CCLRC Rutherford Appleton Laboratory

Summary

- Previous sessions had demonstrated convincingly the value of satellite observations for *atmospheric research*:
  - Limb-sounding
    - Stratospheric profiling now extended to mid/upper troposphere (emission as well as occultation)
    - Eg uplift & long-range transport of products from biomass burning and industrial pollution; 2-D O_3
  - Nadir-sounding: near-uv/vis/swir
    - Sensitivity in lower troposphere (if R_{surf} high)
    - Eg pin-point surface emission sources

  → *Highly complementary techniques*

  - Nadir-sounding: mid-ir
    - Value added to uv/vis/swir
    - Insensitivity at ground-level & additional species

  →*MetOp + Envisat promises to be a powerful combination*

Thu pm session & posters on data assimilation & other applications

1. Expanded on use of assimilation:
   - generation and validation of data for research
   - operational analysis/f'cast of stratospheric ozone
   - pilot projects / trials for newly-emerging operational applications for satellite data:
     - Monitoring global distributions of
       - Constituents important to climate
       - Gaseous and particulate pollutants
     - Forecasting air quality

     → Means to combine effectively satellite and ground-based *in situ* measurements

2. Covered other applications of satellite data

1. Data Assimilation

Talks:

- *ASSET Intercomparison Project*
  - William Lahoz (DARC)
- *Assimilation of O3 data from GOME, SCIA & OMI*
  - Ronald van der A (KNMI)
- *Simultaneous assimilation of MIPAS & SMR O3 profiles into CTM*
  - Sebastien Massart (CERFACS)
- *Variational assimilation of satellite &* in situ *aerosol into CTM*
  - Lars Peter Nieradzik (U.Cologne)

Posters:

- *Multi-year strat & trop ozone by GOME-1 DA*
  - Thilo Erbertseder (DLR)
- *Towards operational assimilation of satellite AOD & type in a CTM*
  - Marion Schroedter-Homscheidt (DLR)

CCLRC Rutherford Appleton Laboratory

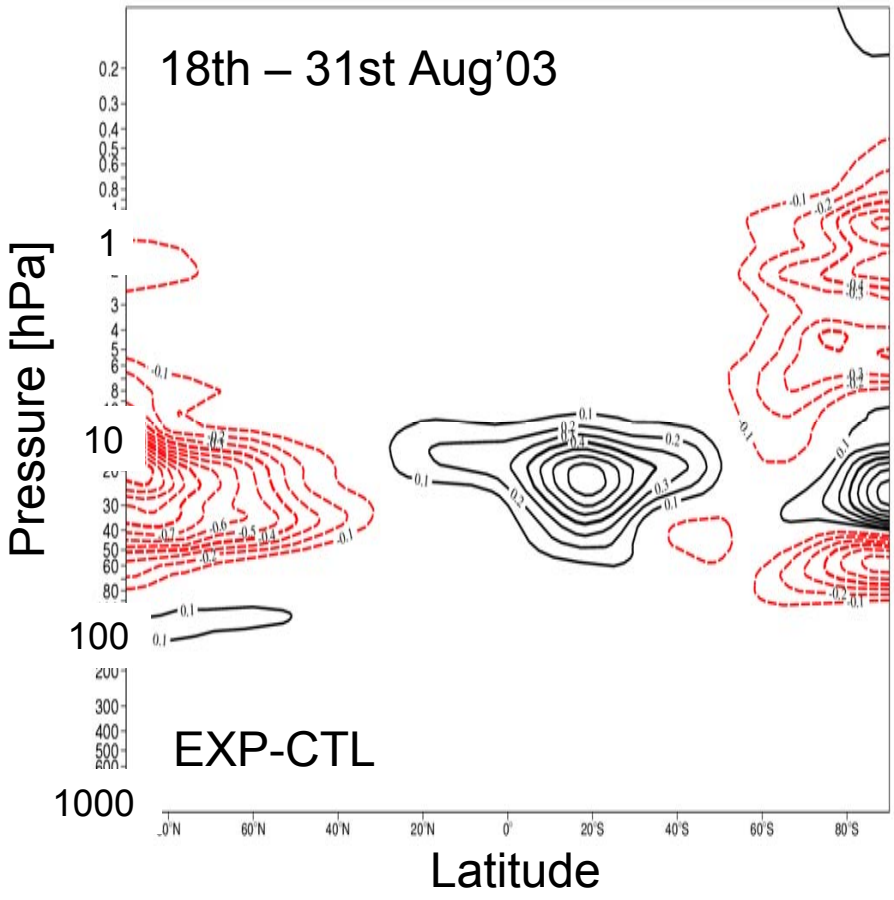
Data Assimilation: Status

- Active field of R&D
- Different schemes: 3D,4D0 var, kalman filter, direct inversion
- Assimilation of different quantities
  - Trace gas columns (vertical or LOS) and profiles
  - Aerosol optical depth & type (-> PM10, PM2.5)
  - Radiances
  - Information content (remove prior & diagonalize S_y)
- Assimilation into either GCMs or CTMs
- [GEMS
  - Reactive gases, g-house gases, aerosol
  - GCM coupled to CTMs

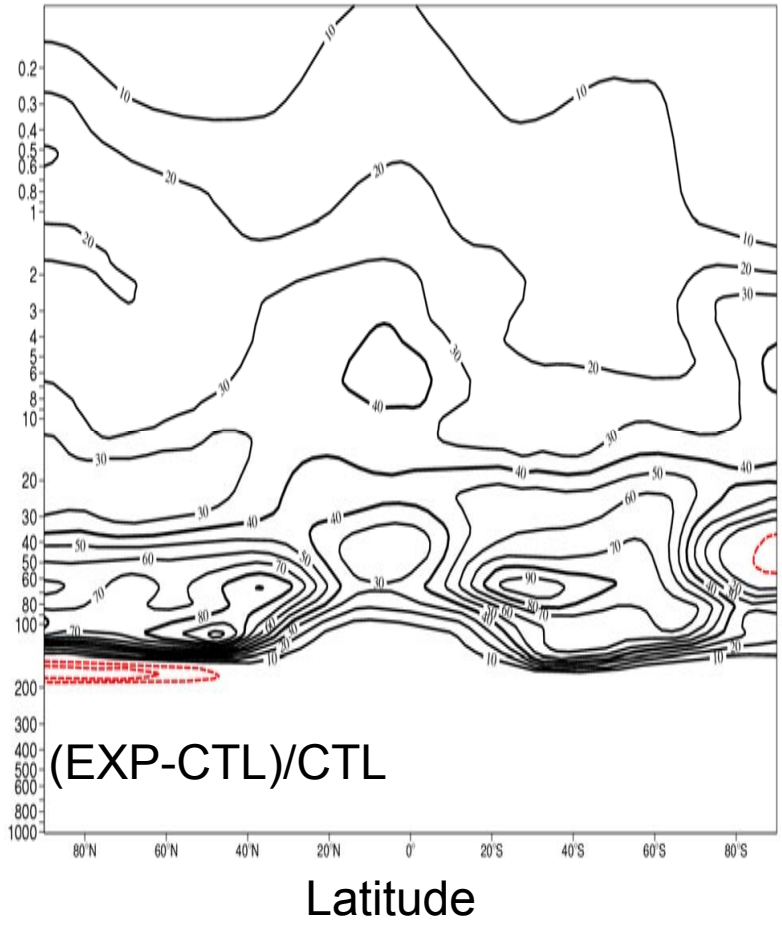
  → Extended re-analysis of Envisat/Aura period]
- Also: derivation of tropospheric distributions from LOS columns, by assimilating stratospheric profiles into CTM

Zonal Mean Analysis Differences

O_3 [ppmv]



H_2O [%]



EXP = MIPAS radiances assimilated in 4D-VAR

N. Bormann, ECMWF, private comm.

2. Other Applications

Talks:

- *Estimate of global lightning source using* in situ *and remote-sensing and model*
  - Ulrich Schumann (DLR)
- *Regional AQ forecast over Greece (PROMOTE)*
  - Panayiotis Symeonidis (Aristotle U. of Thessaloniki)
- *Gaseous & particle emissions from shipping seen by satellites*
  - Heinrich Bovensmann (U,Bremen)
- *Atmospheric applications on GRID with focus on MIPAS & GOMOS*
  - Christian Retscher (ESRIN)
- *Use of remote-sensing for solar energy purposes (ENVISOLAR)*
  - Marion Schroeder-Homscheidt (DLR)

Other Applications (contd)

Posters:

- *Applications & development of atmospheric chemistry products*
  - L.Flynn et al (NOAA)
- *SAF on O3 and atmospheric chemistry monitoring*
  - T.Riihisaari et al (FMI, DLR, KNMI)
- *IGACO-O3: First step in implementing IGACO*
  - A.Malkki et al (FMI, WMO)
- *DUE GlobAerosol: building AQ & health monitoring services*
  - C.Gomez-Cid et al (GMV)
- *NorSEN: use of Envisat derived & g-based aerosol*
  - G.Hansen et al (Norway & Finland)
- *Radiometer-based estimation of AOD*
  - V.Karathanassi (Nat.Tech.U.Athens)
- *SCIA 4-years in space: data usage and outlook*
  - H.Bovensmann et al (U.Bremen)
- *Using GRID for SCIA data sharing & processing in NL-SCIA-DC*
  - W.S.deCerff et al (KNMI, SRON, SARA, NIKHEF)
- *Modelling CO2 source & sinks of European land vegetation using AVHRR NDVI (LAI)*
  - K.Wisskirchen et al (DLR)

- The applications covered were novel and diverse.
- Continuity & consistency of data will be vital
- Envisat mission ops possible till 2011 (fuel)
- MetOp to cover 2006-2020

  → Operational centres in Europe and US planning to utilize

CCLRC Rutherford Appleton Laboratory

Discussion

- Stimulated by *U.Schumann*:
  - In principle, preferable to modify model to achieve agreement with observations, since this benefit would apply generally, not just locally.
- *H.Elbern* agreed that when a specific model deficiency could be identified, it could then be corrected. However, in most cases this was not so, and assimilation was then the optimal approach.
- *D.Carriolle* and *W.Lahoz* concurred with further examples.
- *W.Lahoz* pointed to the role which assimilation could play in mission design, as well as data analysis & validation.
- *H.Kelder* queried ESA's perspective on assimilation as tool to add value to satellite data and test new mission concepts
- *C.Zehner* stated ESA's continuing mandate to generate only L1 & L2 products, but willingness to facilitate data assimilation
- ESA's initiative to broaden the user base for satellite data from science research to operational applications was generally welcomed.