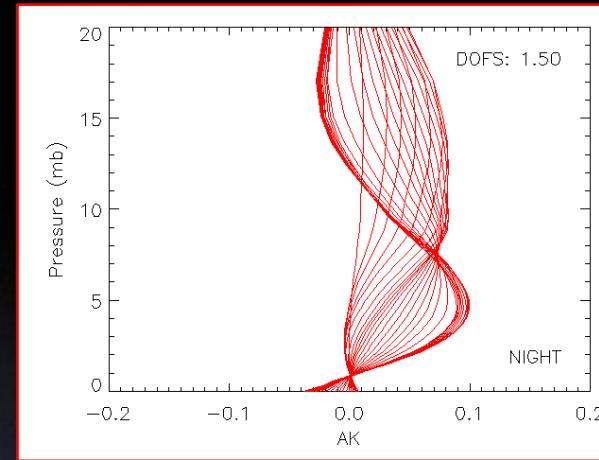
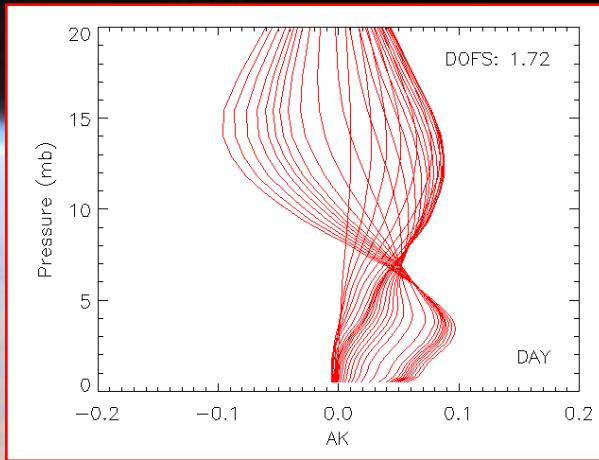


	Day Total CO RMS (10^{18} molecules/ cm^2)	Day Residual RMS ($\text{nW}/(\text{cm}^2.\text{cm}^{-1}.\text{sr})$)	Night Total CO RMS (10^{18} molecules/ cm^2)	Night Residual RMS ($\text{nW}/(\text{cm}^2.\text{cm}^{-1}.\text{sr})$)
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Background	2.20 ± 0.40 (6519)	0.60 ± 0.61 (6519)	2.08 ± 0.49 (7155)	0.40 ± 0.40 (7155)
Enhanced Region	3.44 ± 0.33 (1164)	0.63 ± 0.63 (1164)	3.47 ± 0.43 (779)	0.41 ± 0.41 (779)

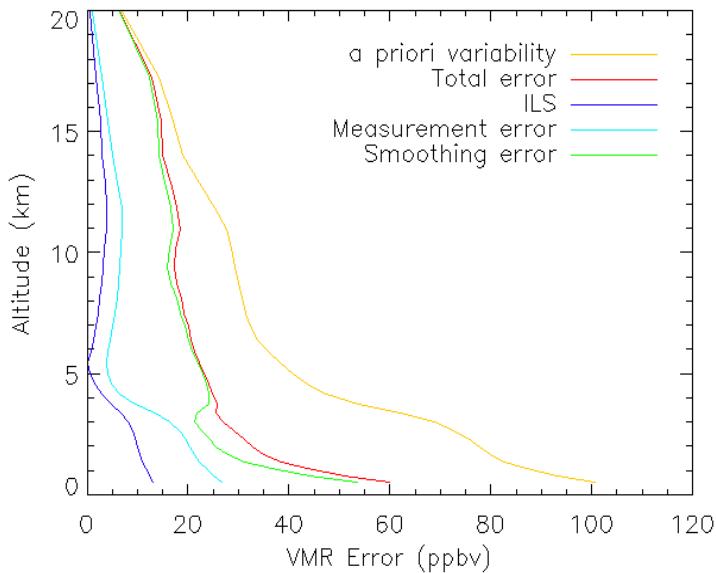


Retrieved Profiles and Averaging Kernels

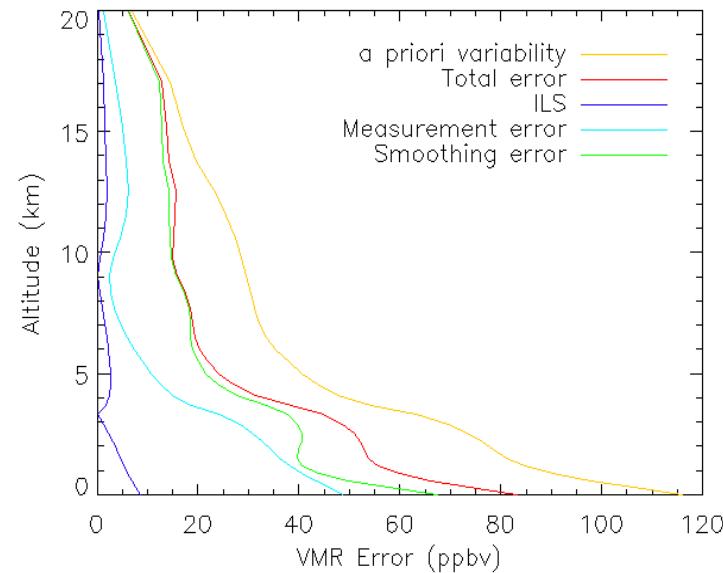


Retrieval Errors

Day, Enhanced



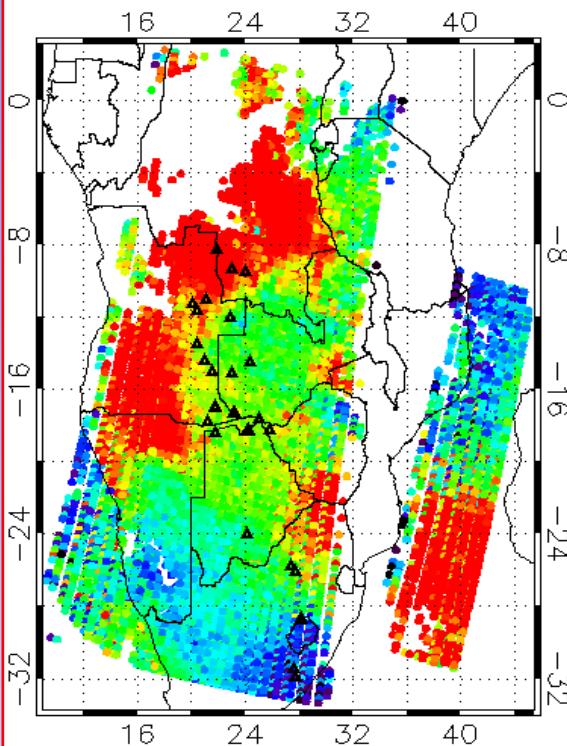
Night, Background



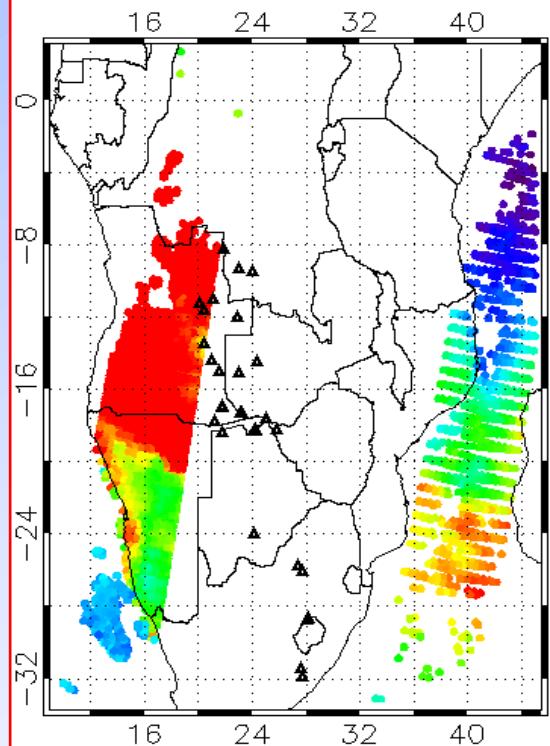


DAY CO Plots: 1st September 2007

IASI

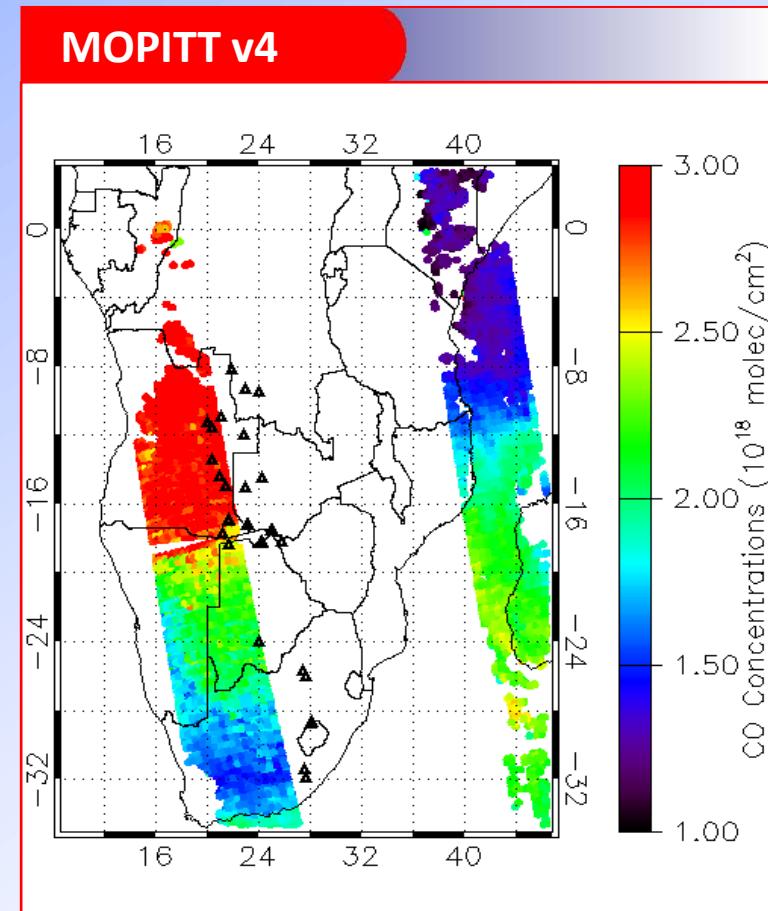
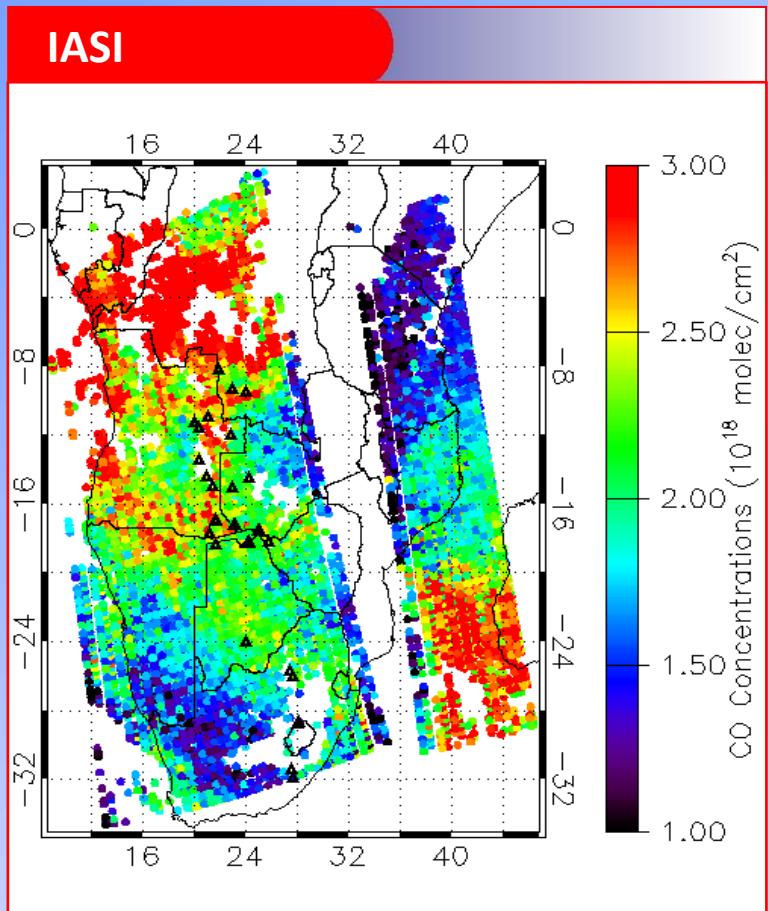


MOPITT v4



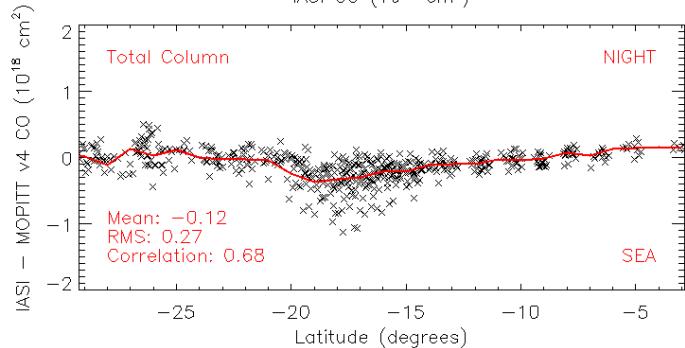
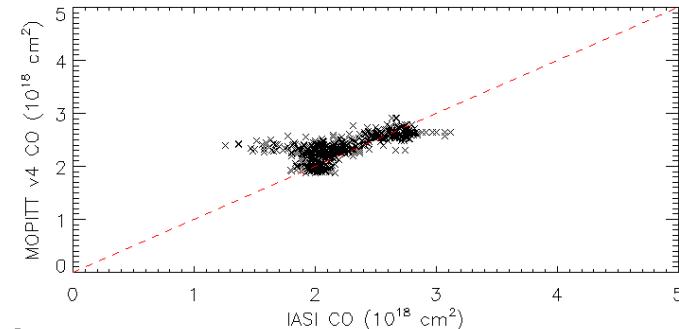


NIGHT CO Plots: 1st September 2007

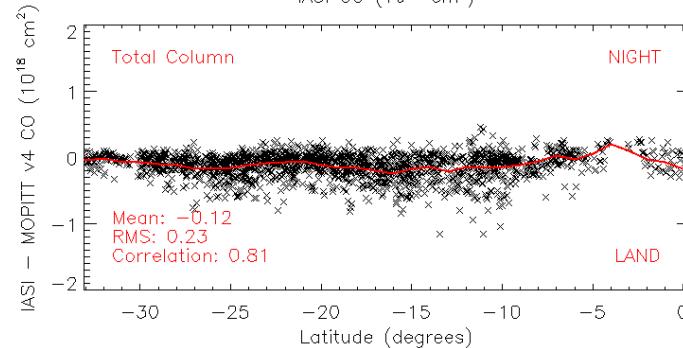
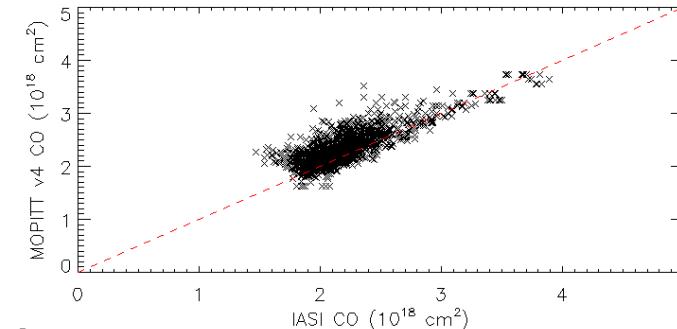


IASI - MOPITT v4 CO (NIGHT)

SEA

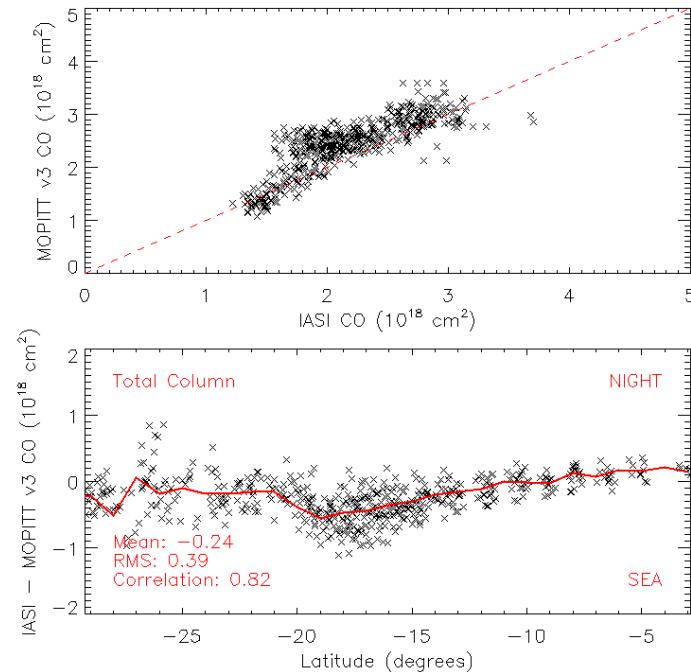


LAND

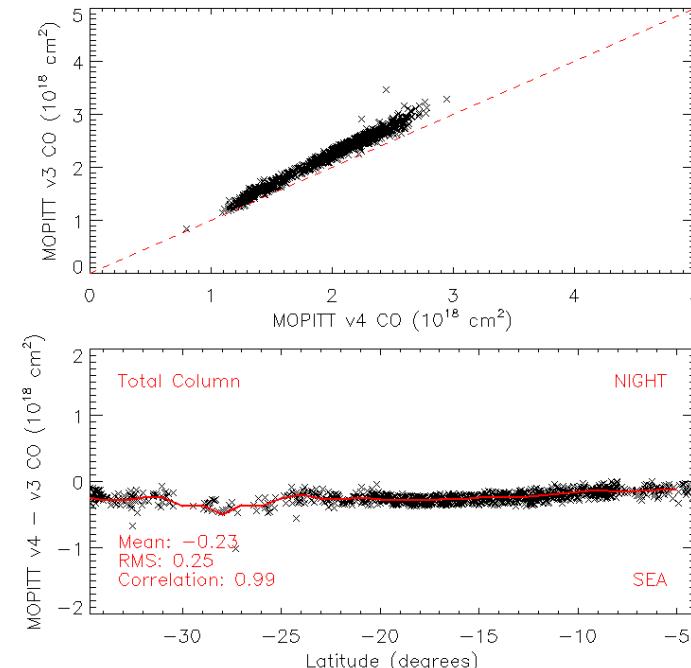


Comparison with MOPIIT v3 data

IASI – MOPITT v3

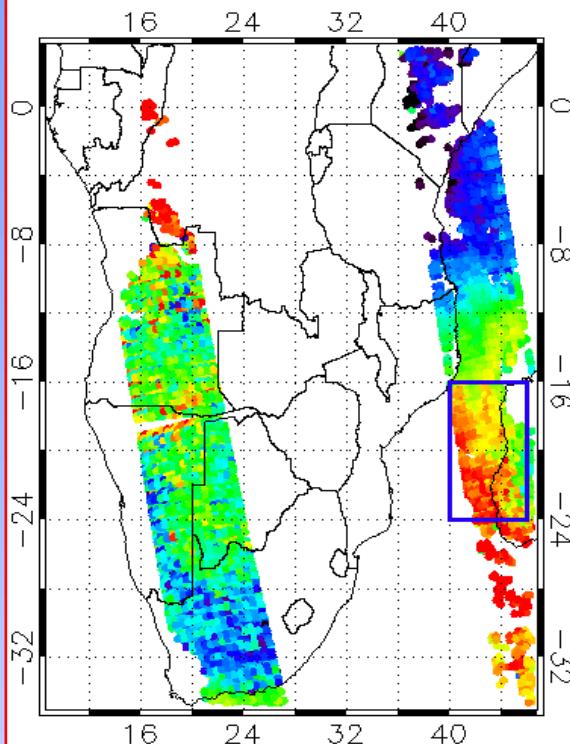


MOPIIT v4 – v3

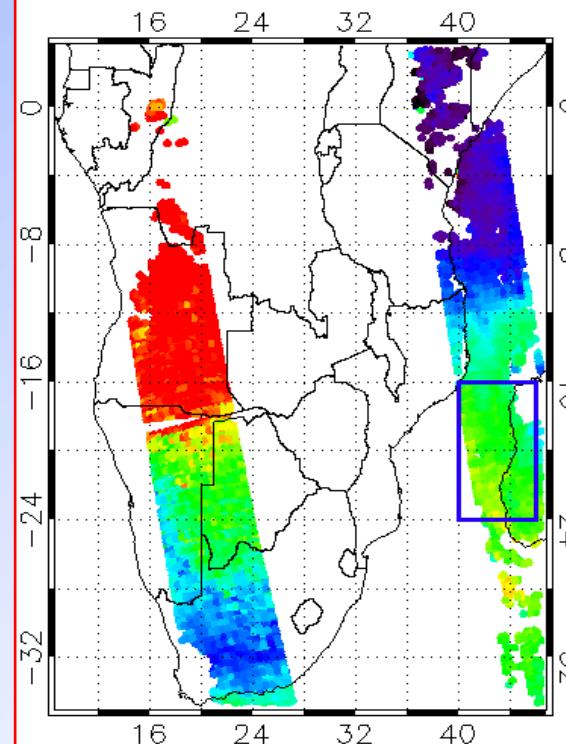


Plume Not Detected by MOPITT v4 data?

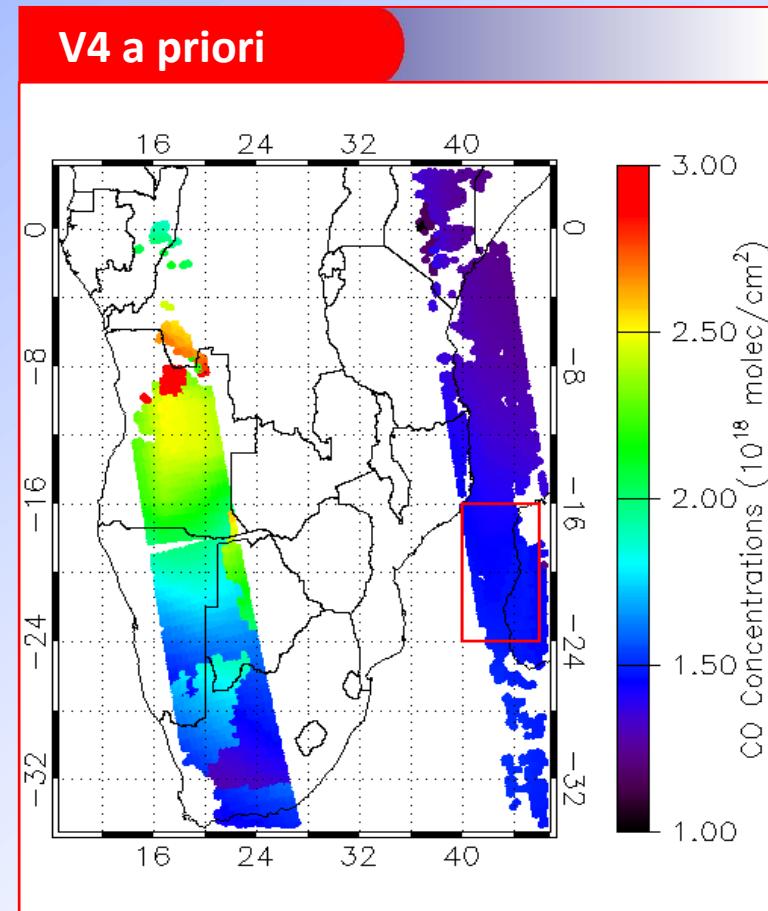
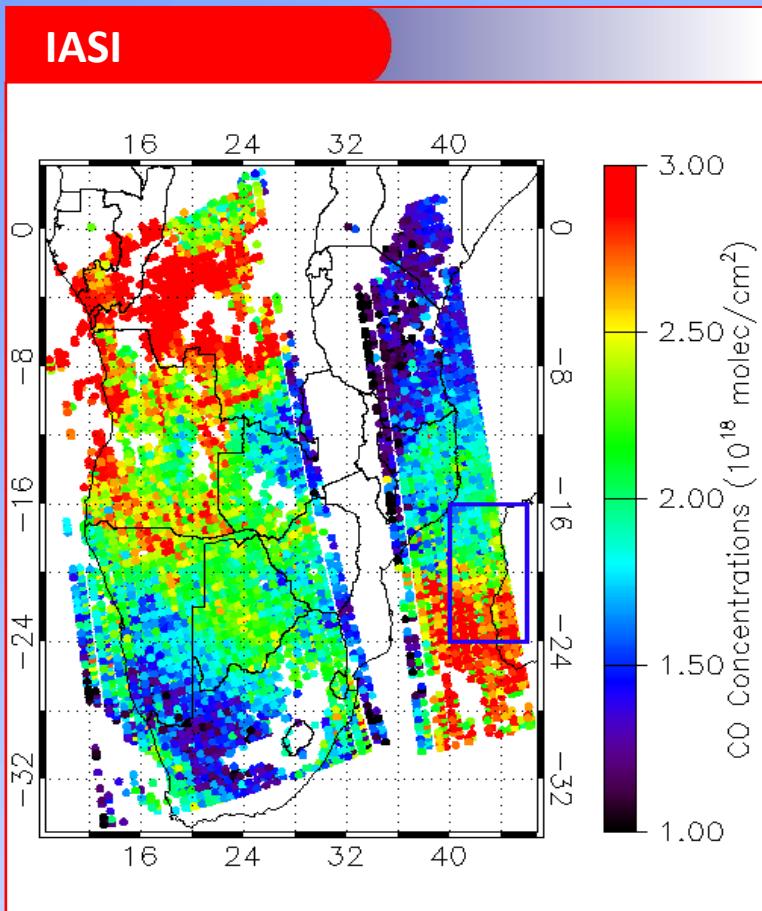
MOPITT v3



MOPITT v4

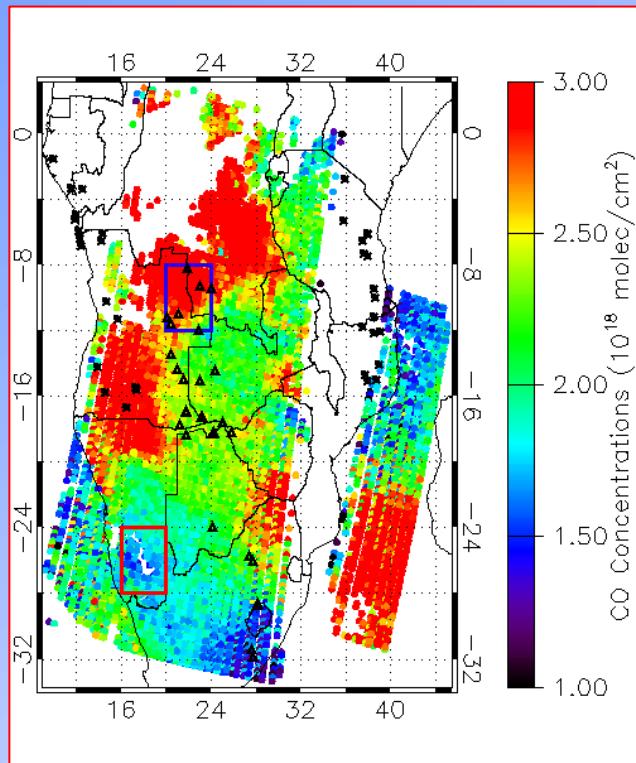


Plume Not Detected by MOPITT v4 data?





Top-Down Estimation



Background = MEAN(Total Column) * Area
Enhanced = MEAN(Total Column) * Area
Emissions = Enhanced - Background

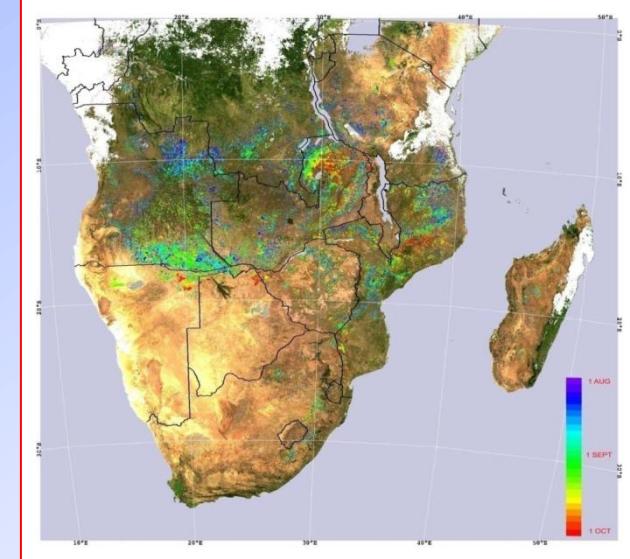
IASI: 0.0984 Tg
MOPITT v3: 0.1175 Tg
MOPITT v4: 0.1144Tg

Bottom-Up Estimation

$$\text{Emissions} = \text{BA} * \text{AFL} * \text{CC} * \text{EF}$$

- BA = Burnt Area (km^2)
- AFL = Available Fuel Load (kg dry matter km^{-2})
- CC = Combustion Completeness (%)
- EF = Emission Factor (g species / kg dry matter)

$$\text{Emissions} = \text{BA} * \text{AFL} * \text{CC} * \text{EF} = 0.1083 \text{ Tg}$$

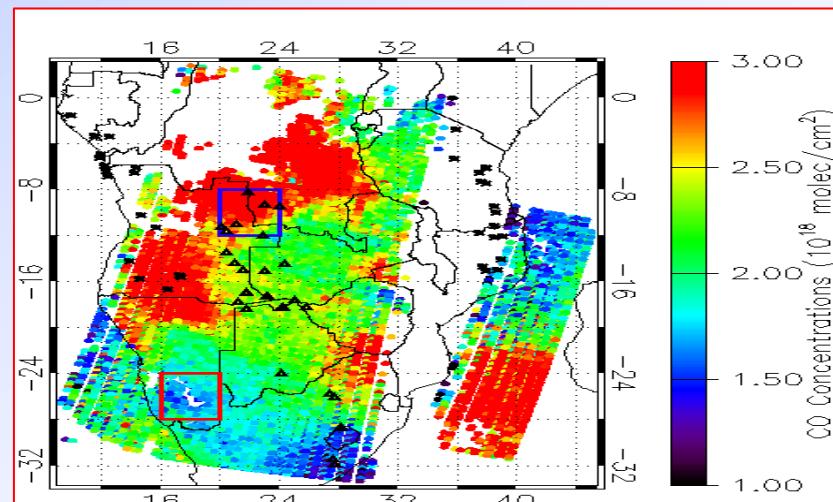
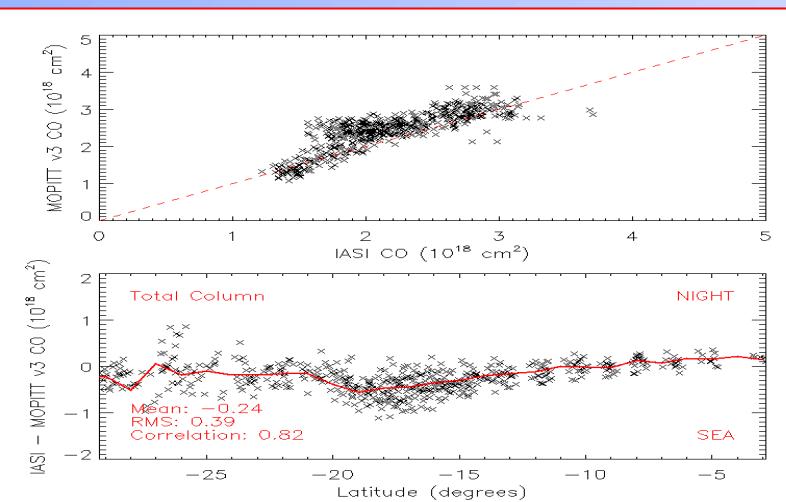
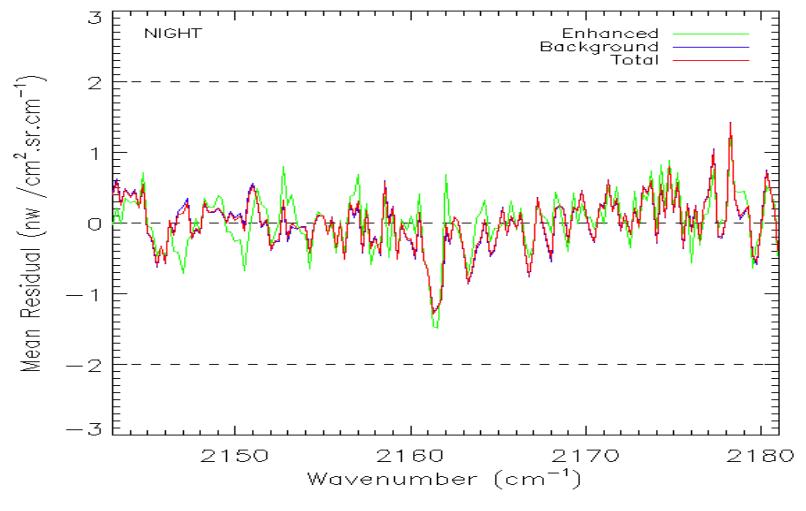


Estimates of the Total Global Burnt Area in 2000 ($\times 10^6 \text{ km}^2$) :

Methodology	GBA	L3JRC	GFEDv2	GLOBCAR
	3.56	3.73	3.51	1.92

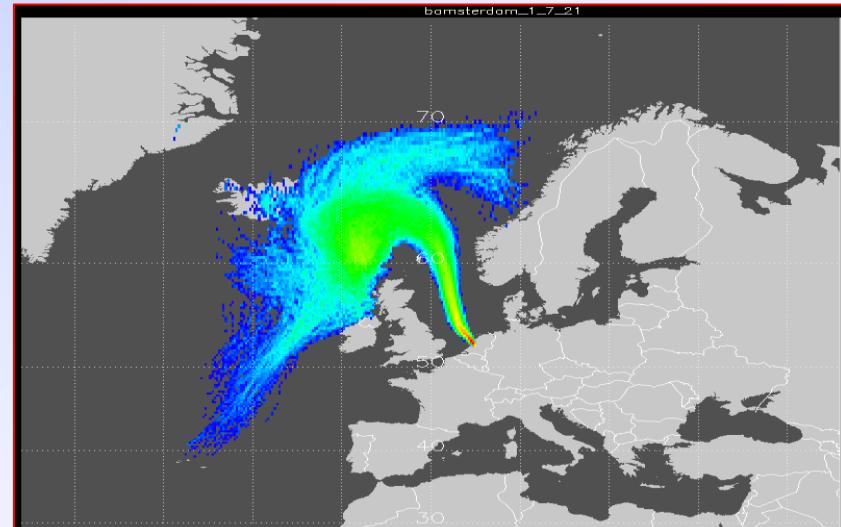
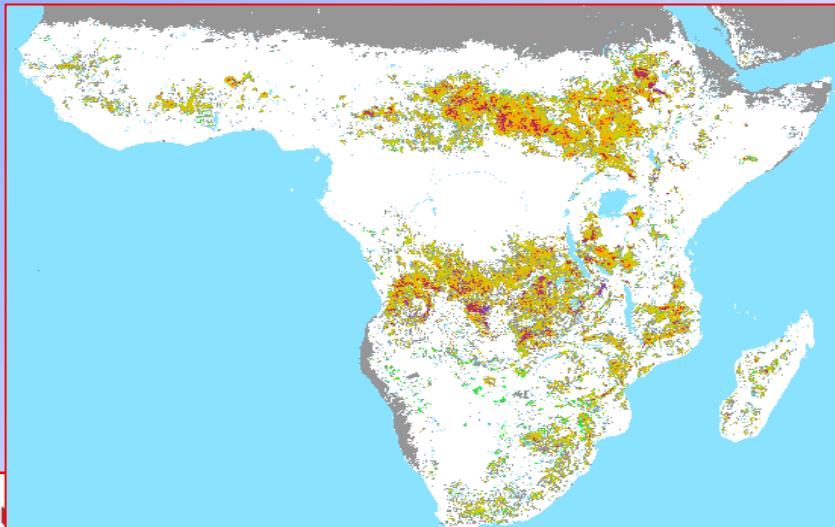
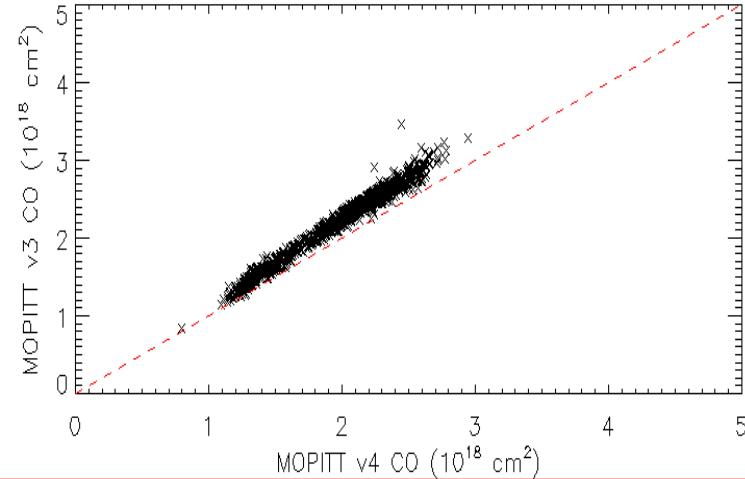
Summary

- 1) New retrieval scheme optimised for CO using IASI over a localised region.
- 2) IASI and MOPITT v3 similar, IASI and MOPITT v4 similar, but local differences.
- 3) Simplified top-down estimate leads to an underestimation, expected because of IASI's insensitivity to the boundary layer.



Future Work

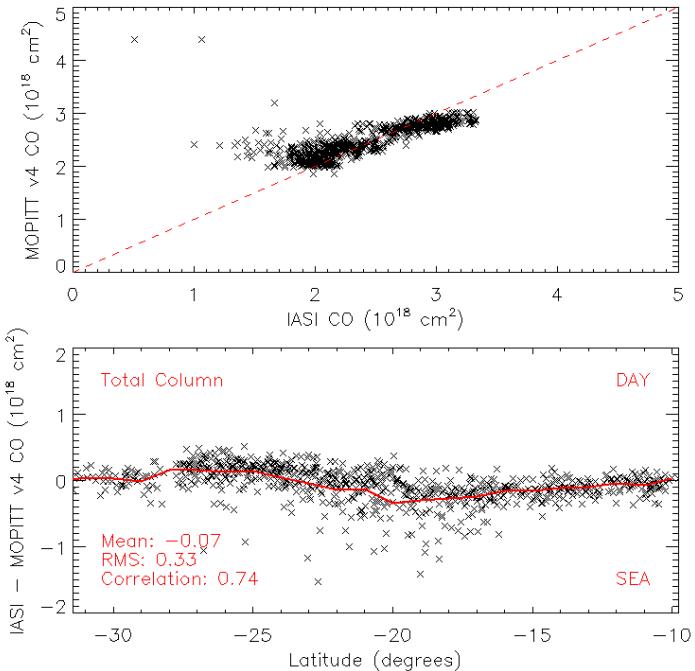
- 1) Further inter-comparison with IASI and MOPITT datasets.
- 2) Investigation into the correlation between IASI and different BA models.
- 3) Explore short timescale evolution approach to top-down estimations of CO emissions.



Thank you for
Listening

IASI - MOPITT v4 CO (DAY)

SEA



LAND

