Assessing methane emissions using SCIAMACHY-ENVISAT observations

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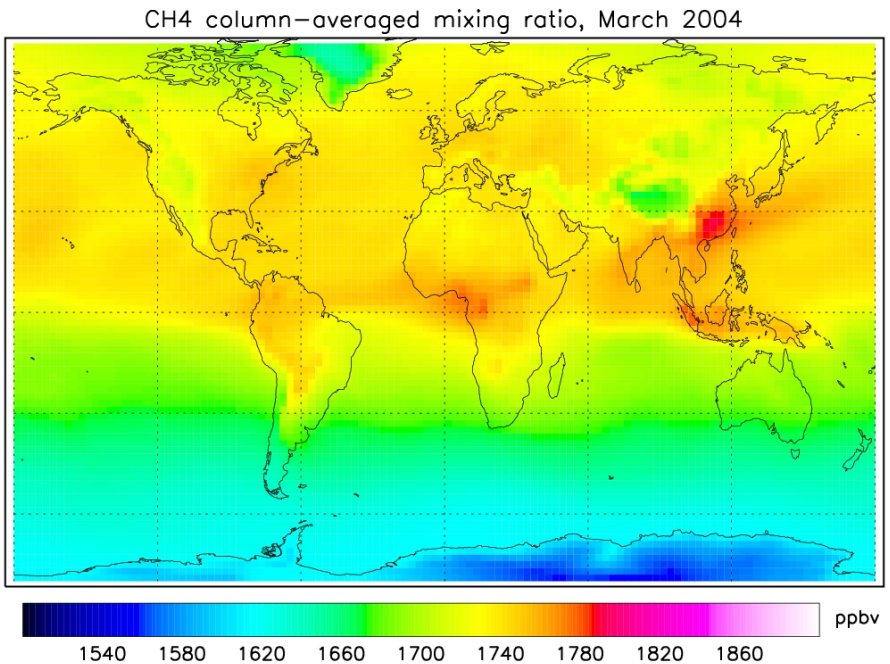
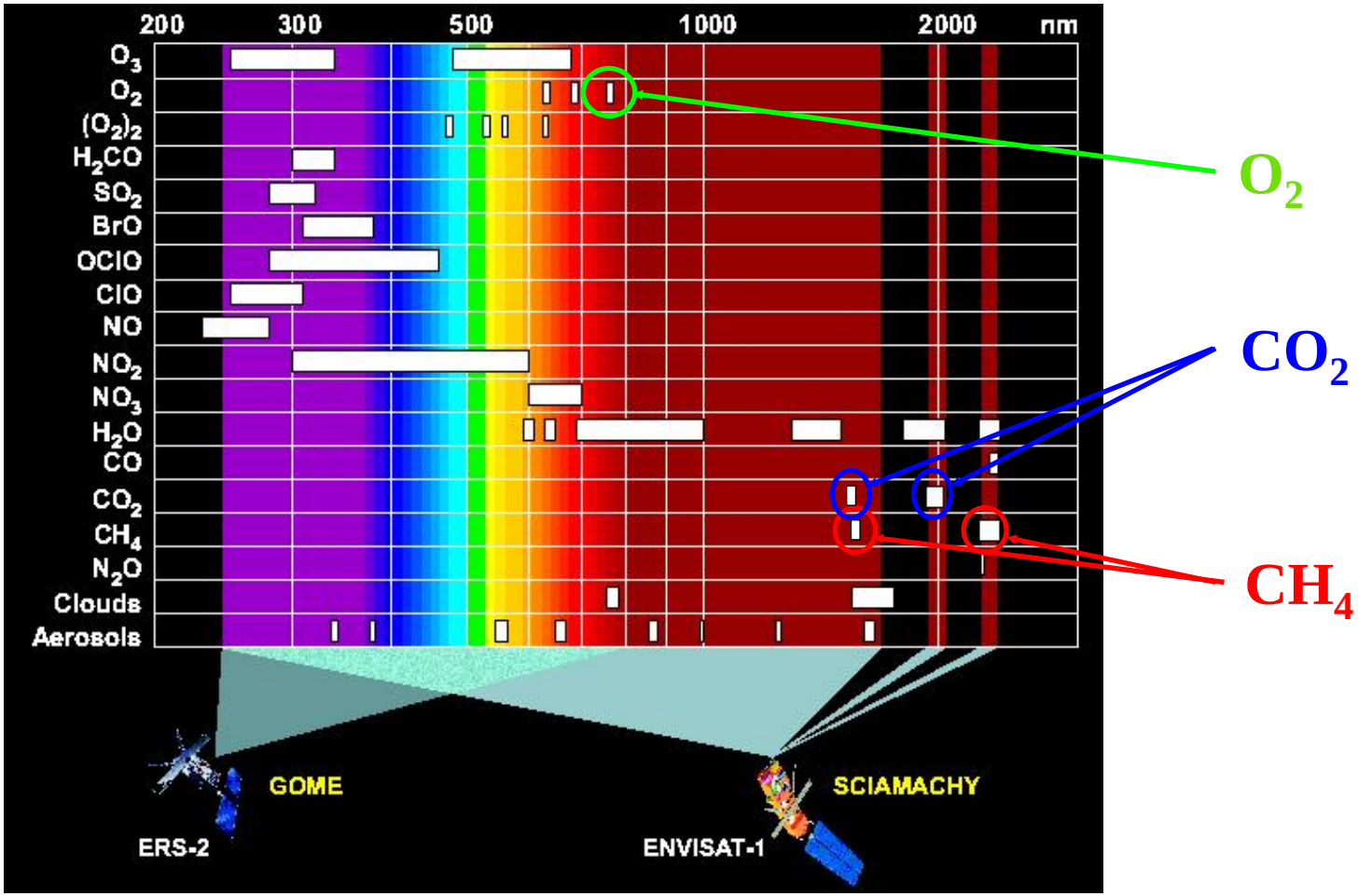
Motivation / Challenge

- Satellites offer great potential for improving emission estimates of CH_4 (and other gases)
  - Spatial coverage
  - Representativity (volume instead of point measurement)
- But: high precision needed to resolve small variations in CH_4 column

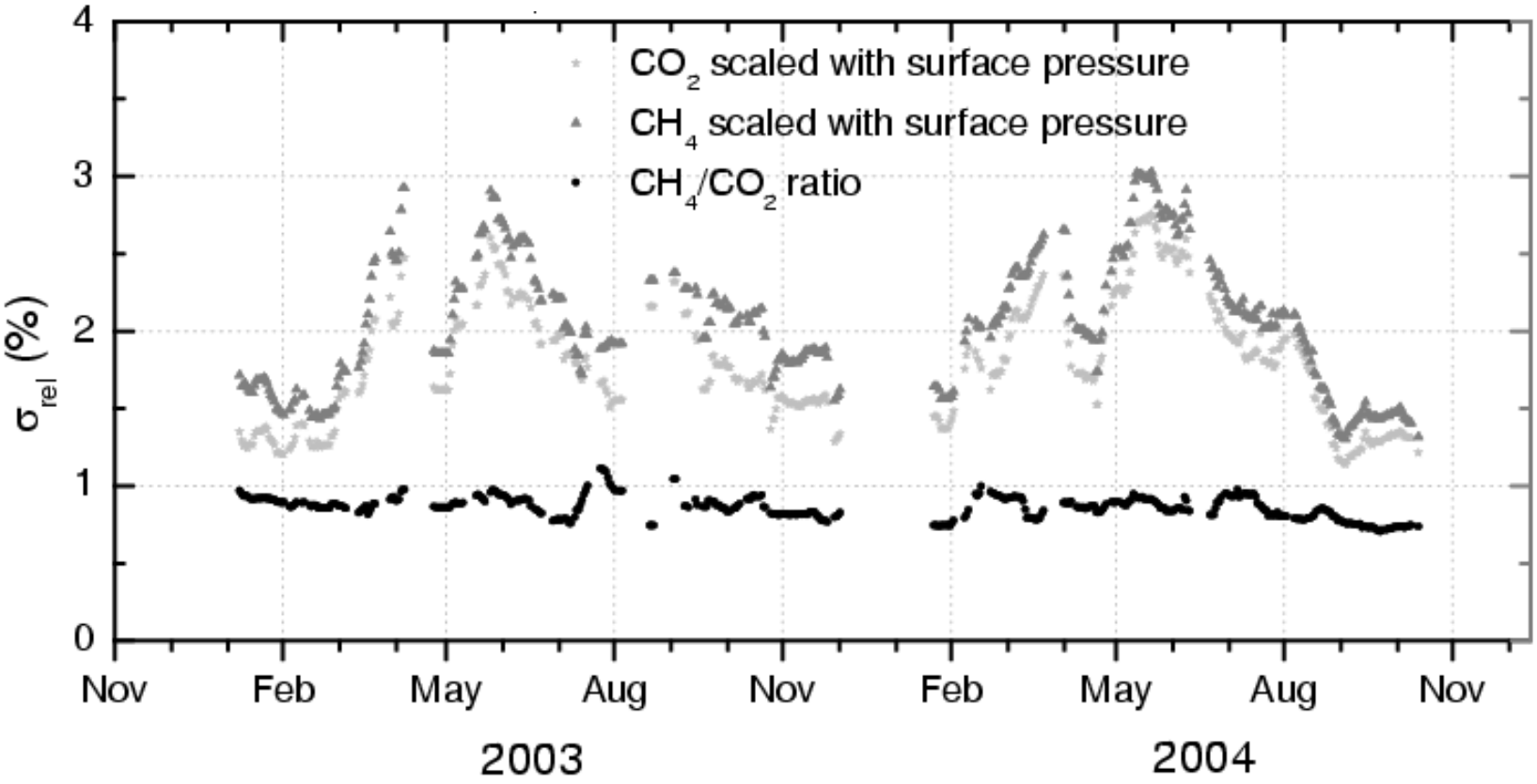


SCIAMACHY on ENVISAT



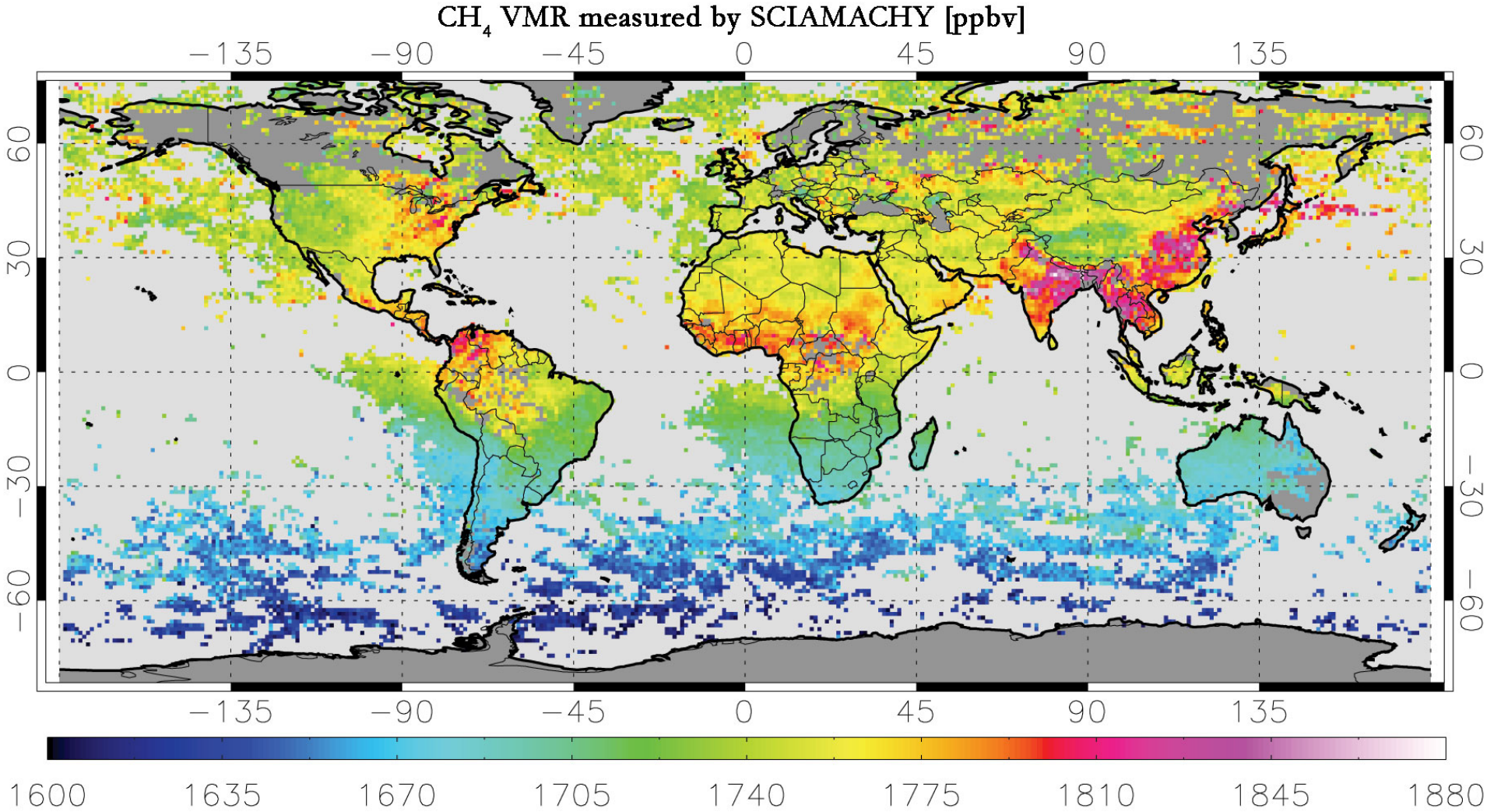
Normalizing CH_4 columns

Standard deviation over Sahara

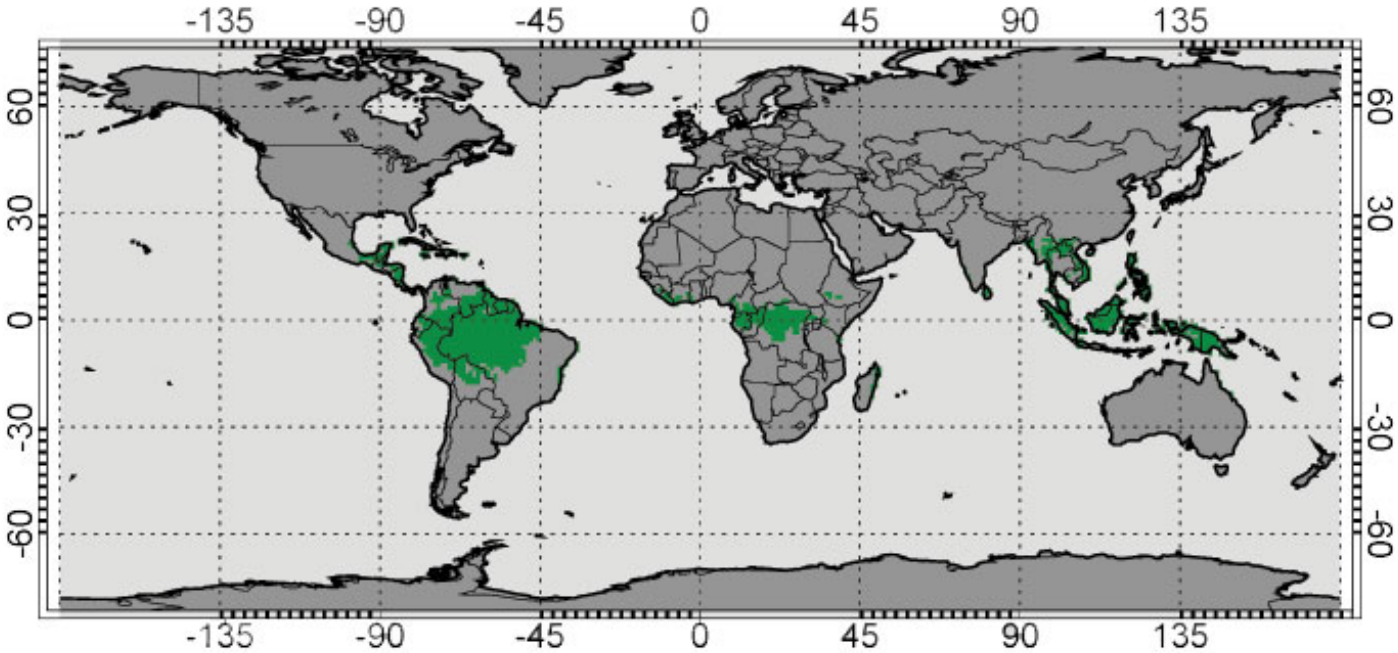


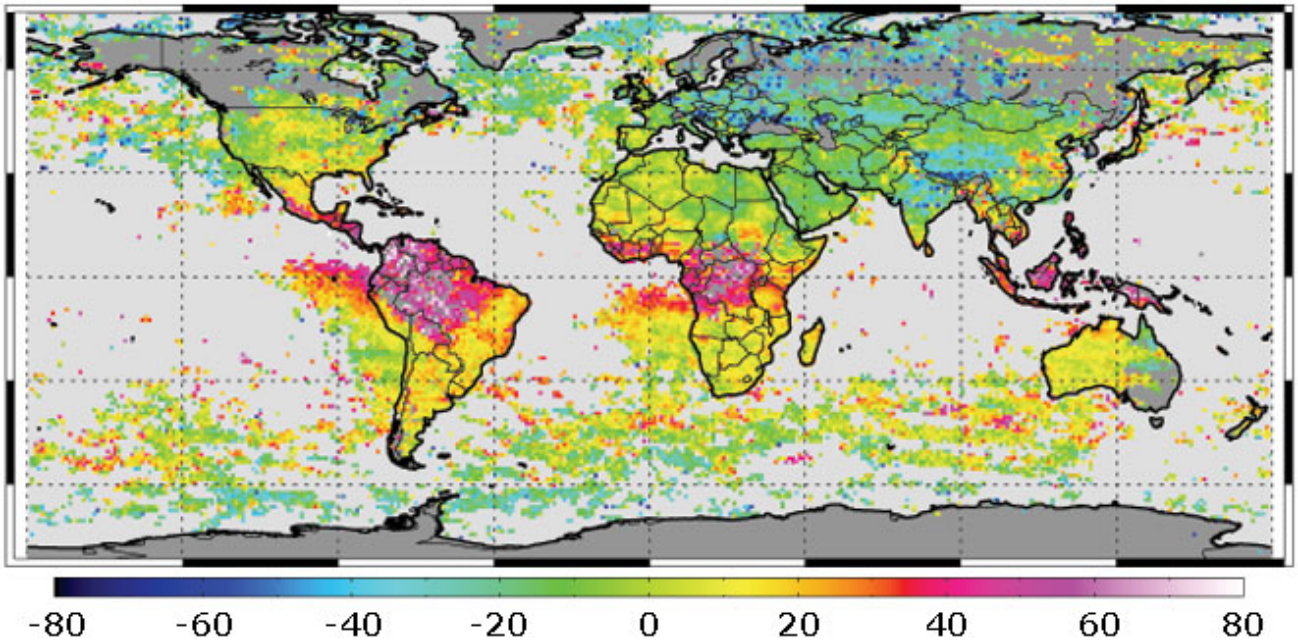
Frankenberg et al., JGR, submitted

Aug-Nov 2003



C. Frankenberg, J.F. Meirink, M. van Weele, U. Platt, T. Wagner, Science, 2005

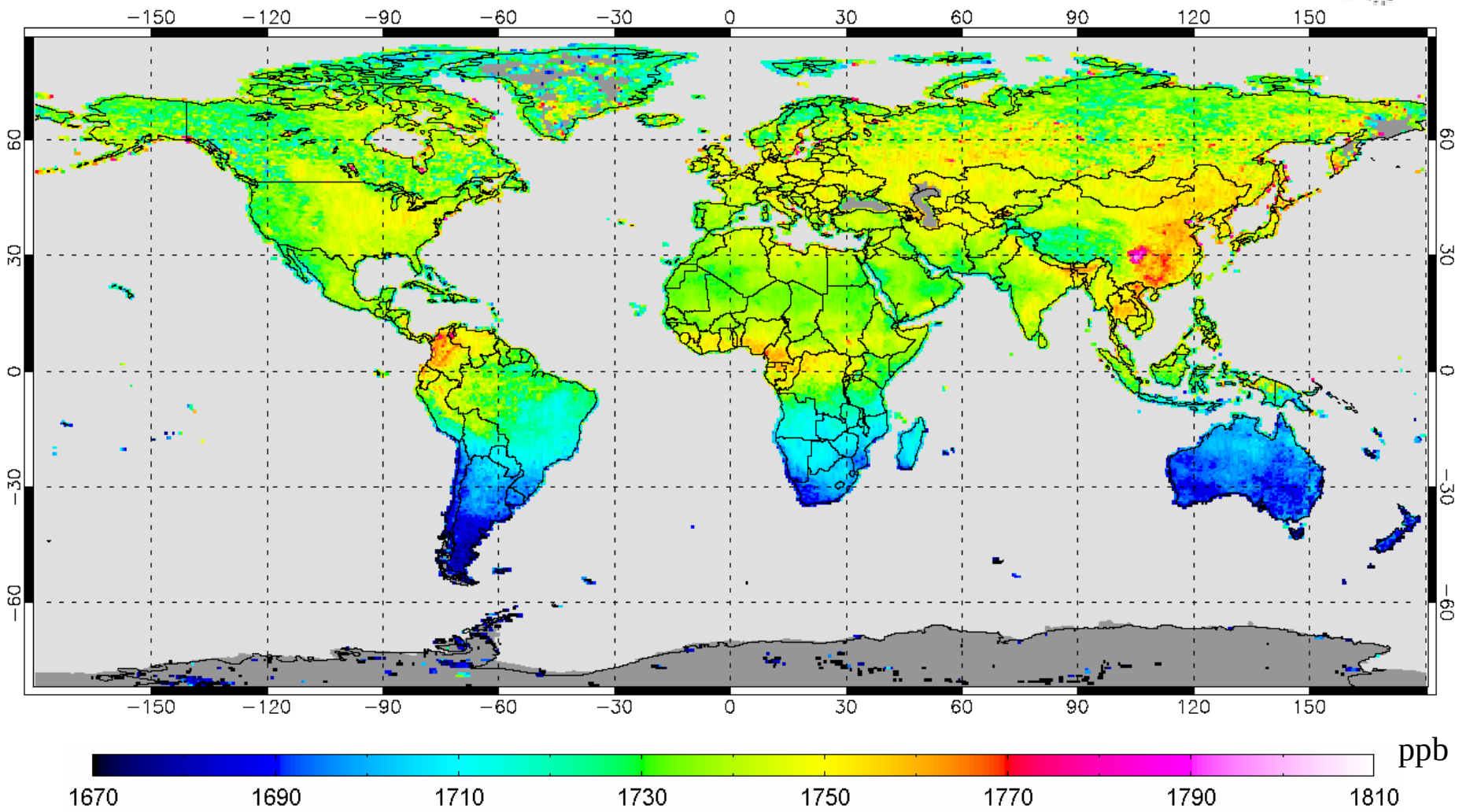




lovember 2005

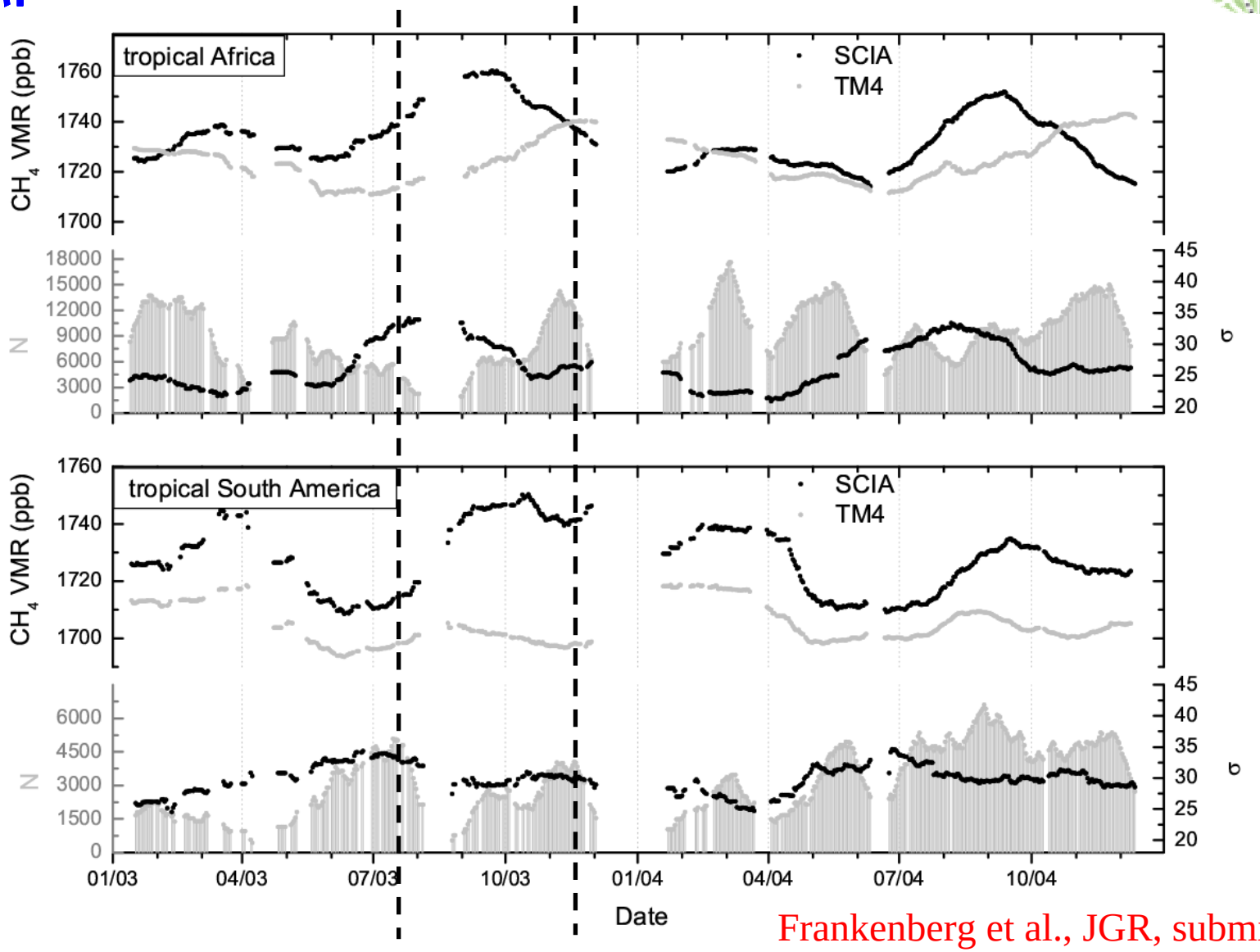
C. Frankenberg, J.F. Meirink, M. van Weele, U. Platt, T. Wagner, Science, 2005

2003/2004 mean CH_4 concentration



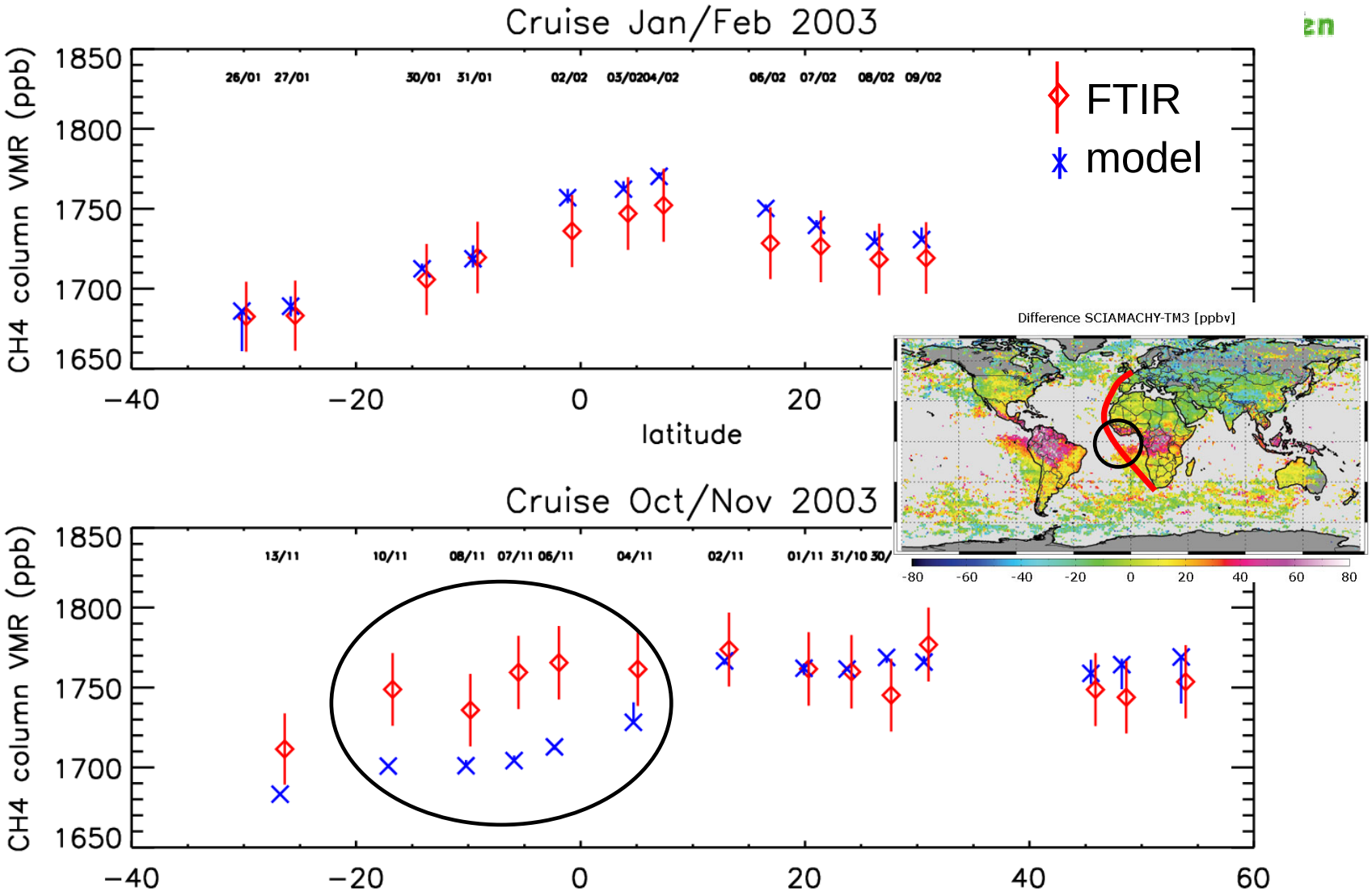
Frankenberg et al., JGR, submitted

Timeseries in tropics



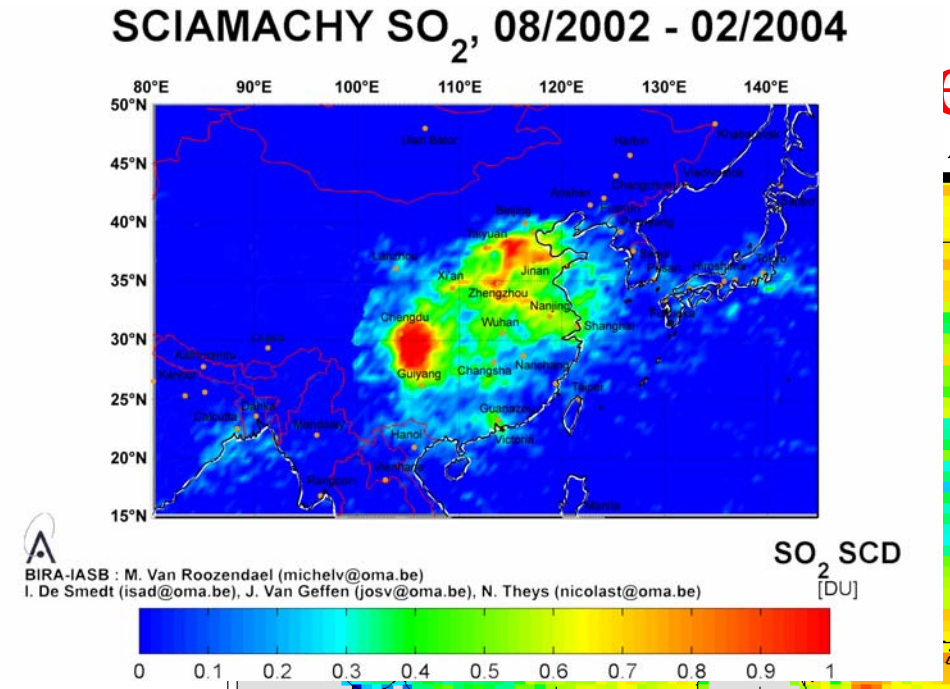
Frankenberg et al., JGR, submitted

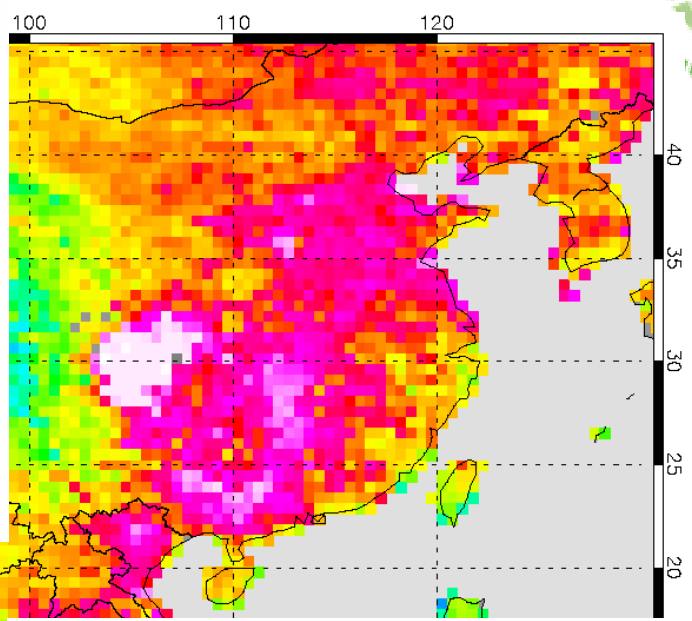
Comparison FTIR cruise with model



FTIR data: Thorsten Warneke, Univ. Bremen

er Asia





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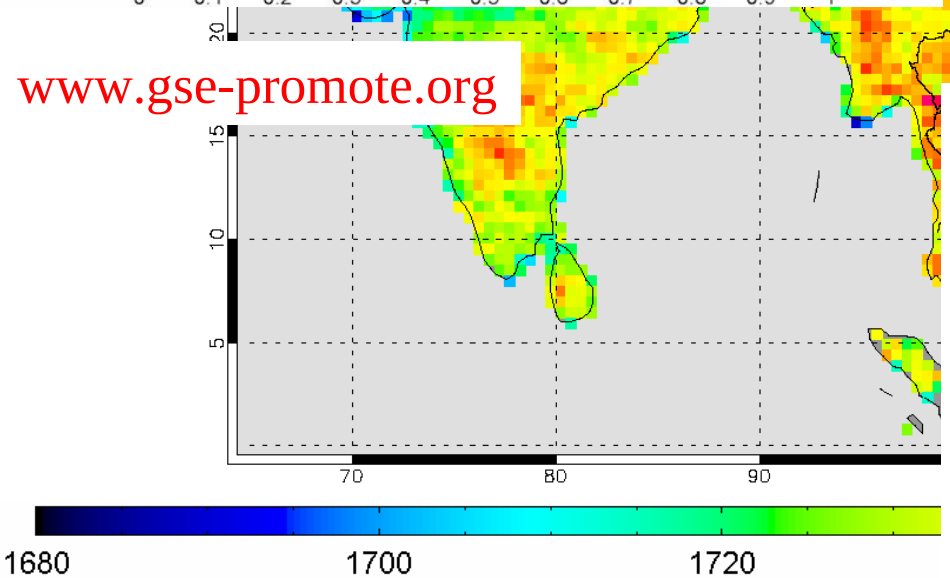
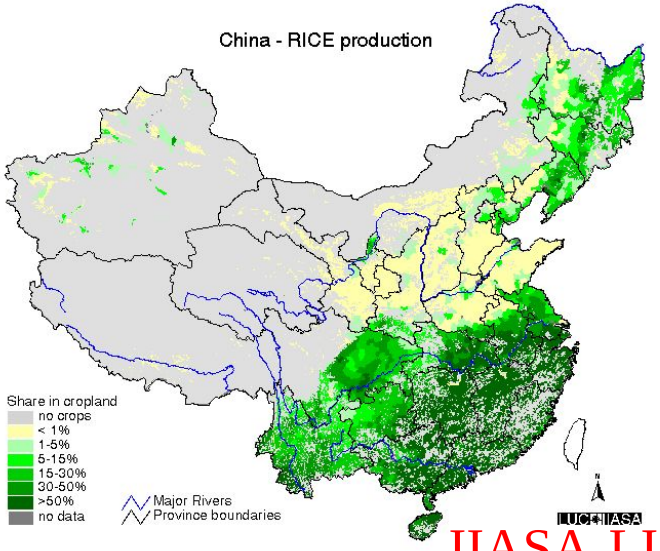




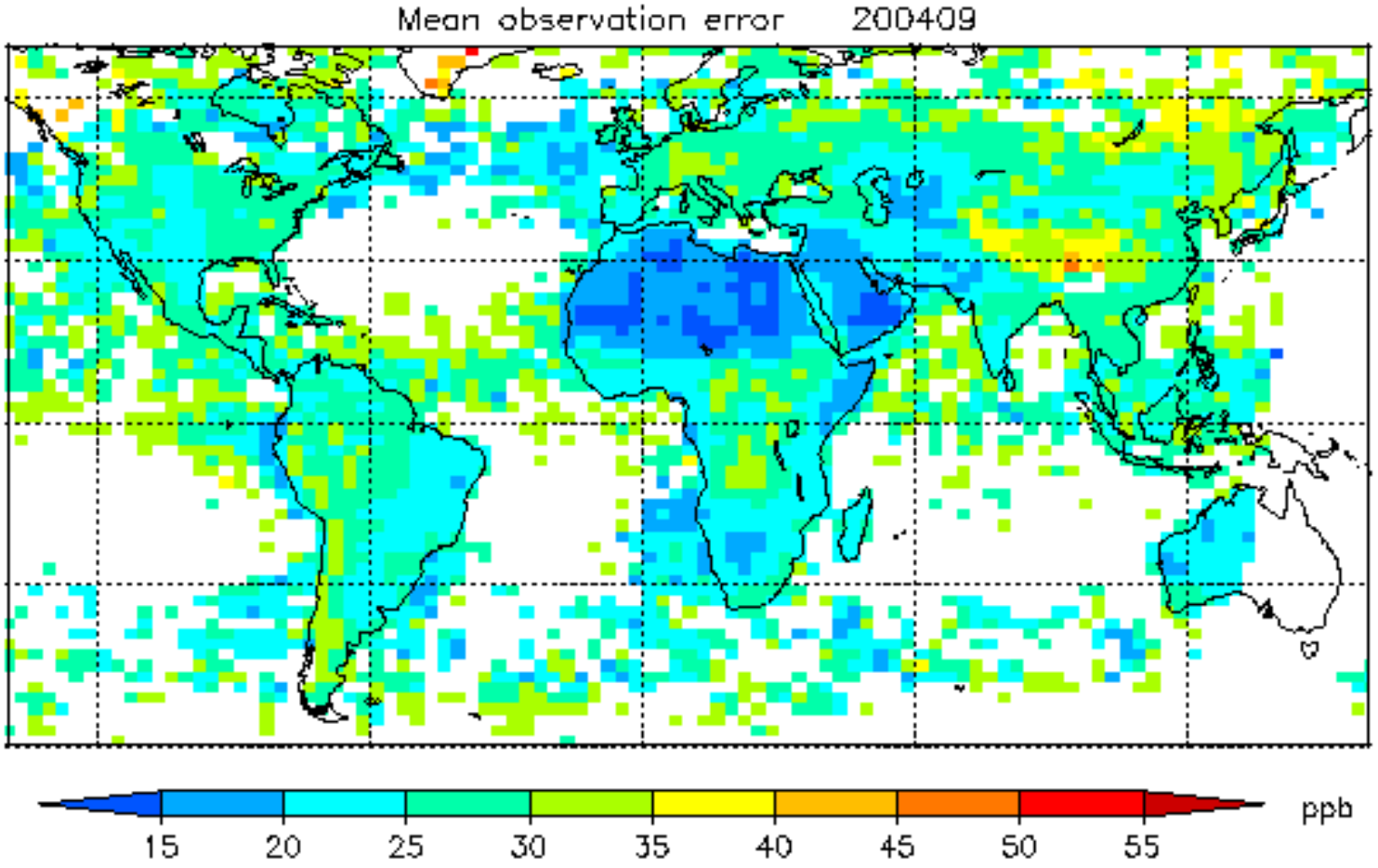
IIASA-LUC

Inverse modelling

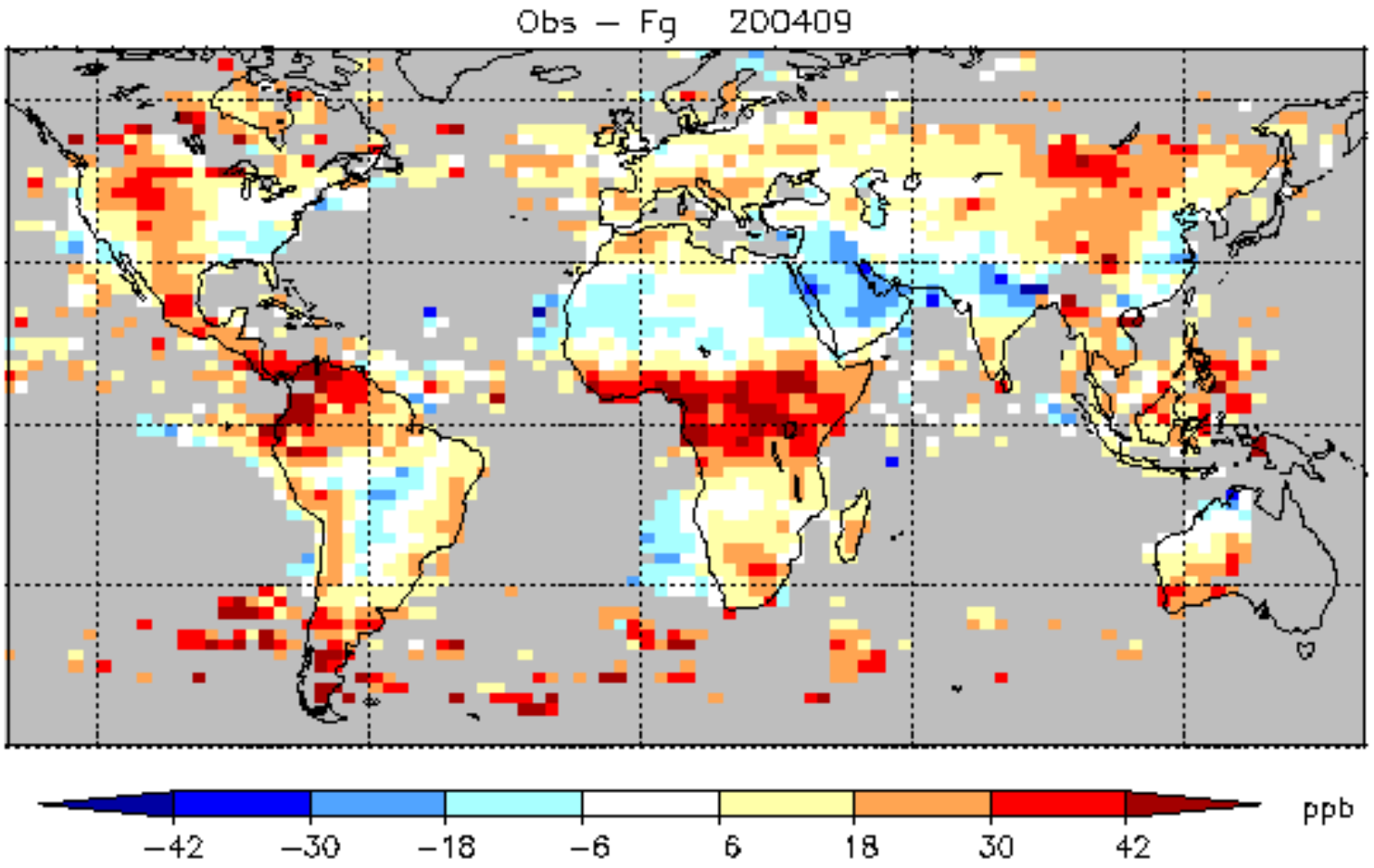
- Method: 4D-Var data assimilation
  - Optimization of monthly-mean surface fluxes *and* initial concentrations
  - Sensitivity experiments with synthetic SCIAMACHY data in Meirink et al., ACPD, 2005
- Model: TM4
  - 3x2 degrees x 25 vertical layers
- **Preliminary** results real data for September 2004

Observation error

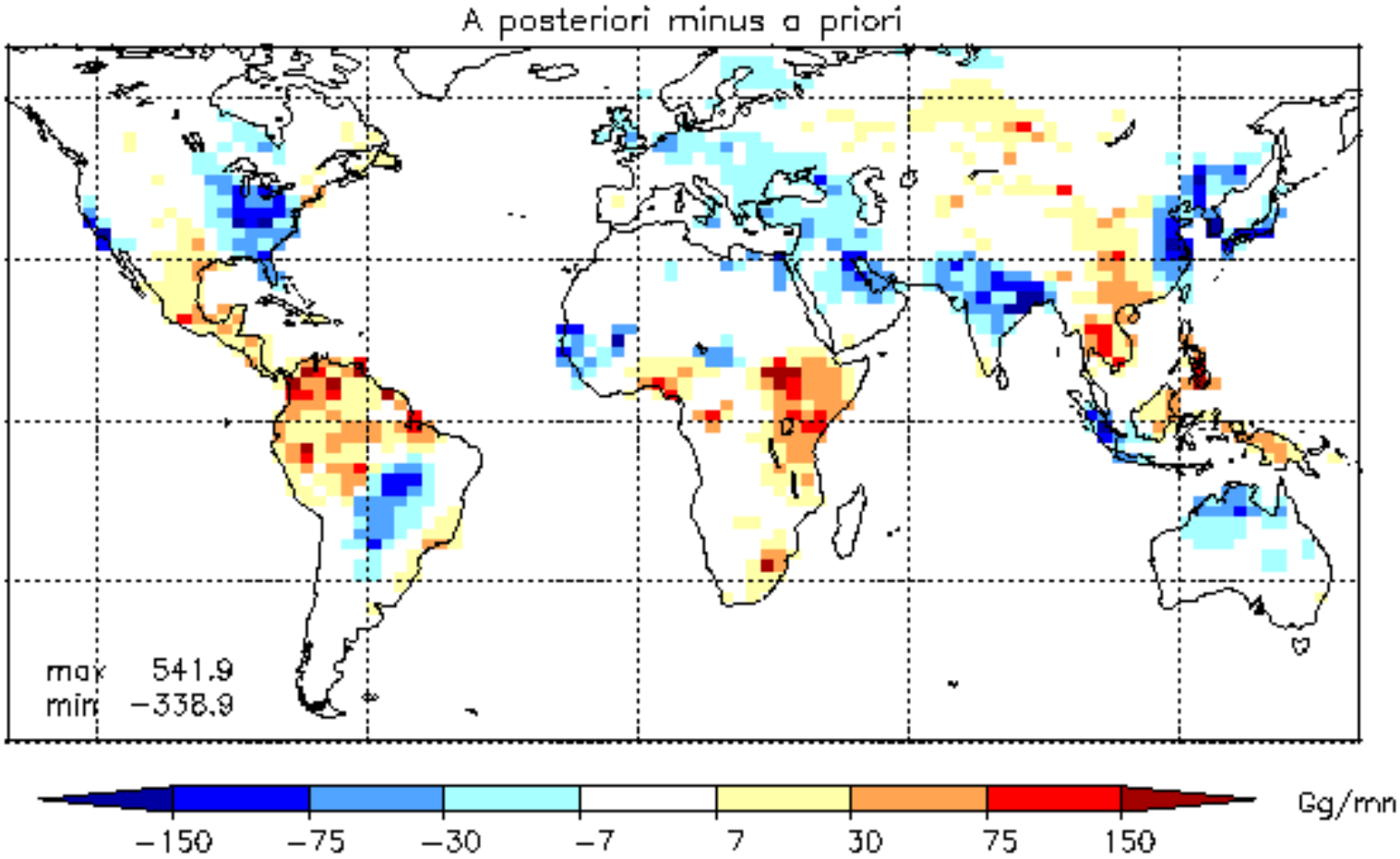
mean-error estimate based on fit residuals



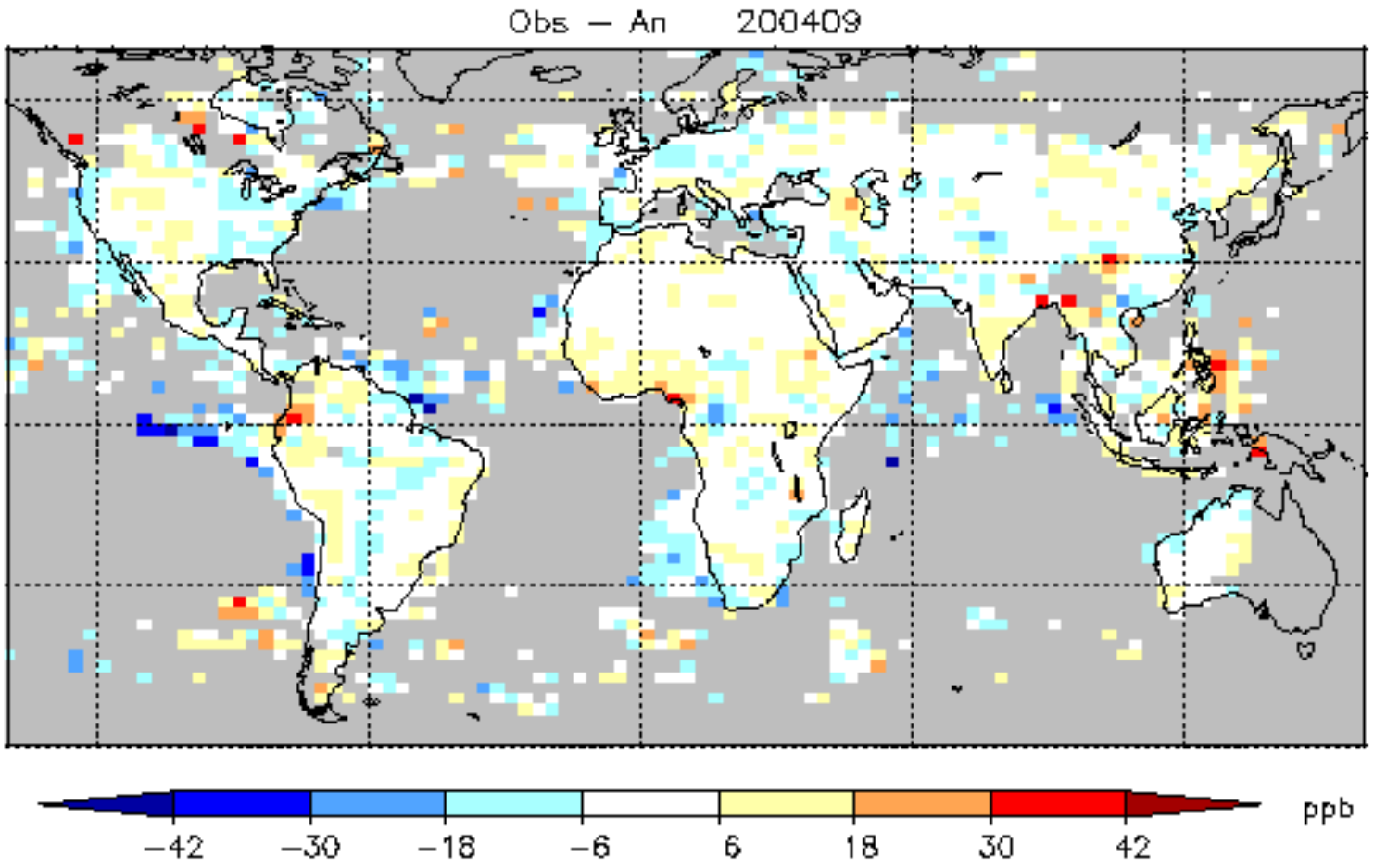
Observation - first guess



Emissions: analysis – first guess



Observation - analysis



Summary

- Precise retrievals of atmospheric methane from SCIAMACHY
- Measurements broadly as expected, but surprises: high concentrations in tropics, Aug-Nov
- Inverse modelling based on 4D-Var
  - Preliminary application to SCIA data
- More validation needed (difficult!)