

GEMS Global Production System and Data Infrastructure (PRO sub-project)

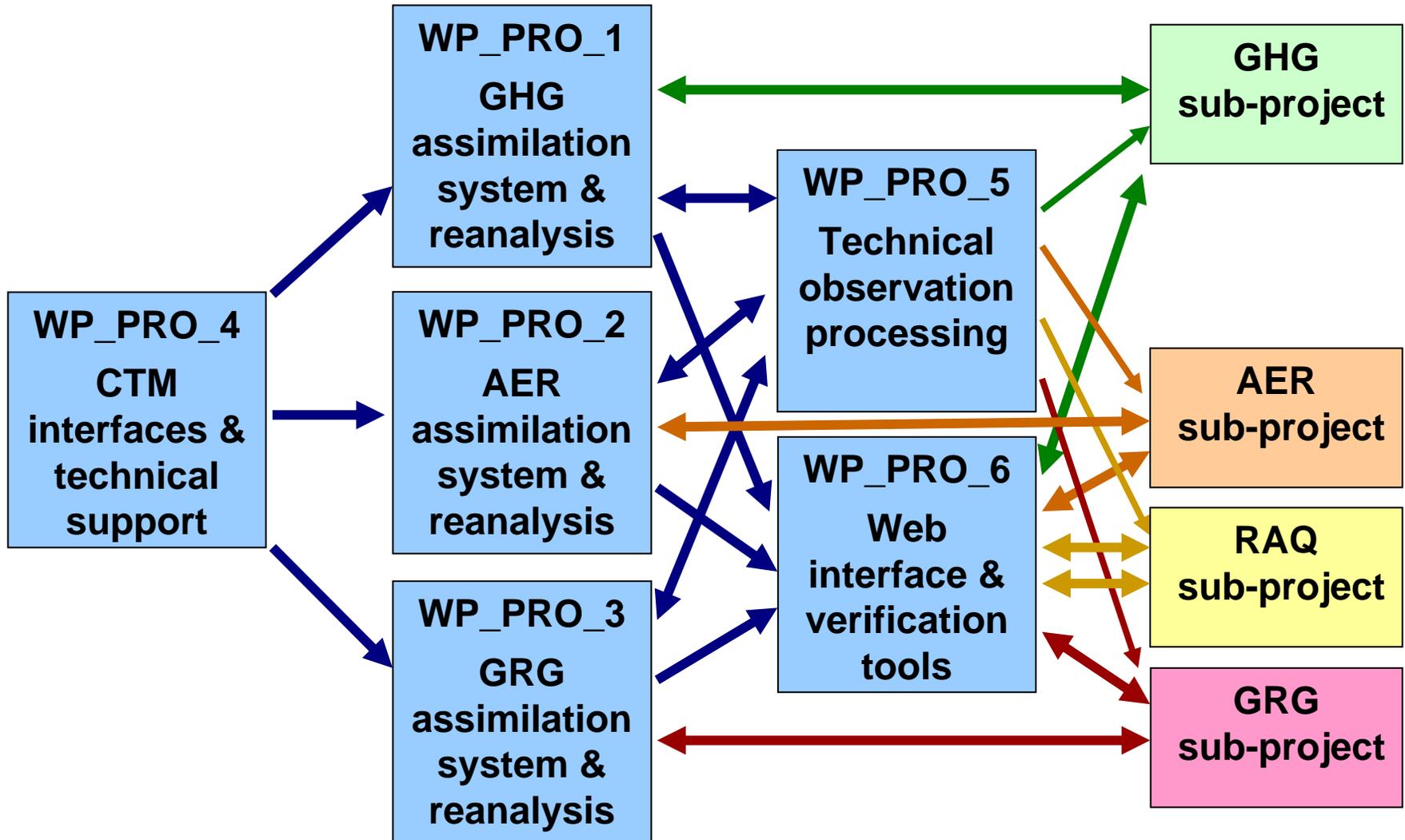
Sub-project manager: Adrian Simmons

Sub-project partner: ECMWF

Objectives of PRO sub-project

- **Develop global data assimilation for GHG, GRG and AER (Year 1 ...)**
- **Acquire, pre-process and monitor observations (Year 1 ...)**
- **Develop web/verification infrastructure (Year 1 ...)**
- **Produce trial analyses for GHG, GRG and AER (Year 2 ...)**
- **Build integrated GEMS assimilation system (Year 3)**
- **Produce extended analyses (Year 3 ...)**
- **Prepare for operational application, including real-time forecasts to support RAQ (Year 4)**

Components of the PRO sub-project

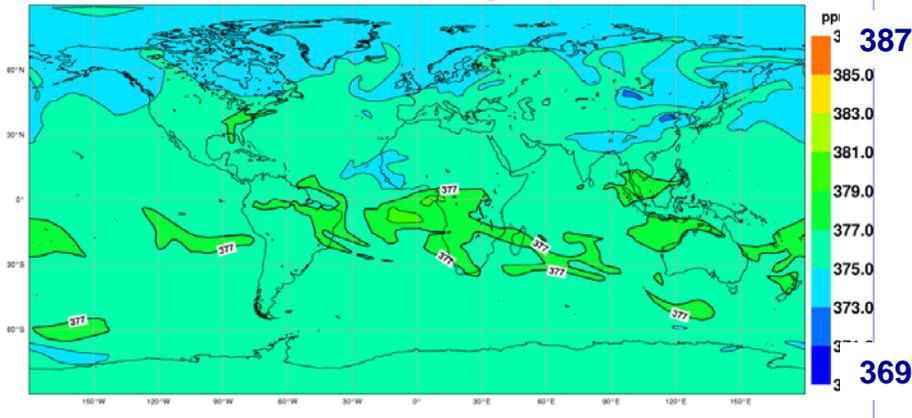


GHG Status (Richard Engelen)

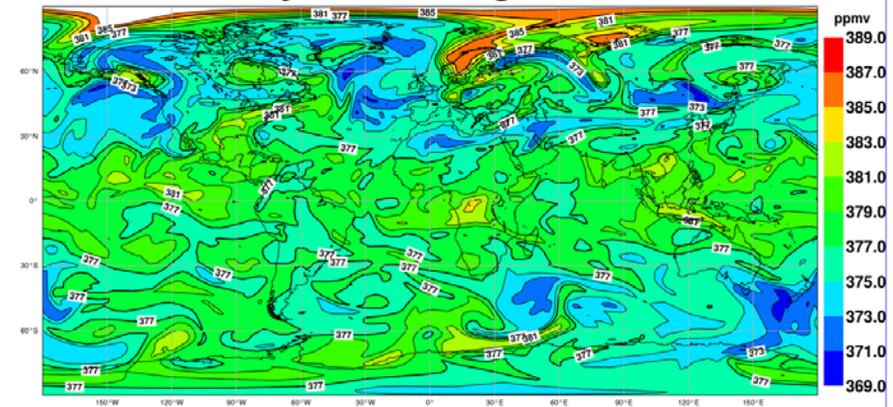
- **Main GHG assimilation system has been built**
- **Forecasting-system (IFS) changes for GHG, GRG, and AER have been integrated and are being tested for inclusion in a forthcoming standard release of IFS**
- **Diurnal cycle of natural biosphere is being integrated**
- **Work is in progress on missing pieces (forecast/analysis error, interface with prepIFS)**
- **Work is in progress on B-matrix**
- **Preparations are being made for use of IASI data**

First 4D-Var analysis results for CO₂

300 hPa Forecast - 31 August 2003 12 UTC



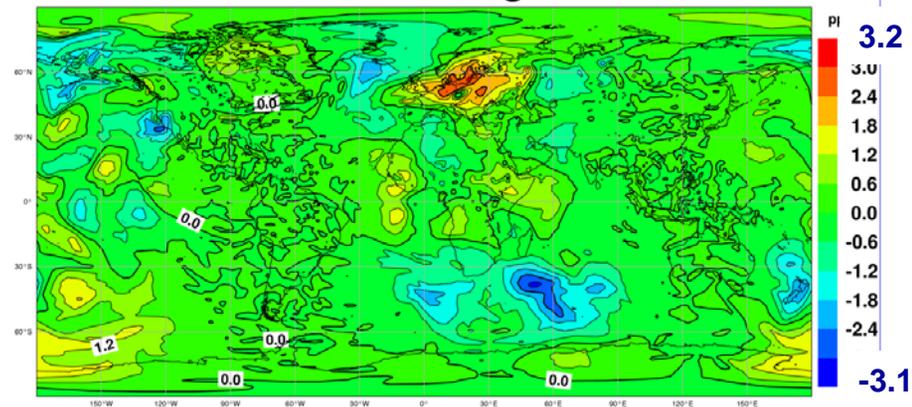
300 hPa Analysis - 31 August 2003 12 UTC



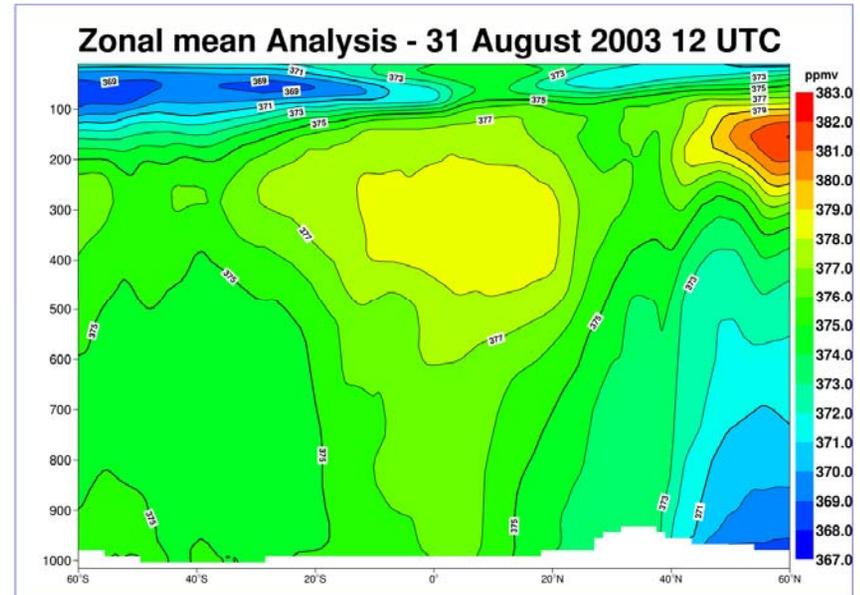
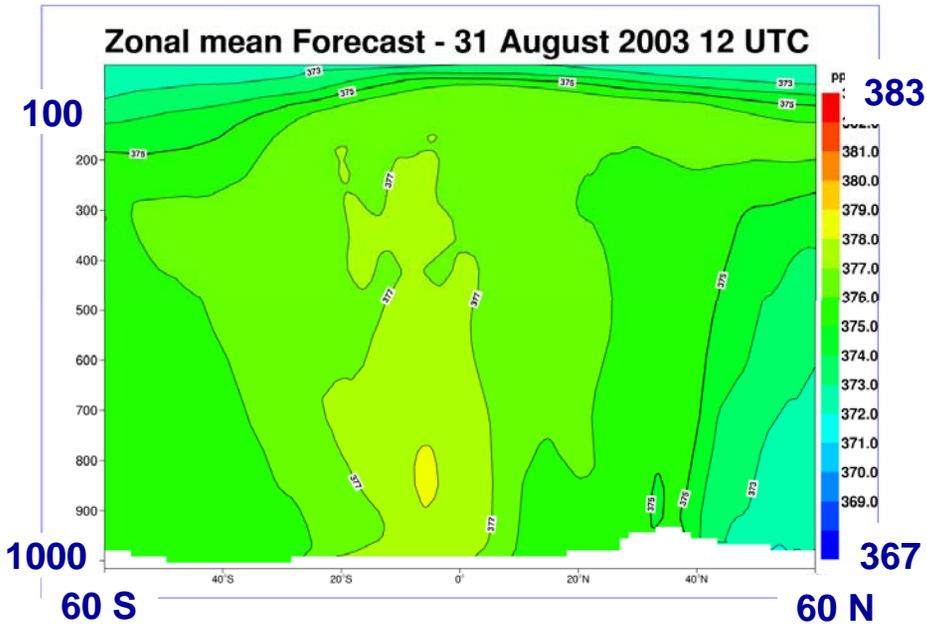
After 31 days of 4D-Var, the analysis has increased the global mean value as well as the spatial gradients.

The increments in any analysis cycle are within ± 3 ppmv.

300 hPa Increments - 31 August 2003 12 UTC

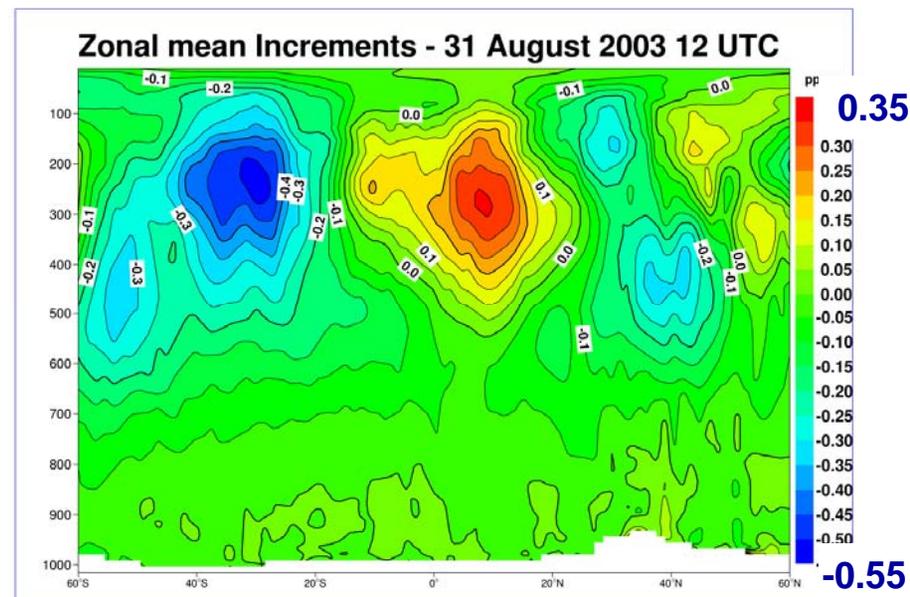


Zonal mean CO₂ distributions



The effect of assimilating AIRS radiances is mainly to increase CO₂ mixing ratios in the upper troposphere and reduce mixing ratios in the SH stratosphere.

However, a very simple background error matrix was used!



GHG Milestones for months 13 to 30

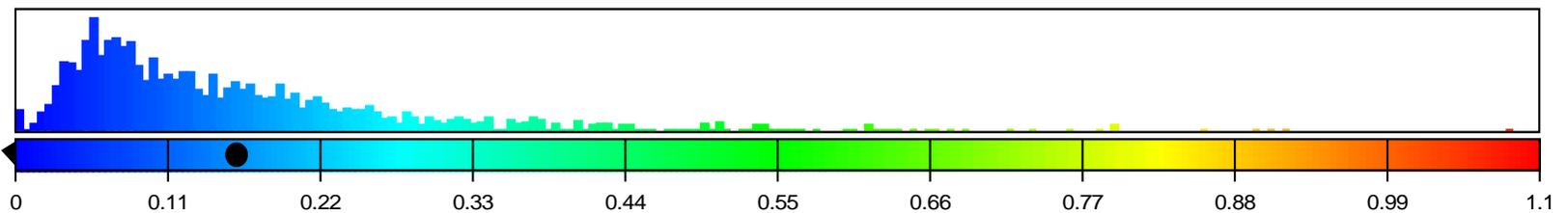
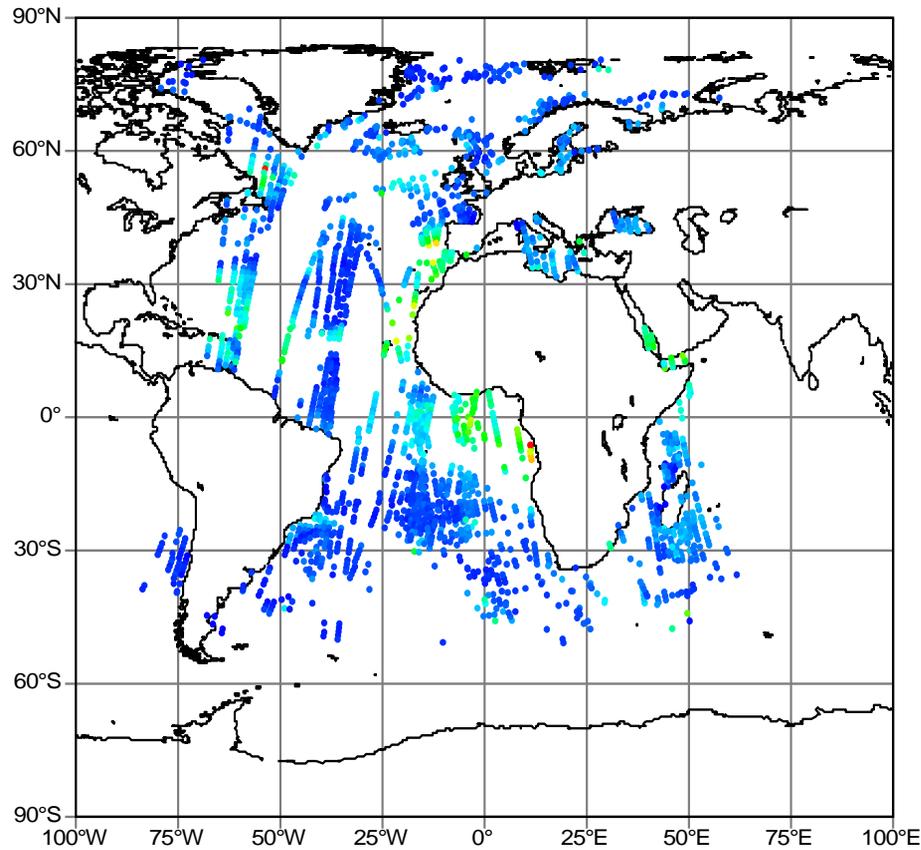
- **Month 15 (May 2006):** preparation for IASI and Sciamachy assimilation
- **Month 18 (Aug 2006):** definition of background constraint
- **Month 21 (Nov 2006):** start of CO₂ reanalysis
- **Month 24 (Feb 2007):** initial validation of reanalysis
- **Month 27 (May 2007):** finalize 2-year CO₂ reanalysis
- **Month 30 (Aug 2007):** production of integrated GEMS system

AER Status (Angela Benedetti)

- **New observation pathway has been defined in IFS for aerosol optical depth**
- **Preliminary background error covariance matrix for aerosol mixing ratios has been derived using the NMC method**
- **An aerosol optical depth observation operator has been implemented (including tangent linear and adjoint)**
- **Technical changes to IFS to allow for an aerosol optical depth assimilation are continuing**
- **First analysis increments have been obtained with MODIS observations**

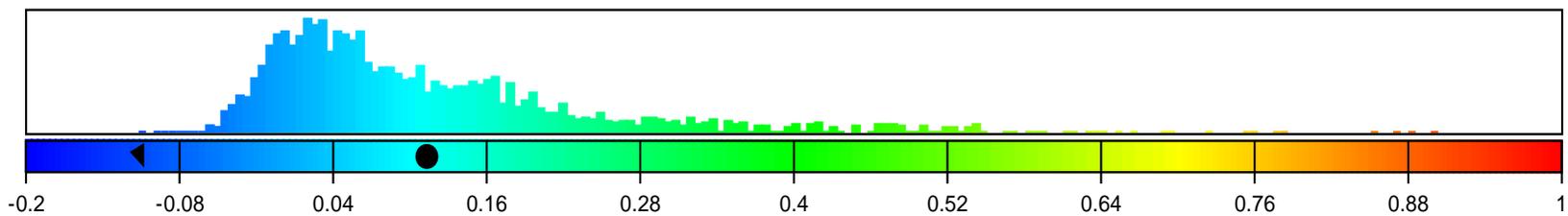
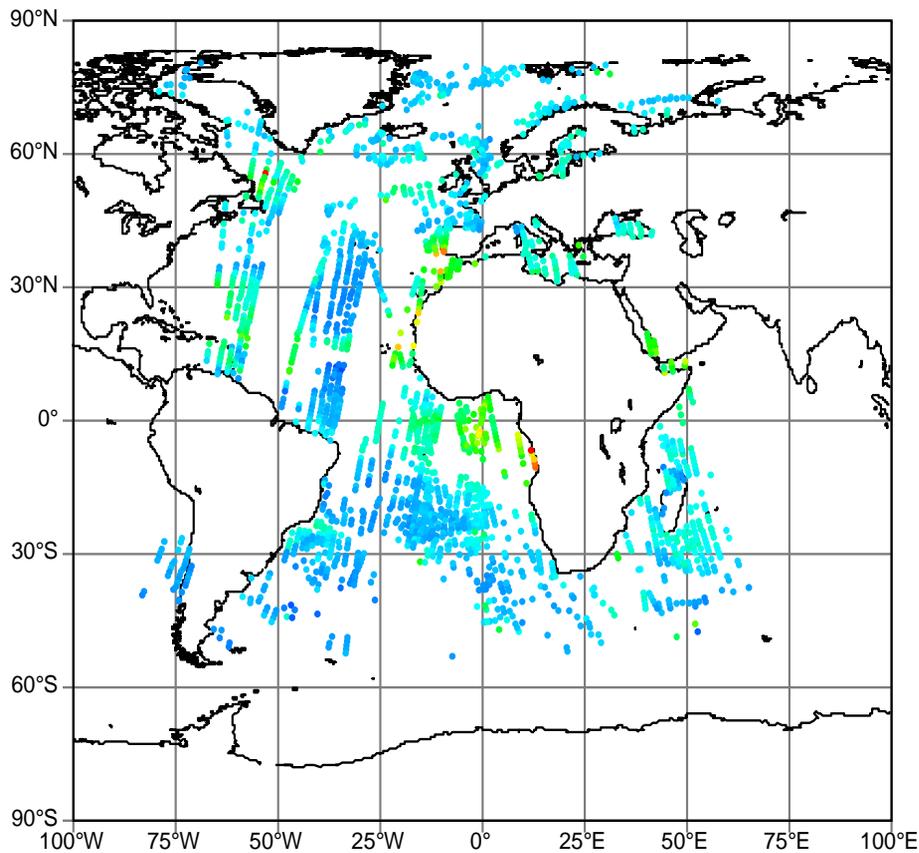
Preliminary results (2003080112 – one analysis cycle)

MODIS Aqua+Terra AOD at 0.55 microns (ocean only)



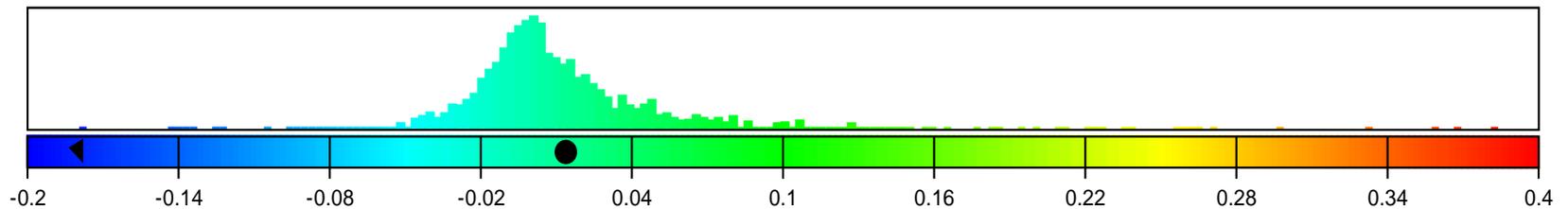
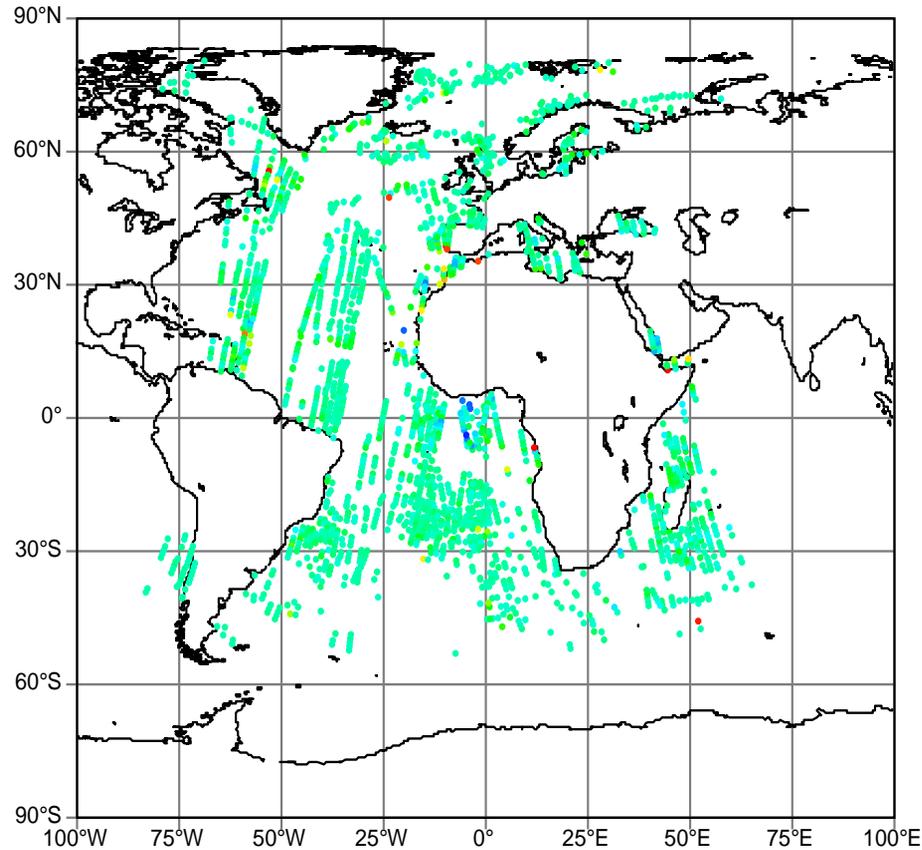
Preliminary results (2003080112 – one analysis cycle)

First guess departures (obs-model) for AOD at 0.55 microns



Preliminary results (2003080112 – one analysis cycle)

Analysis departures (obs-model) for AOD at 0.55 microns



AER Milestones for months 13 to 30

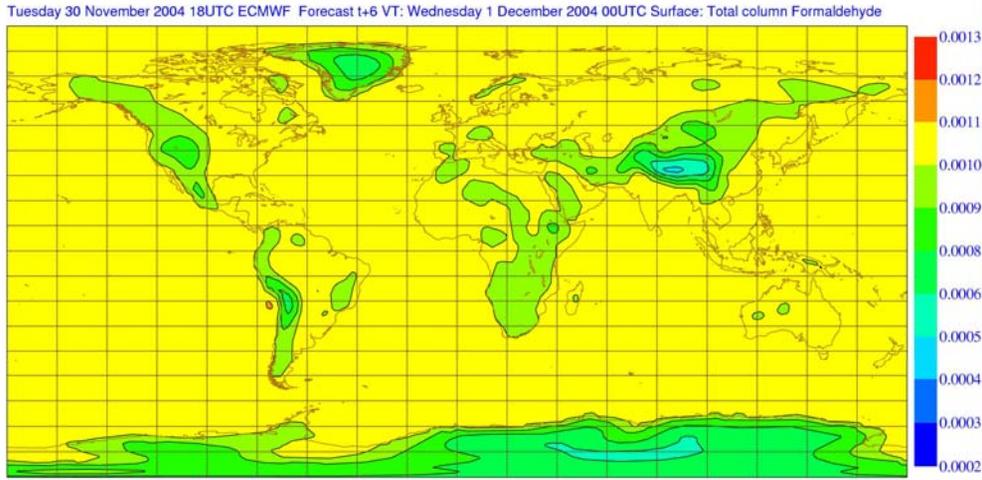
- **Month 18 (Aug 2006):** system ready for test assimilation of optical-depth data
- **Month 18 (Aug 2006):** start work for assimilation of aerosol-affected radiances
- **Month 21 (Nov 2006):** start of AER reanalysis using optical-depth data
- **Month 24 (Feb 2007):** initial validation of reanalysis
- **Month 27 (May 2007):** finalize 2-year AER reanalysis
- **Month 30 (Aug 2007):** production of integrated GEMS system; capability for radiance assimilation

GRG Status (Antje Dethof)

- **2003 reanalysis run for GRG partners has been completed**
- **First version of GRG assimilation system is in place:**
 - **simple total column observation operator**
 - **diagonal B matrix**
 - **constant initial field**
 - **no chemistry**
 - **using tool to incorporate non-BUFR observations**
 - **running single-observation experiments and experiments with MOPITT CO data**

Test assimilation of MOPITT total column CO data

Background 20041201, Oz



Obs error 10%

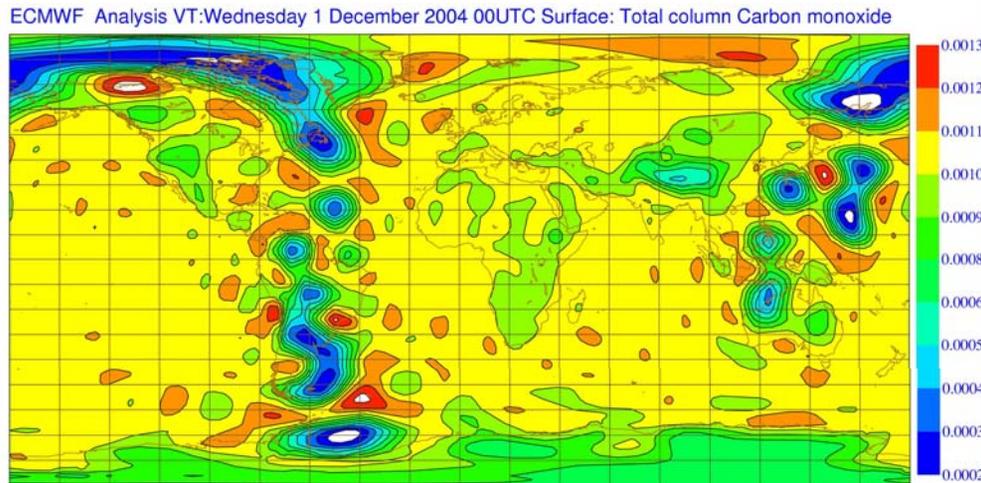
diagonal B,
 $\sigma_b=1.e-7$ kg/kg,

Background field= $1.e-7$ kg/kg

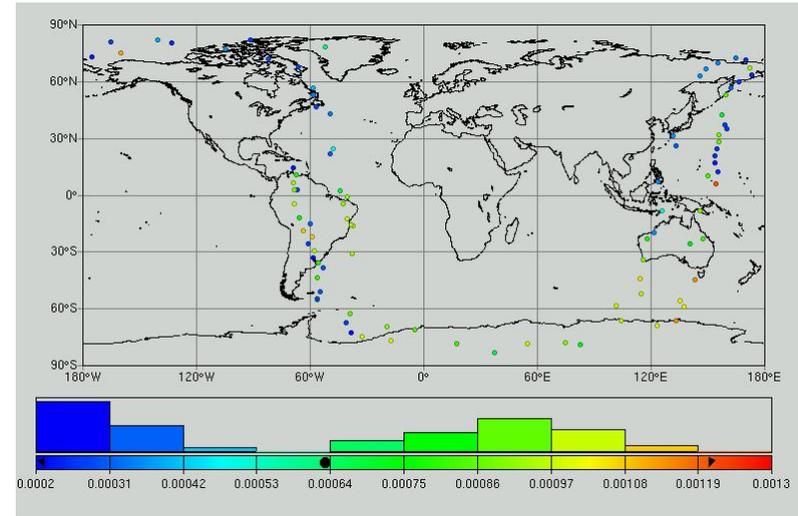
No chemistry

Analysis, 20041201, Oz

Kg/m2



CO observations



GRG Milestones for months 13 to 30

- **Month 15 (May 2006):** implementation of GRG assimilation system with IFS/CTM coupling
- **Month 18 (Aug 2006):** initial test analysis for several reactive gases
- **Month 21 (Nov 2006):** start of GRG reanalysis
- **Month 30 (Aug 2007):** finalize 2-year GRG reanalysis
- **Month 30 (Aug 2007):** production of integrated GEMS system

Support Status (Claes Larsson)

- **ECMWF's experiment-preparation tool, prepIFS, has been upgraded to support the GEMS experiments**
- **Users have been supported with creating the OASIS4 input files and description of model**
- **OASIS4 configuration tool has been optimized**
- **A new release of prepIFS that integrates OASIS4 configuration into the web interface has been created**
- **Users have been supported in creating the prepIFS greenhouse gas configuration files**
- **Development of prepIFS to support coupled IFS/CTM has started**

Support Milestones for months 13 to 30

- **Month 20 (Oct 2006):** **Completion of interface between IFS and CTMs**

- **Others to be developed**

Status of observation processing and archival support (Martin Suttie)

- **Prepared and submitted BUFR code proposals to WMO**
 - Have been reviewed by Expert Team
 - Majority accepted (rejection of aerosol types – to be clarified)
 - Awaiting official report
- **Constructed local BUFR tables including new GEMS parameters**
- **Started encoding GEMS observations**
 - KNMI SCIAMACHY NO₂ HDF to BUFR under test
 - MODIS Aerosol HDF to BUFR; writing of BUFR being finalised
 - Developed reading software for KNMI GOME/SCIAMACHY HCHO HDF
- **Acquired substantial data sets**
- **Processed total column ozone data for 2003 reanalysis**
- **Supporting archival/dissemination of CTM fields**

Data Acquisition

- **MODIS Aerosol (Terra & Aqua) for 2003**
 - ([ec:/oparch/gems/modisaerosol/aqua\[terra\]/YYYYMM/DD/*.raw.gz](ec:/oparch/gems/modisaerosol/aqua[terra]/YYYYMM/DD/*.raw.gz))
- **KNMI SCIAMACHY NO₂ for 2003 and 2004**
 - (ec:/oparch/gems/sciamachy/knmi_no2/YYYYMM/DD/no2track*.raw.gz)
- **MOPITT CO for 2003 and 2004**
 - (ec:/oparch/gems/mopitt_co/YYYYMM/DD/*.raw.gz)
- **AURA TES CH₄ and CO for July 2005**
 - ([ec:/oparch/gems/tes_ch4\[co\]/200507/DD/TES-Aura_L2-CH4\[CO\]*.raw.gz](ec:/oparch/gems/tes_ch4[co]/200507/DD/TES-Aura_L2-CH4[CO]*.raw.gz))
- **KNMI GOME HCHO for December 2001**
 - (ec:/oparch/gems/gome/knmi_hcho/200112/DD/ch2otrack*.raw.gz)

Obs-processing Milestones for months 13 to 30

- **Month 15 (May 2006):**
 - Completion of obs processing chain for separate assimilation systems
- **Month 18 (Aug 2006):**
 - Provision of archive and retrieval service for GEMS_PRO observations
 - Feeding PRO applications from GEMS_PRO Observation Data Base
 - Observations ready for GHG and AER reanalyses
- **Month 21 (Nov 2006)**
 - Identification of candidate observations for real-time acquisition
 - Observations ready for GRG reanalysis
- **Month 24 (Feb 2007)**
 - Further observations processed as needed by GHG and AER reanalyses
- **Month 27 (May 2007)**
 - Further observations processed as needed by GRG reanalysis
- **Month 30 (Aug 2007)**
 - Completion of obs processing chain for unified GEMS assimilation system
 - Initial preparation of real-time acquisition system for GEMS_PRO obs

Status of web interface and verification (Miha Razinger)

- **Web based information system**

- implemented facilities for news items, project reporting, document exchange and threaded discussions
- developed extraction and conversion tools for progress reports in GEMS collaborative system; identified issues to be addressed before next reporting is due

- **Data monitoring tools**

- started revising satellite monitoring plotting software to meet GEMS requirements for simpler addition of new satellites and longer time series

- **RAQ verification**

- began liaison with WP_RAQ_4

News item:

2003 reanalysis for GRG CTM partners completed - Mozilla

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2003 reanalysis for GRG CTM partners completed

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The 2003 reanalysis run that will provide initial conditions for the GRG CTM partners has been completed. To retrieve data from the experiment please use EXPVER=500, CLASS=E4. The horizontal resolution of the experiment is T159 (T95 in the first minimization), the vertical resolution is L60 and is the same as the vertical resolution used in the operational analyses at the end of 2005 (see the model levels [here](#)). More information about the experiment's settings can be found in the [here](#).

Information about the fields archived in EXPVER=500 can be found on ECMWF's MARS website <http://www.ecmwf.int/services/archive/d/catalog/class=e4/stream=oper/expver=500/>. A description of the GRIB codes can be found on <http://www.ecmwf.int/services/archive/d/parameters>.

Model Levels

NFLEV=	60	PS=	1013.250 hPa	H=7km		
N:	a:	b:	ph [hPa] :	pf [hPa] :	z [km] :	dz [km] :
1	20.000	0.00000000	0.200	0.100	64.565	infinity

Start | Re: the E2280 query re e... | 2003 reanalysis for G... | Download Manager | Meeting_20050831 | PRO_Y1 | RAQ_Paris_Collaboration... | PRO_Plan_M13-30 - Micr... | 14:56

Web access to 2003 reanalysis:

plot46, Sat Feb 4 15:02:52 2006 - Mozilla

http://www.ecmwf.int/services/archive/d/inspect/personal/results/plot46%2C%20Sat%20Feb%20%204%2015%3A02%3A52%202006/

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Personal > Results of your tasks > plot46, Sat Feb 4 15:02:52 2006>

plot46, Sat Feb 4 15:02:52 2006

Atmospheric model 12:00:00 Surface 500 2 metre temperature 40 years reanalysis 2003-08-10 Analysis

Task complete

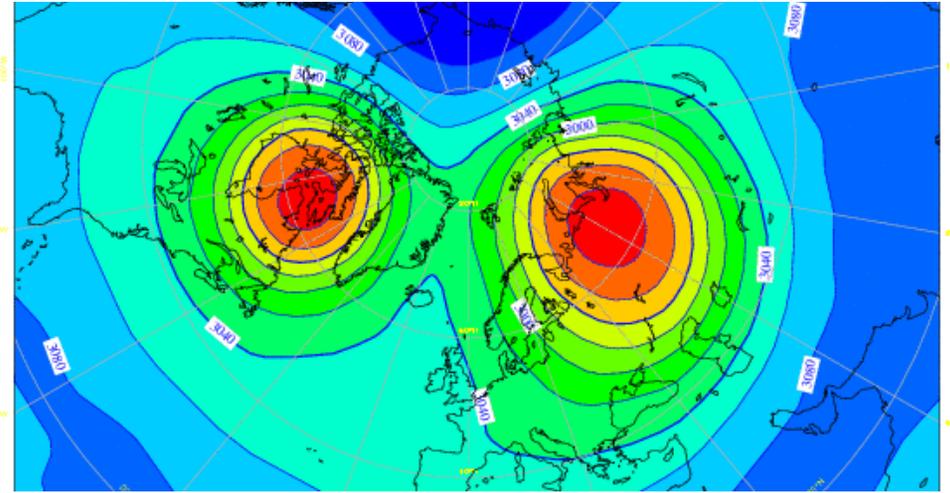
1 field retrieved

Name	Size	Created
grib	32.1 Kbytes	Sat Feb 4 15:04:57 2006
Plots		Sat Feb 4 15:04:57 2006

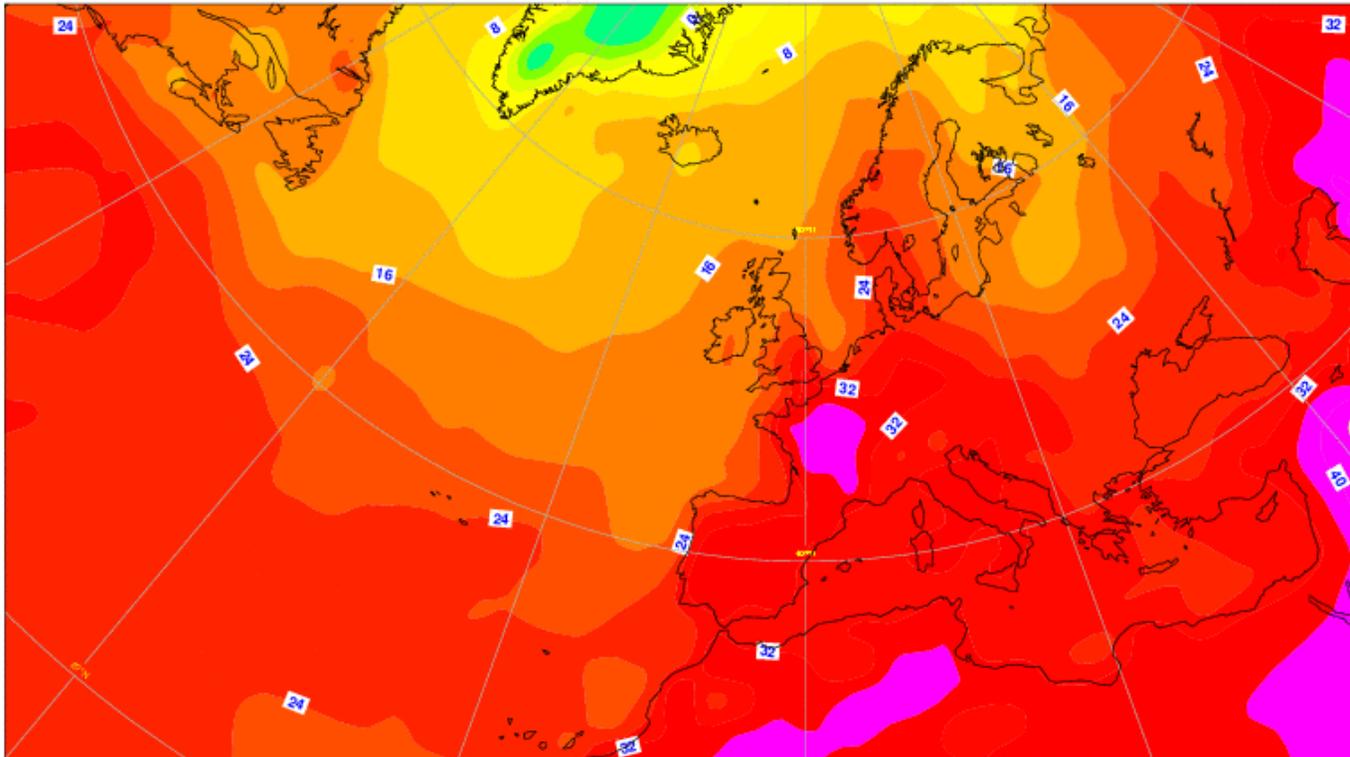
04-02-2006 © ECMWF

Web plots from 2003 reanalysis

17 February 2003 12UTC 10hPa geopotential height



ECMWF Analysis VT: Sunday 10 August 2003 12UTC Surface: 2 metre temperature



Web and Verification Milestones for months 13 to 30

- **Month 13 (March 2006):**
 - Begin developing web-based tools for GEMS data access and retrieval
- **Month 15 (May 2006):**
 - Definition of RAQ verification tools following completion of D_RAQ_4_1.1
- **Month 18 (August 2006):**
 - Begin developing the verification tools for RAQ
 - Begin developing dedicated data and observation capabilities for RAQ
- **Month 21 (Nov 2006):**
 - First version of GEMS observation monitoring tools
- **Month 24 (Feb 2007):**
 - Provision of comprehensive web based information system
- **Month 27 (May 2007):**
 - First tests of RAQ verification system with real data, with delivery of observations and model output from WPs RAQ_3 and RAQ_1