Impact of the assimilation of the ozone total column of IASI aboard METOP on the vertical profiles

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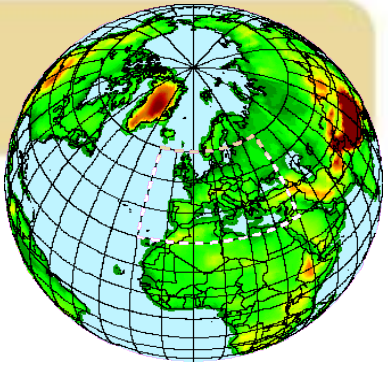
Model: MOCAGE



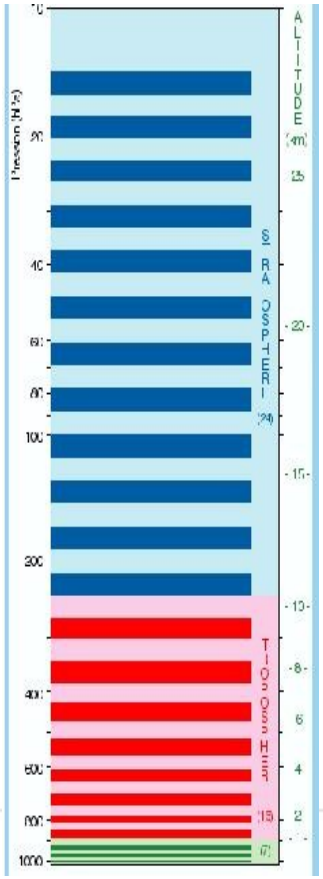
- **Global Horizontal Configuration :**
  - (2°x 2°) ➔ Comprehensive chemical schems
  - (0.5°x0.5°) ➔ Linear chemical schems (O3, CO)

Verticale configuration :

  - 47 levels : 0 → 5 hPa
  - 60 levels : 0 → 0.1 hPa

- **dynamical forcing :**
  - ARPEGE (Météo-France NWP) ➔ 47 levels
  - ECMWF ➔ 47 levels ; 60 levels

- **chemical scheems :**
  - RACMOBUS (tropo + strato)
  - REPROBUS (strato)
  - CARIOLLE (Linear O3 strato)
  - CARIOLLE (Linear CO tropo + strato)



Assimilation module: PALM

- **Method**: Variational (3D-FGAT)

→ Hybrid method between

3D-VAR and 4D-VAR

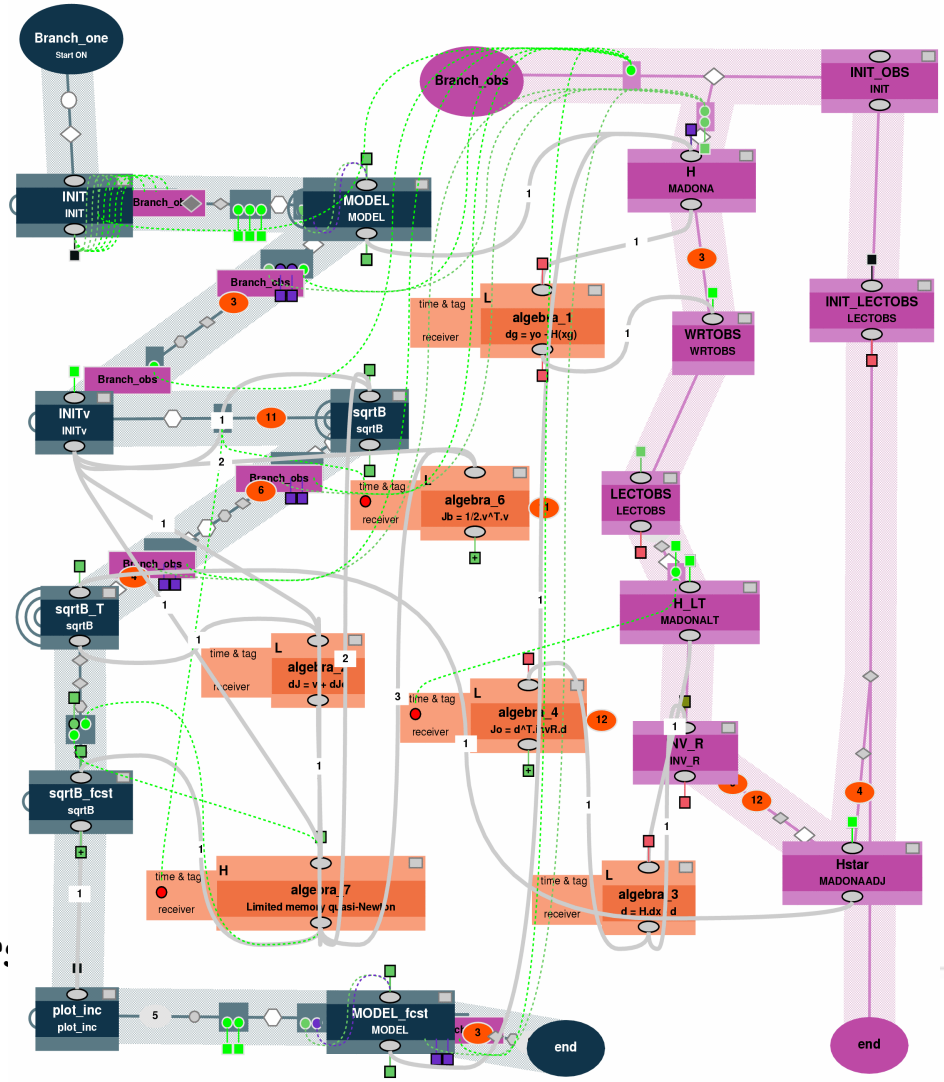
→Minimisation of the cost function (observations + model)

- **Advantages**: Modular Processes

→flexibility (choice of the parameters)

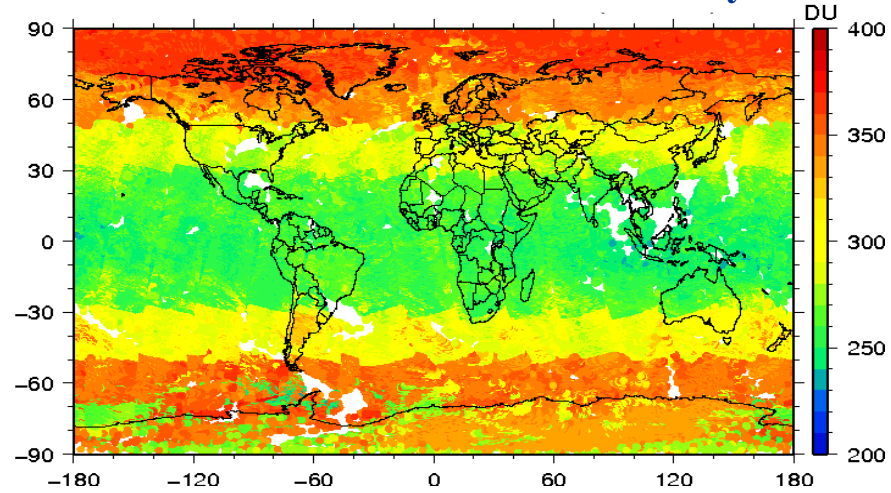
- **Takes into account the vertical correlation**

→ The characterization of different layers is more realistic

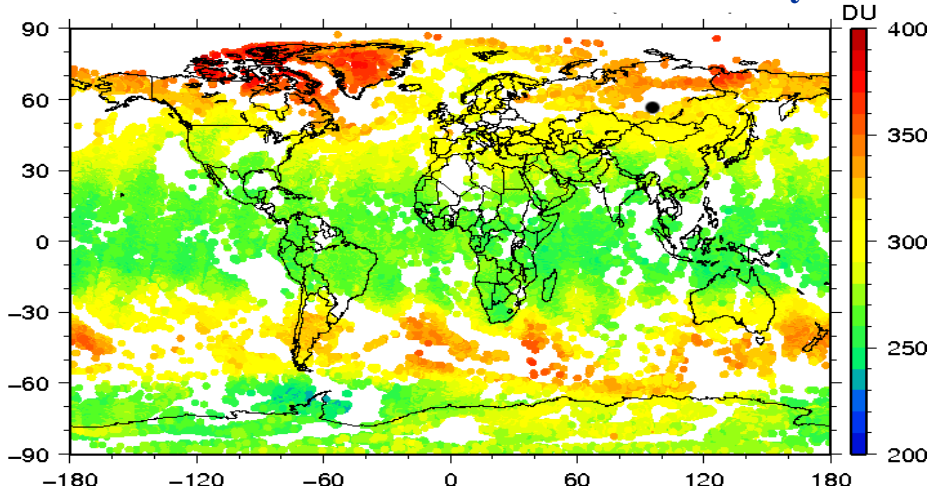


Ozone IASI: Selection of the observations

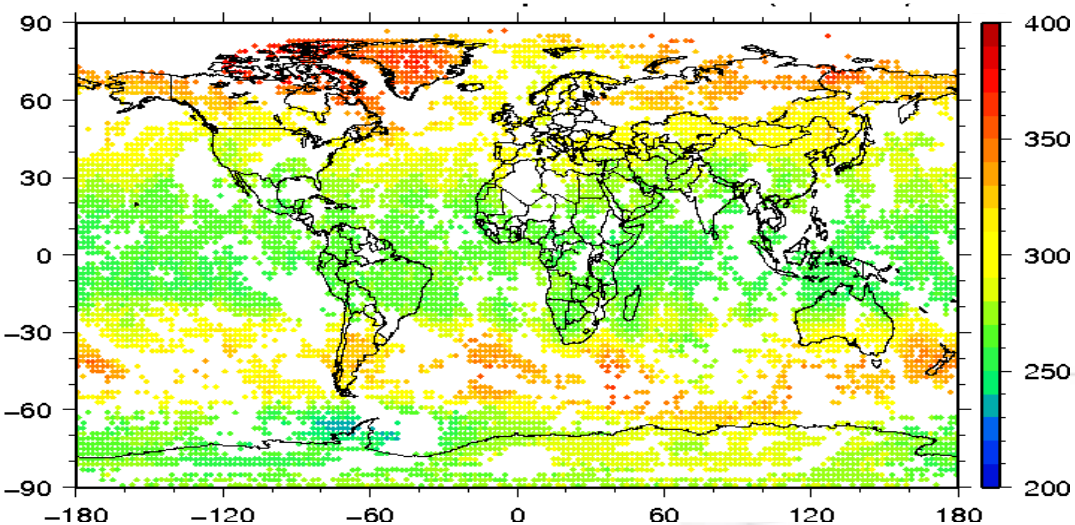
All data: ~ 600000 measurements / day



Without clouds: ~ 100000 measurements / day



Super-observations (2°x2°) : ~ 12000 measurements / day



Assimilation methodology

The minimization of the cost function is done in in the space observations following two distinct methods :

1- comparison between two columns and propagate the increment with H^T

→ more suitable for tropospheric species

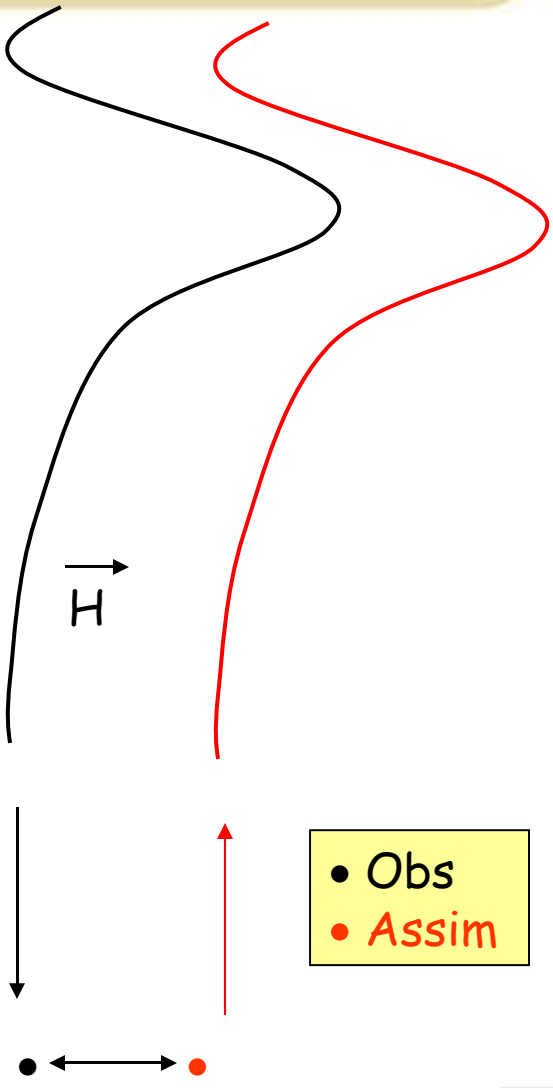
→ This method takes into account the air density

2- Construct a pseud-profile from observations ➔ Comparison between two profiles: the first-guess and the pseudo-observation profile

→ This method considers that the first-guess profile is somewhat realistic

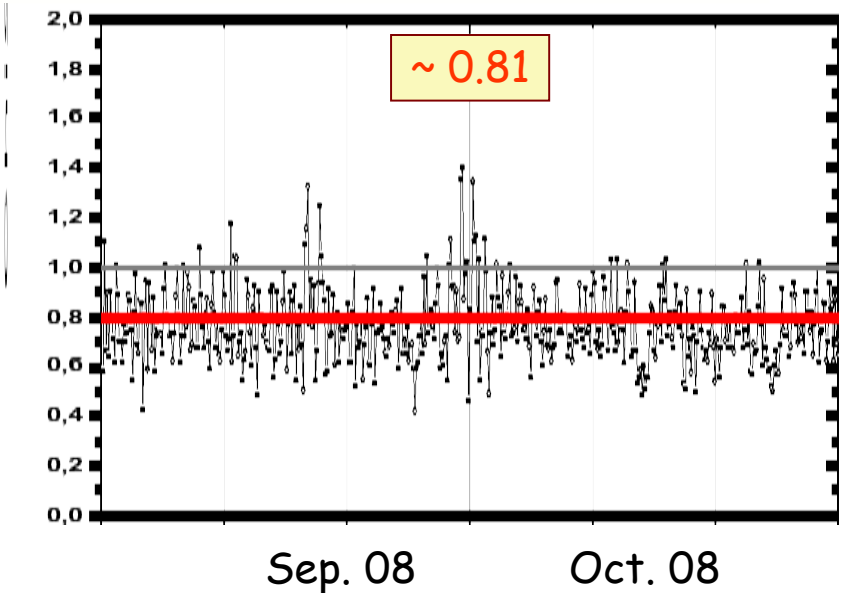
→ Much appropriate for stratospheric species

→ No propagation of the increment

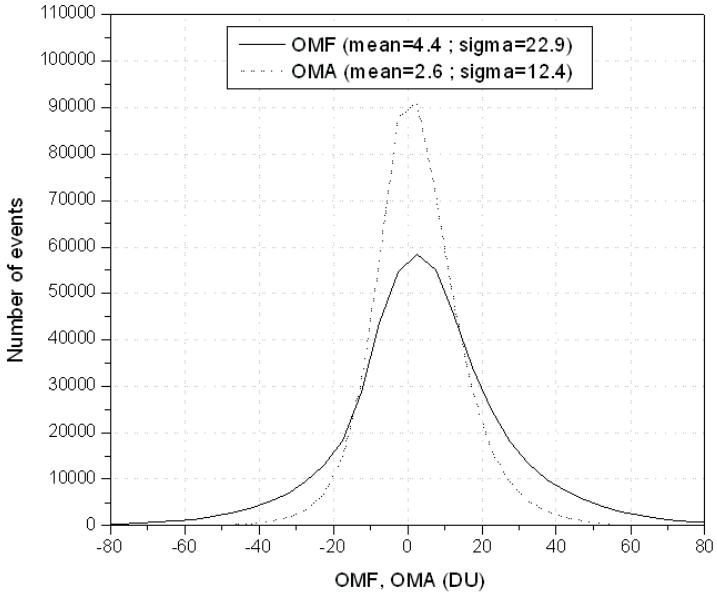


Ozone Assimilation: A posteriori diagnostics

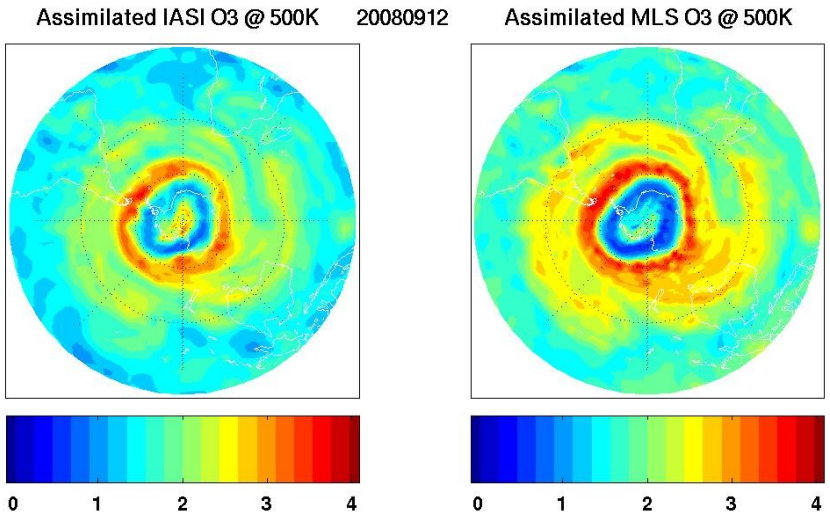
- **Chi2 test :**
  - → Cheks the consistency of the background and the observation error covariance matrices (B &R)
  - → Idealy : Chi2~1

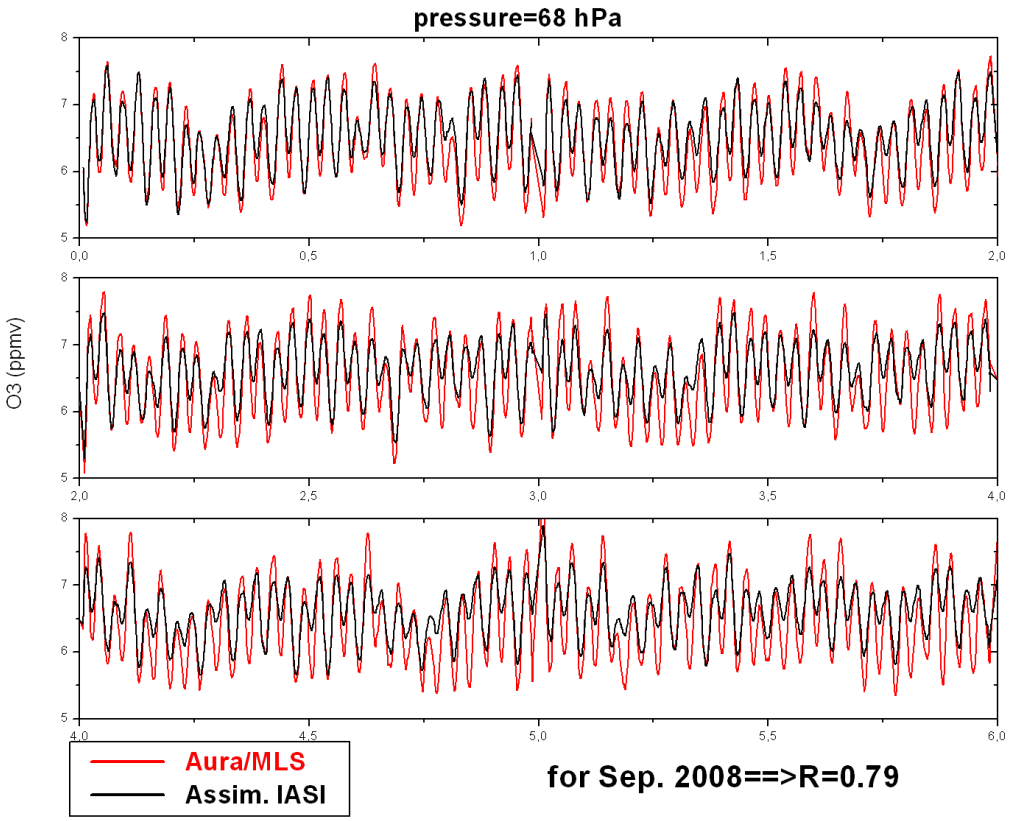


- **OMA residuals & OMF innovations :**
  - → Consistent self-diagnostic defined in observation space
  - → Checks the consistency of both forecasts and analyses distributions with respect to the observations.



Assimilation Results: vertical profiles



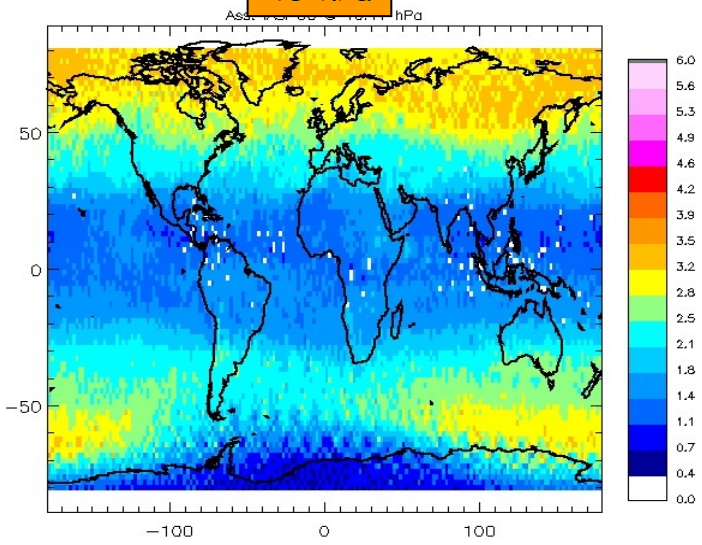


for Sep. 2008==>R=0.79

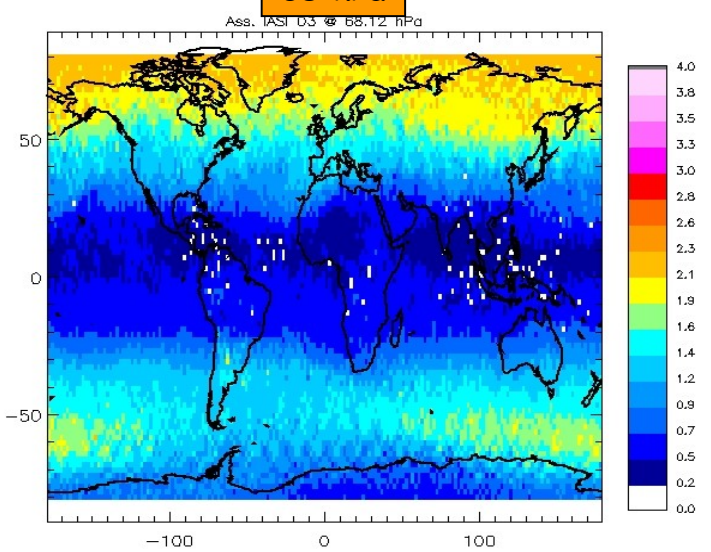
➔ In general, good agreement between both fields for all assimilation period

Assimilation Results: vertical profiles

46 hPa

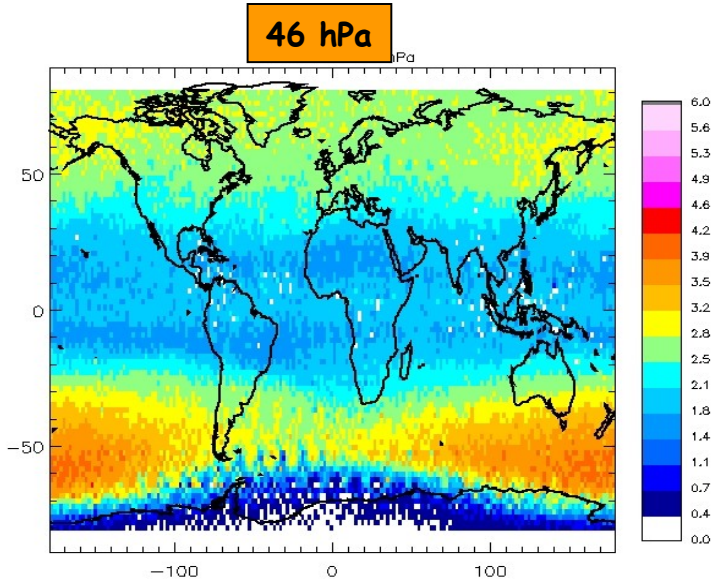


68 hPa

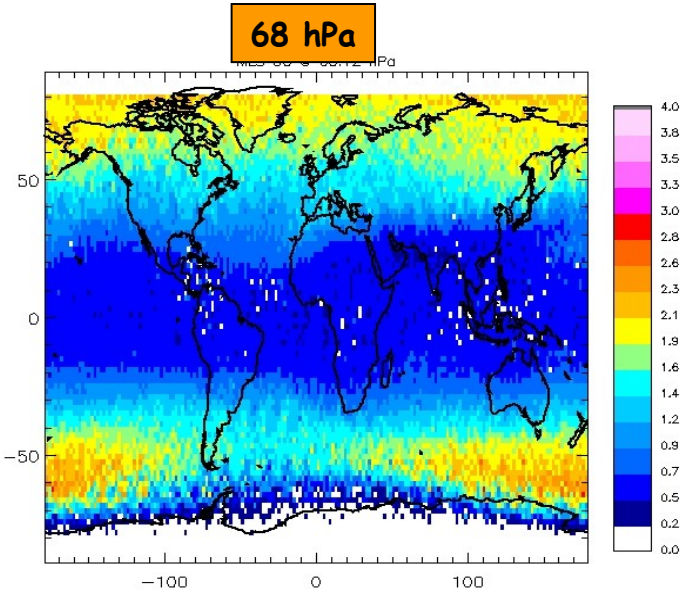


Ass. IASI
(Average of Oct.2008)

46 hPa



68 hPa



MLS O3
(Average of Oct.2008)

Assimilation Results: vertical profiles

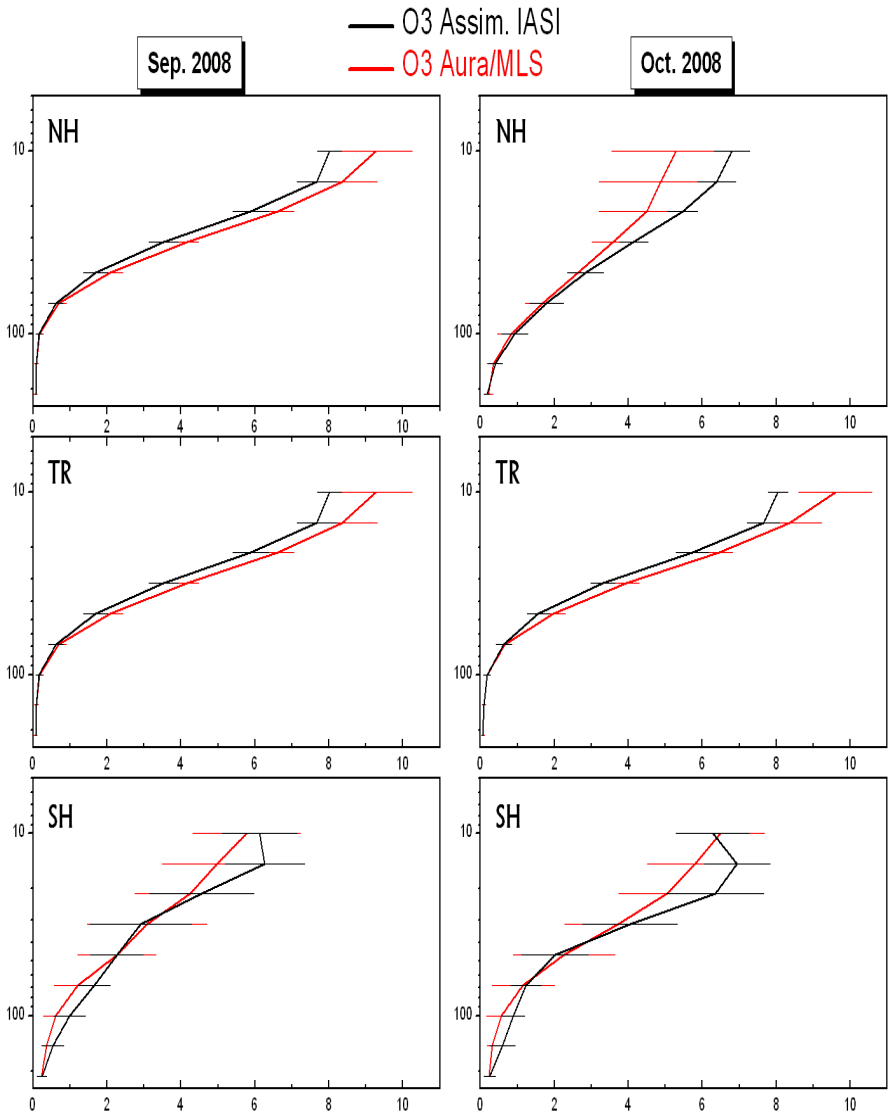
In terms of vertical profiles

➔ Good agreement between IASI assimilated field and MLS up to 50 hPa

➔In the NH, no systematic biases

➔In the TR, MLS overestimates Ozone compared to IASI analyses

➔In the SH IASI overestimates Ozone



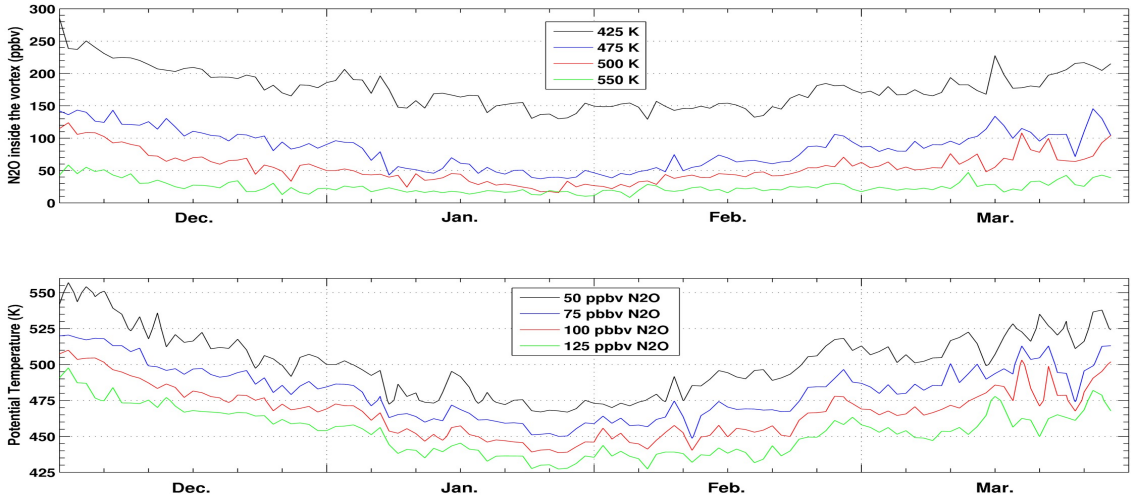
Summary

- Assimilation of O3 IASI:
  - In general good agreement in terms of vertical profiles

- To do !!!
  - First: validation of the observations ➔ ozonesondes
  - Second: quantifying the biases between IASI and MLS (OMI)

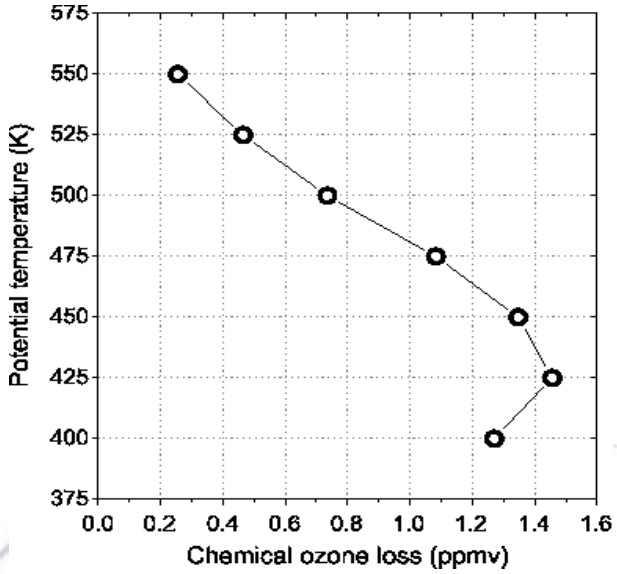
Perspectives : Calculation of chemical ozone loss inside the vortex

➔ Estimation of the subsidence inside the vortex : e.g. N2O/MLS as a tracer



2004/2005 Arctic winter

➔ Estmation of the chemical ozone loss inside the vortex:



Thank you for your attention