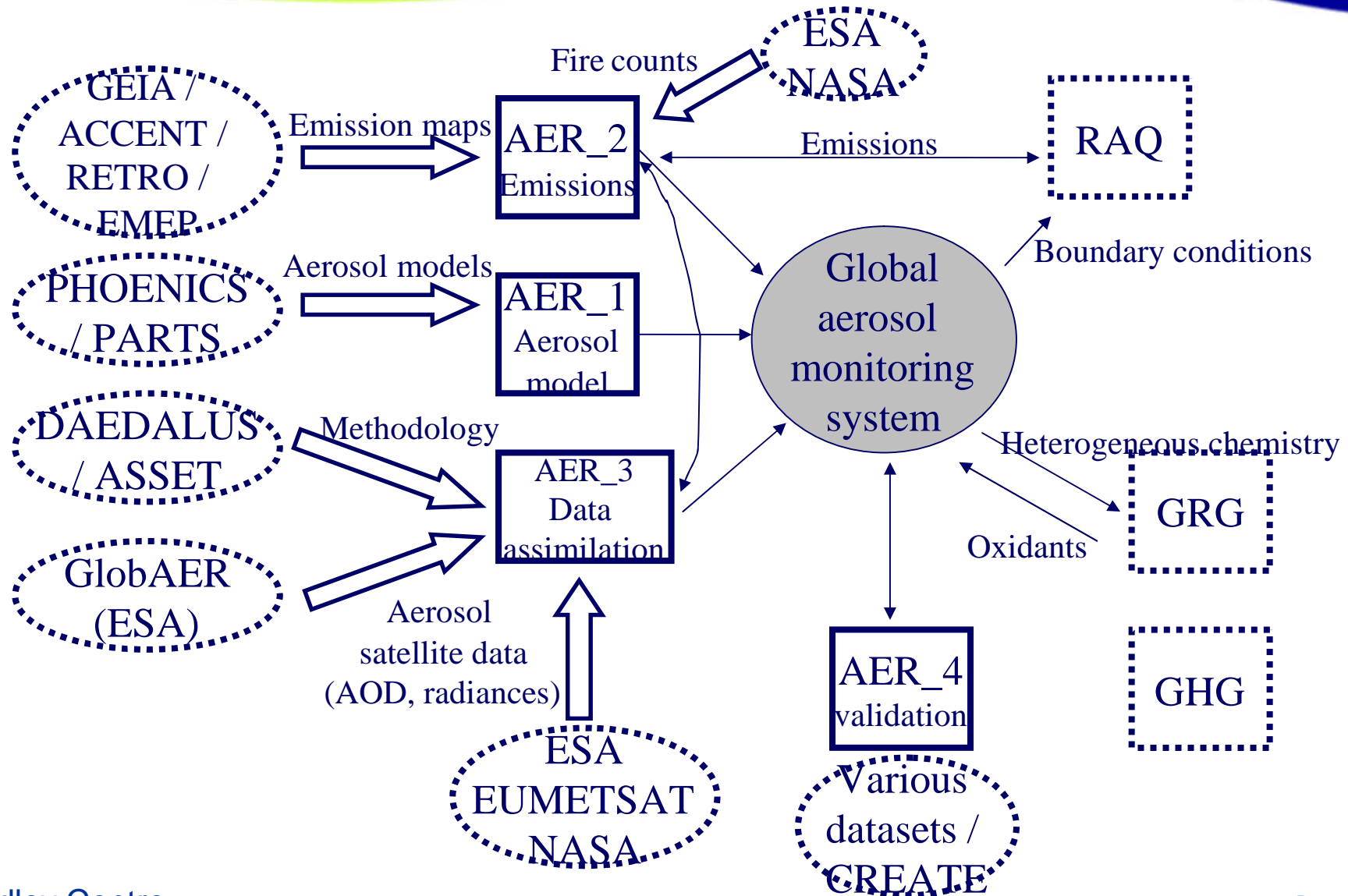# GEMS-aerosol work plan

Met Office, ECMWF, CNRS-LOA, MPI-M, CEA-IPSL-LSCE, NUIG, SA-UPMC, FMI, DWD, RMIB, DLR (no cost)

Olivier Boucher

Presentation to the GEMS annual assembly

Reading, 9 February 2006

Aerosol monitoring in GEMS

Objectives of the aerosol breakout session

1/ Review progress from all partners

2/ Make a number of key decisions
- model set up for the next year or so
- emission datasets
- satellite datasets for data assimilation
- interfaces with other sub-projects
- evaluation strategy

3/ Agree on and polish workplan for months 13 to 30

4/ Decide if interim aerosol meetings are needed

Constraints

- PRO workplan

- Availability and quality of model and satellite data

- Model cost: choice of the scheme and sensitivity experiments

- Requirements from other sub-projects (RAQ)

Project	MAM 2006	JJA 2006	SON 2006	DJF 2006/7	MAM 2007	JJA 2007
GHG_ Modelling at ECMWF	Continue validation of model transport, surface fluxes	Continue validation of model transport, surface fluxes	Assessment of GHG model performance in Data Assimilation	Assessment of GHG model performance in Data Assimilation	Assessment of GHG model performance in Data Assimilation	Prepare upgrades of GHG model
AER Modelling at ECMWF	Continue Validation of Aerosol Model	Continue Validation of Aerosol Model	Assessment of AER model performance in Data Assimilation	Assessment of AER model performance in Data Assimilation	Assessment of AER model performance in Data Assimilation	Prepare upgrades of AER model
GRG Modelling at ECMWF	Finalise Interfacing to CTM1	Continue Validation of IFS_CTM1 Interfacing	Continue Validation of IFS_CTM1 Interfacing	Assessment of GRG model performance in Data Assimilation	Assessment of GRG model performance in Data Assimilation	Assessment of GRG model performance in Data Assimilation
Pro 1 GHG DA System & Reanalysis	Validation of GHG Assimilation System	First trial GHG reanalyses	Production of GHG reanalysis 2003-2004, with reruns as needed	Production of GHG reanalysis 2003-2004, with reruns as needed	Production of GHG reanalysis 2003-2004, with reruns as needed	Prepare upgrades of GHG data assimilation system
Pro2 AER DA System & Reanalysis	Validation of GHG Assimilation System	First trial AER reanalyses	Production of AER reanalysis 2003-2004, with reruns as needed	Production of AER reanalysis 2003-2004, with reruns as needed	Production of AER reanalysis 2003-2004, with reruns as needed	Prepare upgrades of AER data assimilation system
Pro3 GRG DA System & Reanalysis	Validation of GHG Assimilation System	Validation of IFS_CTM1 Interfacing in 4D-Var	First trial GRG reanalyses	Production of GRG reanalysis 2003-2004, with reruns as needed	Production of GRG reanalysis 2003-2004, with reruns as needed	Production of GRG reanalysis 2003-2004, with reruns as needed
Pro 4 Technical Support &CTM Interfaces	GUI for Process control of IFS, OASIS4, CTM1	Complete GUI for Process control of IFS, OASIS4, CTM1	Interface IFS_CTM2, PREPIFS support for GEMS, incuding l remote users	Interface IFS_CTM3 and PREPIFS support for GEMS, incuding l remote users	Support for CTM interfaces & PREPIFS support for GEMS, incuding l remote users	Support for CTM interfaces & PREPIFS support for GEMS, incuding l remote users
Pro5 Technical observation processing	Complete data acquisition & re-formatting for 2003-2004	Begin data acquisition for 2000- 2002 & 2005-2006	Data formats and converters for GEMS observations and field variables	Data formats and converters for GEMS observations and field variables	Data formats and converters for GEMS observations and field variables	Data formats and converters for GEMS observations and field variables
Pro 6 Web interface and verification tools	Build web access to boundary conditions	Complete web-access to boundary conditions Begin archive of LAM runs	RAQ Data acquisition, Displays & Verification tools	RAQ Data acquisition, Displays & Verification tools	RAQ Data acquisition, Displays & Verification tools	RAQ Data acquisition, Displays & Verification tools

- "4-variable scheme" in the troposphere
-coarse dust and sea-salt calibrated against full ECMWF 10-bin scheme
-gas precursor and accumulation mode aerosol from LMDZT
-opportunity for upgrades (RAQ)
-fudge PM2.5/PM10 variable?

- 1 moment stratospheric aerosol scheme in the stratosphere
- prescribed maps of sigma and r0, OK for background conditions only
- to be tested first in LMDZT
- to be ported to ECMWF
- stratospheric mask:
  $p < 300$ mb AND (wv < 7 ppmv OR and O3 > 100 ppbv)
potential vorticity

- 2003, then 2003-2004

- T159L60 (or 91 ?)   eq 1.125°

AER model setup - reanalysis

Number of sensitivity runs=function(CPU, evaluation)

- Sensitivity runs to be performed in the 9 months

  w/o data assimilation (1-2 year periods)
      vertical resolution L91 vs L60
      wave model on/off
      w/o and w stratospheric aerosol
      dust and sea-salt source functions
      biomass burning emissions (sub-monthly variability)

  w data assimilation (1-2 week, up to 1 month periods)
  (possibility of reducing the amount of satellite data assimilated
  to speed up the system and afford longer test periods)
  1/ MODIS total ocean AOD, 2/ MODIS fine/total ocean AOD
  3/ MODIS fine/total ocean and total land AOD, 4/ total + SAGE
  biomass burning emissions (sub-monthly variability)

- 1 final 2-year experiment with data assimilation (PRO)

AER model setup - reanalysis

- Diagnostics
  - list of variables
    - AOD @ 14 wavelengths (+extra UV and IR to be defined)
    - fine-mode AOD, absorption AOD,
    - effective radius of total size spectrum
    - mass concentrations, fudged PM (?)
    - profile of extinction coefficient @ 5 wavelengths (strat + trop)
    - radiation (surface UVB with interactive O3,   PAR, SW
      direct & diffuse, LW) using a second radiation call with aerosols
    - visibility

  - temporal sampling: 3 hourly (+daily and monthly means)

  - wind-sector sampling (Mace Head, Cape Grim)

Hadley Centre

Emissions

- Fossil-fuel

  $SO2/BC/OC$ = AEROCOM (updated from EDGAR, ships, ...)

  consult with GRG and Frank first to avoid inconsistencies

  BC from AEROCOM and CO from RETRO will be compared

  $H2S$ = scaled to $SO2$

  neglect ammonium and nitrate

  2 levels of injection

  seasonal cycle =paste from RAQ in Europe as possible upgrade

  weekly cycle = same

  diurnal cycle = same

  annual increase rate = projections to 2003/04 from Laxenburg

- Biomass burning GFEDv2, monthly, 1997-2004, ASCII, 1°x1°
  SO2 = MS to discuss how to get it
  BC / OC / PM2.5 / TPM

  injection height = AEROCOM?
  MS to review AEROCOM, OB to check MISR products on plumes

  sub-submonthly variability =

  $F(x,y,t,day,month)=CLIM(month,X,Y) * hotspot(x,y,day) * f(t)$
  hotspot = smooth function from previous days if no data

  ocean AOD assim, no sub-monthly variability
  ocean + land AOD assim, some refinements needed
  some more investigation needed, consistency with GRG

Emissions

- Dust

  YB and PG to provide a benchmark dust source for 2003
  development on road dust and arable dust
  SK to investigate for a further dust source

- Sea salt

  YB to provide a benchmark sea-salt source for 2003
  Combination of Monahan and Marttensson (T0+16)
  Source function from Andreas (revised Smith supermicron)
  Revised source formulation from MAP in the long run

Emissions

- Natural VOC

  Guenther et al monoterpenes

- DMS

  check with Sylvia Kloster (JRC)

  oceanic DMS climatology + transfer function

- Volcanoes

  continuous emissions: AEROCOM

  explosive emissions: TOMS? (SB)

- Stratospheric source

  chemical production from OCS prescribed

  (using correlations with other LL species in the merged system)

Data assimilation

Merged satellite product for validation:
- Stefan will provide a document with his comparisons (MODIS,MISR,TOMS,AVHRR,POLDER)
- dataset without MODIS for validation of analysis
- MSG and GlobAER AOD: under development, will be used for validation and in the future for assimilation if proven good

Observations to be used in the first reanalysis:
- MODIS data with a bias correction and pixel-by-pixel error estimate over ocean only (AOD to start with, total and fine-mode AOD then)
- MODIS data with ocean and land retrievals

Observation screening and thinning:
- closest pixel
- Blacklist "problem" area

Bias correction for MODIS:
- not recommended to use Remer et al. (need to come up with our own)

Model evaluation

No requirement for centralised aerosol data at ECMWF for the moment
WDCA, AERONET and other database being maintained already

AEROCOM: located at LSCE, ok for daily and monthly point data,
2003-2004 AERONET ok, EMEP?, satellite?
Possibility of including more AOD data into AEROCOM (Brewer+PFR)

List of case events for 2003/2004 (HB+SK, link to GRG)

Need for some headroom for evaluation using DLR data & EARLINET

Need for a few common diagnostics with RAQ and GRG

Future need for verification data at ECMWF in the operational phase
using the MetPy tools. Need to secure NRT access to AERONET.

Scoring against AERONET gridded data
Need to account for data error.

Practical details

Minutes and list of actions to be circulated asap

Workplan for months 13-30

OB to send revised workplan draft with placeholders

Partners to send revised version with track changes by Feb 20.

OB to send TH by 28 Feb.

First year activity report

Partners to send their contribution to WP leaders by 10 March

WP leaders to send to OB by 20 March

OB to send to TH by 31 March

2 potential interim meetings in the autumn

Satellite data (GlobAER, MSG, ATSR)

Evaluation (scores, link to GRG and RAQ)