



Development of the GMES atmospheric services for monitoring and forecasting atmospheric composition

Adrian Simmons

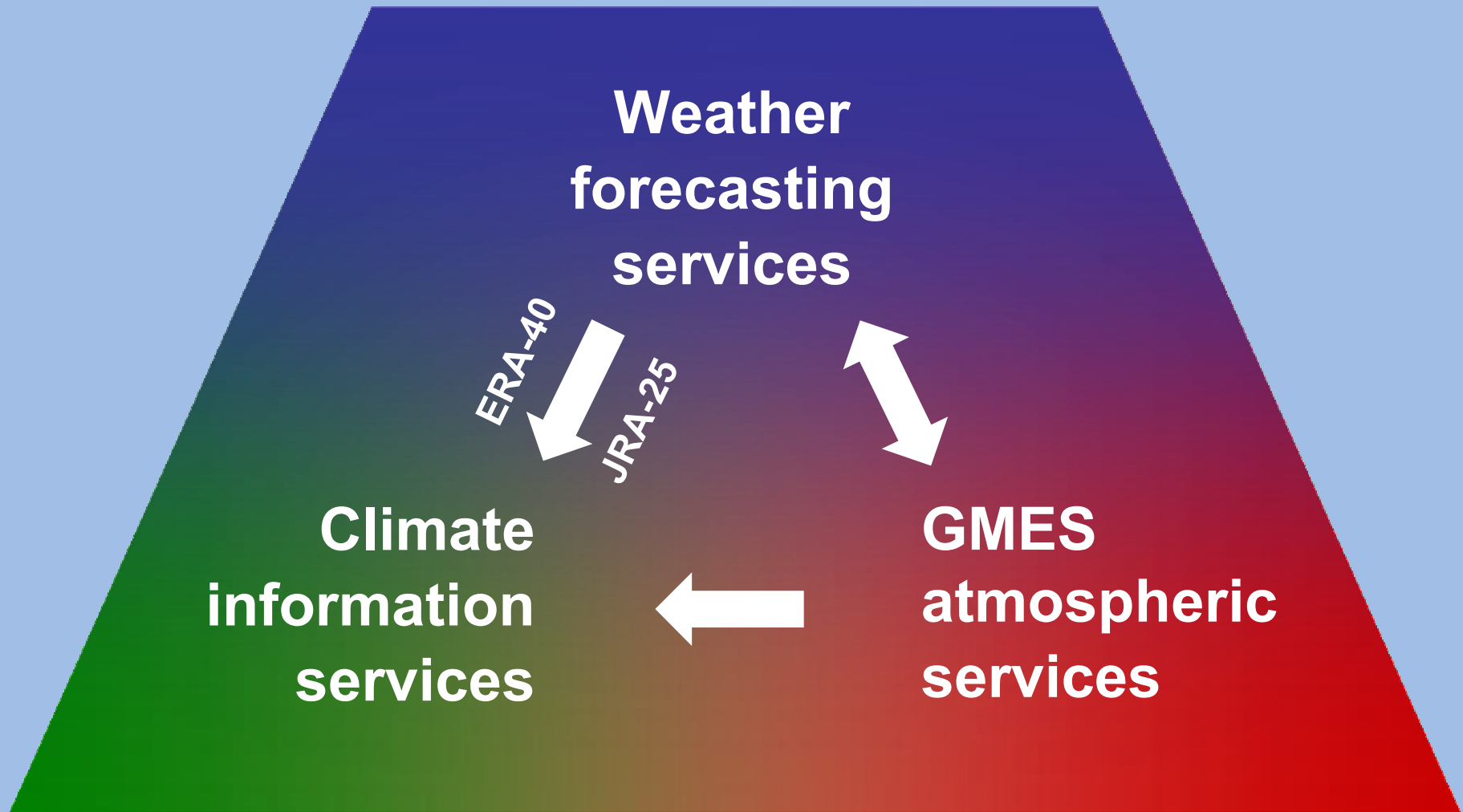
European Centre for Medium-Range Weather Forecasts

Thilo Ebertseder

German Aerospace Agency

AQ Seminar July 16th 2009

Atmospheric services for Europe



GMES atmospheric services: Services related to the chemical and particulate content of the atmosphere

**Global
distributions
and net
sources/sinks
of greenhouse
gases and
aerosols**

European air quality

Long-range transport

Sand and dust storms

Solar energy resources

Exposure to UV radiation

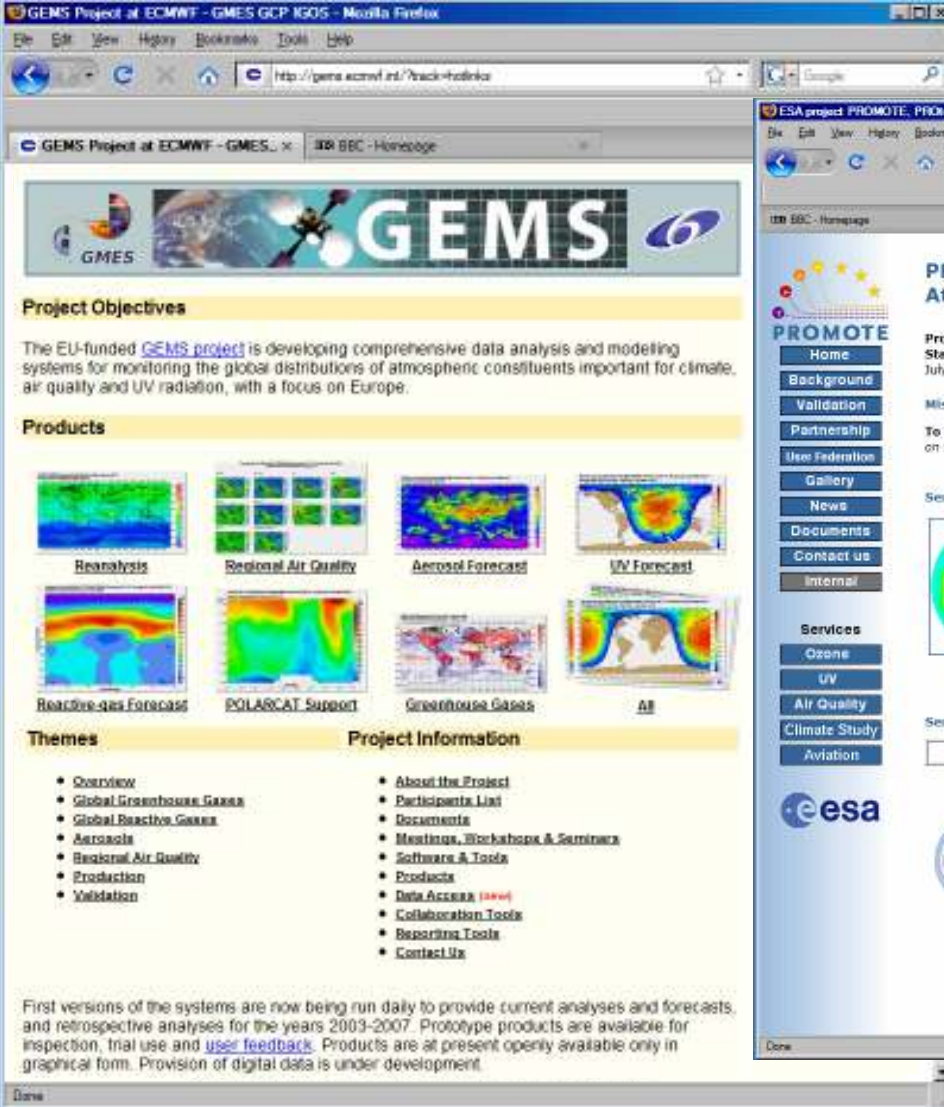


Global Monitoring for Environment and Security

- **A European initiative for providing information on environment and security, initiated by the European Commission and the European Space Agency**
- **It is fostering:**
 - **operational space-based observation of atmospheric composition**
 - **coordination and strengthening of complementary ground-based and airborne observing systems**
 - **development of associated data and information services**
- **It supports five core services: Atmosphere, Land, Ocean, Emergency Response and Security**
- **The pilot for the core GMES atmospheric service is provided by an EC-funded project called MACC**



The core production lines have been developed by the GEMS and PROMOTE projects



GEMS Project at ECMWF - GEMS GCP IGOS - Mozilla Firefox

http://gems.ecmwf.int/Track-Home.htm

GEMS

Project Objectives

The EU-funded [GEMS project](#) is developing comprehensive data analysis and modeling systems for monitoring the global distributions of atmospheric constituents important for climate, air quality and UV radiation, with a focus on Europe.

Products

- Reanalysis
- Regional Air Quality
- Aerosol Forecast
- UV Forecast
- Reactive-gas Forecast
- POLARCAT Support
- Greenhouse Gases
- All


Themes

- Global Greenhouse Gases
- Global Reactive Gases
- Aerosols
- Regional Air Quality
- Production
- Validation

Project Information

- About the Project
- Participants List
- Documents
- Meetings, Workshops & Seminars
- Software & Tools
- Products
- Data Access *(new)*
- Collaboration Tools
- Reporting Tools
- Contact Us

First versions of the systems are now being run daily to provide current analyses and forecasts, and retrospective analyses for the years 2003-2007. Prototype products are available for inspection, trial use and [user feedback](#). Products are at present openly available only in graphical form. Provision of digital data is under development.



ESA project PROMOTE: PROtocol MO尼Toring for the GEMS Service Element - Mozilla Firefox

http://www.gse-promote.org/

PROtocol MO尼Toring for the GEMS Service Element: Atmosphere

Project supported by the European Space Agency
Stage 2 - Up-scaling the GSE Atmospheric Monitoring portfolio
July 2006 - August 2009

Mission

To deliver the Atmosphere GEMS Service Element a sustainable and reliable operational service to support informed decisions on the atmospheric policy issues of stratospheric ozone depletion, surface UV exposure, air quality and climate change.

Services

- Ozone Service
- UV Service
- Air Quality Service
- Climate Study Support Service
- Aviation Support Service

Services by user communities

- Health
- Meteorological
- Environmental
- Research/Modeling
- Policy/Conventions
- Citizens

esa

gmes SERVICES


GEMS, Global Monitoring for Environment and Security, is a joint initiative of the [European Commission](#) and the [European Space Agency](#).

Evolution of the GMES Atmosphere Core Service

GEMS
EC-funded GMES Project
March 2005 – May 2009

PROMOTE
ESA-funded GMES Project
April 2004 – August 2009

MACC “Pilot” GMES Atmosphere Core Service
EC FP7 Collaborative Project
June 2009 – October 2011



“Operational” GMES Atmosphere Core Service
November 2011 –

Current developments

Continuation with new FP7 projects:

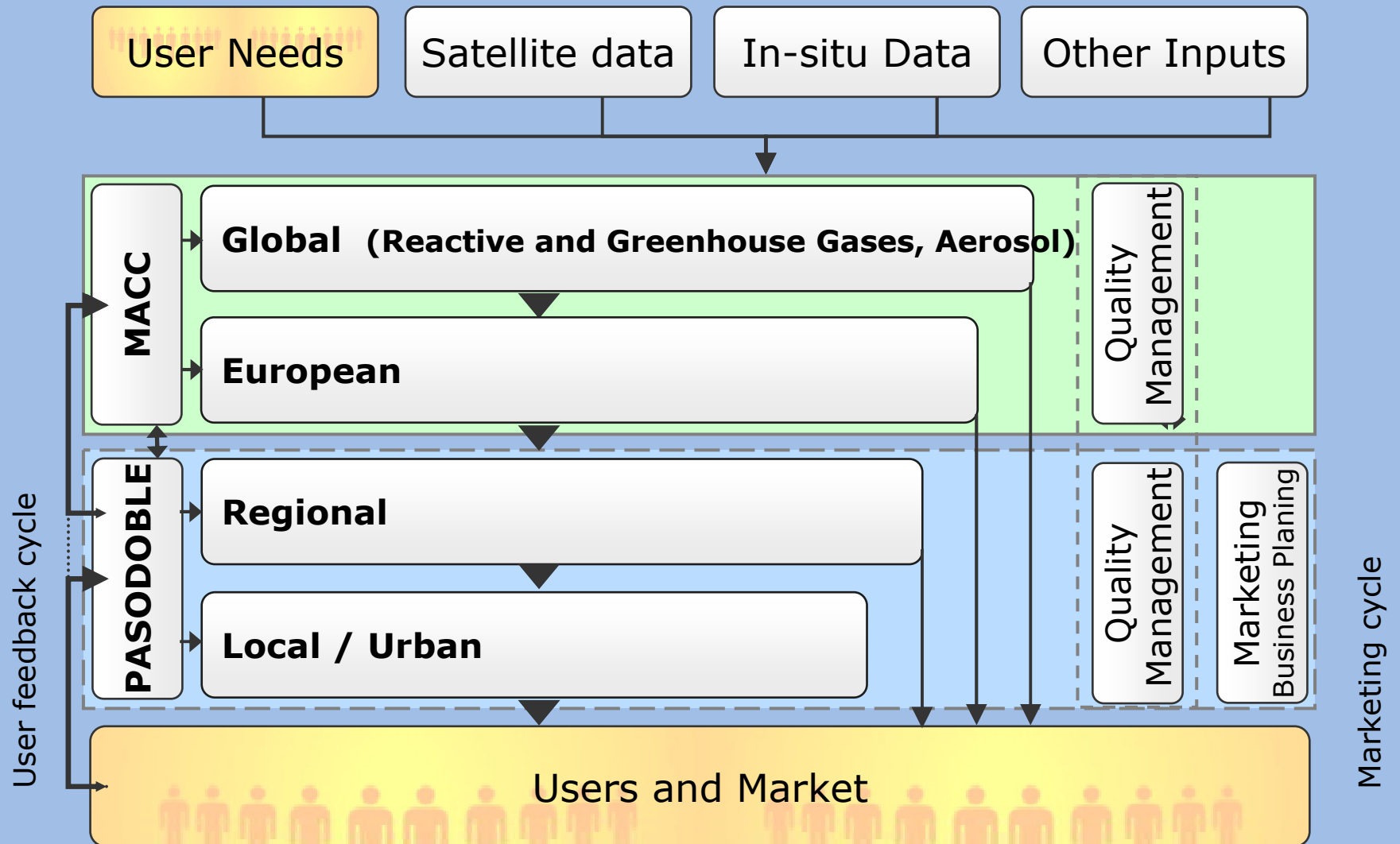
Core:

- **MACC** (start June 2009, also covers GHG, radiation, stratosphere)
www.gmes-atmosphere.eu

Downstream:

- **PASODOBLE** (start ~ Jan 2010)
- Further calls/projects will follow

Current GMES Air Quality Services



The GMES Air Quality Service Line

- **Links global satellite and modelling capacities down to specific local applications throughout Europe according to user needs**
- **Combines daily observations from satellite, measurements from ground-based networks and chemical transport modelling by means of data assimilation**
- **Follows a nested chain from global and European down to national, regional and local levels**
- **Integrates all relevant data and knowledge together with participating users to improve the daily live of European citizens**

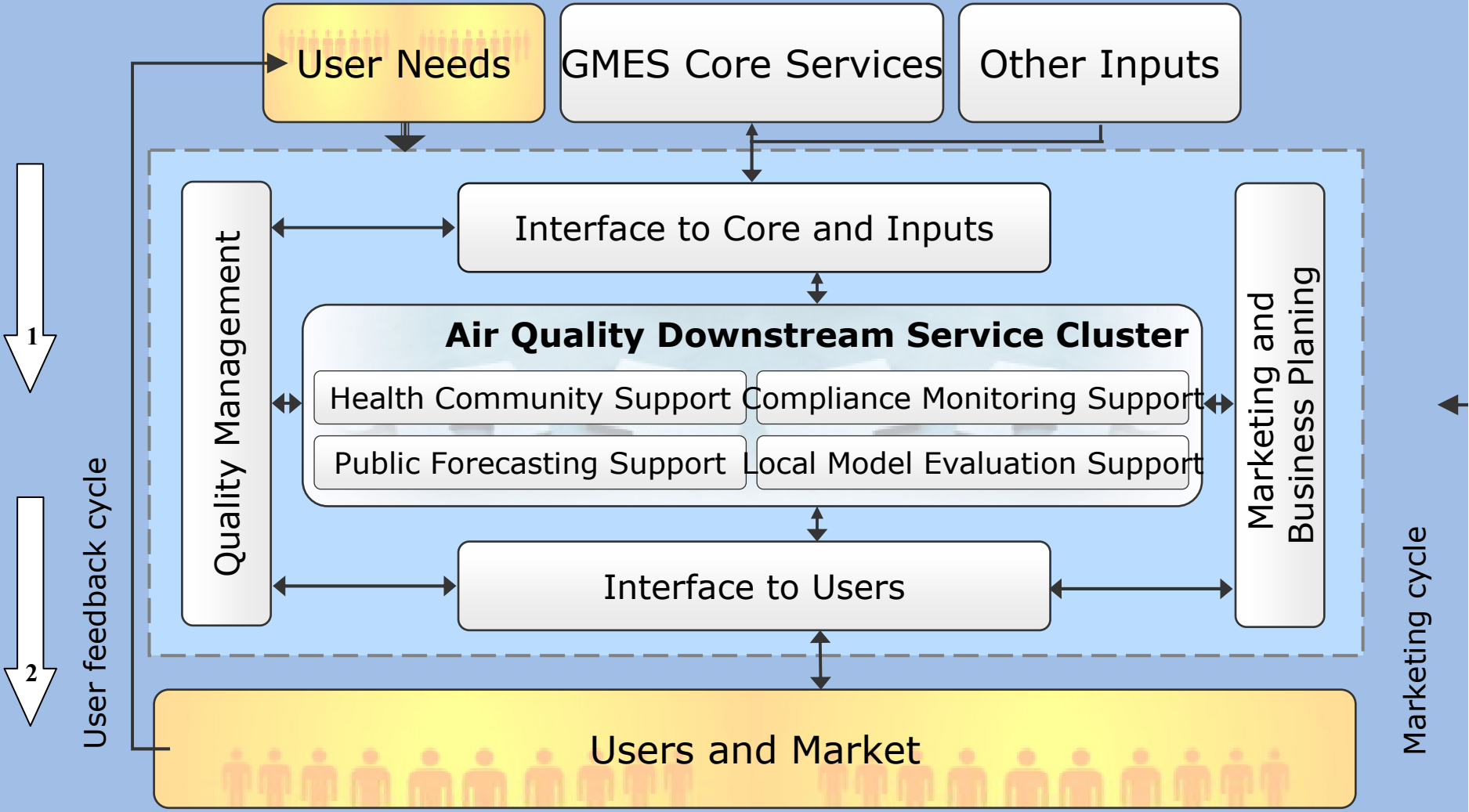
MACC - Product Set - I

- **Global analyses of greenhouse gases, reactive gases and aerosols, provided:**
 - in near-real-time
 - in (~ 6-month) delayed mode
 - retrospectively (2003 - 2010)
- **Some of the required satellite data retrievals**
- **Estimates of global climate forcing, emissions and sinks**
- **Global forecasts of reactive gases and aerosols**
- **Multi-model forecasts and retrospective assessments of air quality for Europe**

MACC - Product Set - II

- **Specific services and/or support for downstream services for:**
 - stratospheric ozone
 - UV radiation
 - solar-energy resources for power generation
 - downscaling air-quality information to local/urban scales
 - health warnings for dust-related meningitis and pulmonary disorder
 - ...
- **Estimates of long-range pollutant transport and source attribution; data in support of related international studies**
- **Tools for evaluating air-pollution control strategies**

PASODOBLE - Concept



PASODOBLE - Objectives

- **Development and demonstration of AQ services for European regions/cities**, based on documented needs and demonstrated capabilities of the ESA GSE PROMOTE user federation and service providers
- **Development and testing of a sustainable generic service infrastructure** in which modular AQ services can be easily added and through which a user friendly and customized access to end products is assured.
- **Utilization of multiple cycles of delivery, use, and assessment vs. requirements and market planning**, based on SLAs to facilitate evaluations of the value of the services thus assuring a leading role for the end users
- **Promotion of use of best practise and harmonization**

Health Community Support Services

- develop **new information products** together with specialists per pathology
- package AQ data to **increase uptake** in health community
- develop and **establish information-dissemination mechanisms** to increase support for specialists e.g. communicative platforms (e.g. among health actors in PACA region, France)
- identification of **weak signals** and spatial-temporal correlations
- provision of **intuitive information** services for people at risk (e.g. discomfort analyses in Thessaloniki and Athens)
- **Cooperation:** e.g. hospitals (e.g. CHU Nice), hospital networks (e.g. CIPE), pharmacy networks (e.g. PH@RE), European Medical Association, Dutch Asthma Fond, Province of Zeeland, System of Emergency Medical Assistance France

Public Information Support Services

- **improvement** of existing/development of new AQ forecast and analysis services
- **region-wise harmonisation** of established services (w.r.t validation protocols, metadata standards, data formats following SEIS, INSPIRE and recommendations of FAIRMODE, HARMO)
- **thematic integration** of services covering AQ, meteorology, aero-allergens, UV
- **Target groups, e.g.**
 - road traffic management (the Netherlands)
 - harbour management (Antwerp, Rotterdam)
 - Olympic Games 2012 (London)
- **Cooperation:** Black Sea Commission, Health Protection Agency, National Water Company Israel, Belgian Interregional Environment Agency, Hellenic Ministry of Environment, National Institute for Public Health and Environment of the Netherlands, Executive Environment Agency Bulgaria, Regional Agencies for Environmental Prevention Italy,

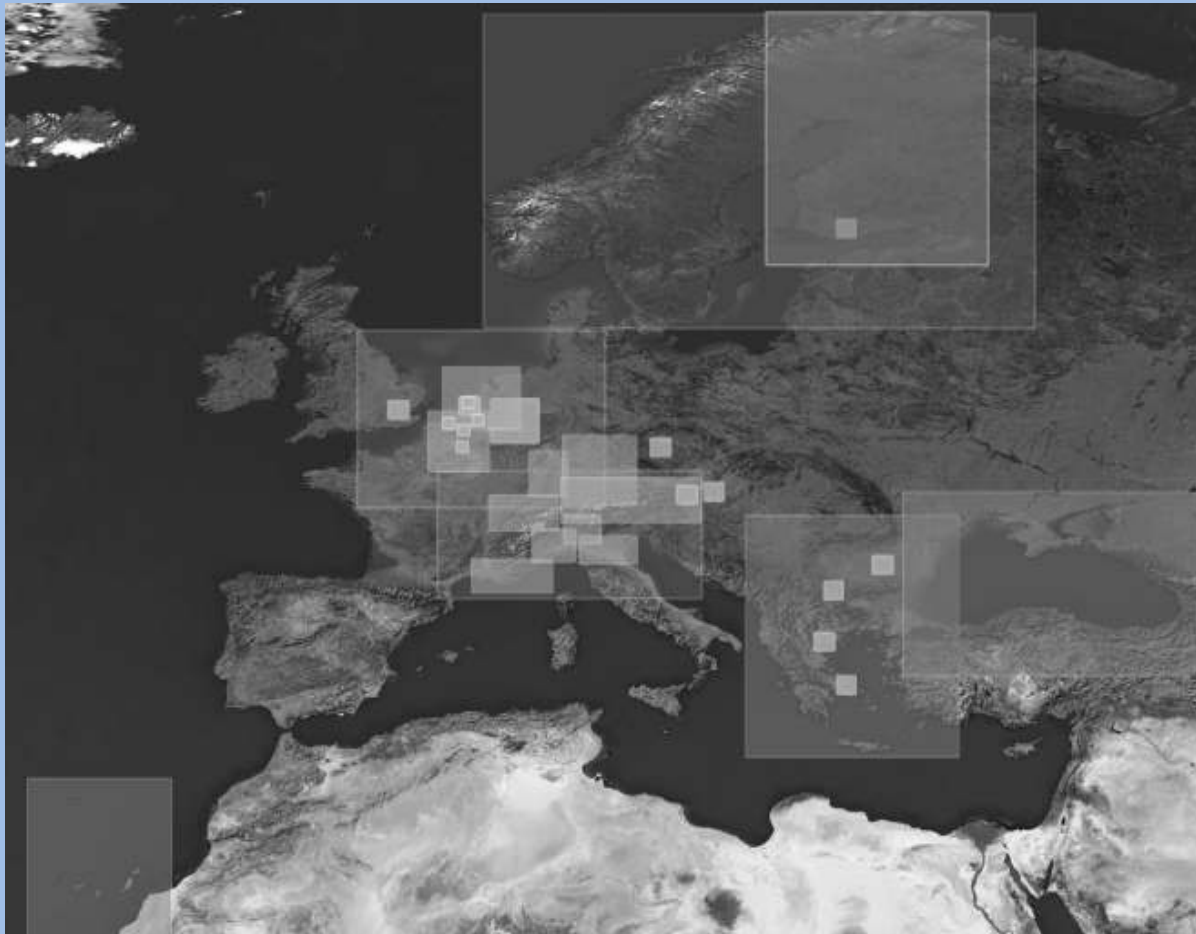
Compliance Monitoring Support for Particulate Matter

- **Collaboration with agencies with AQ Directive compliance duties**
- **Improve upon existing desert dust services to provide daily quantitative analysis of dust**
- **Provide explanation of exceedance of local emissions or advected dust**
- **Develop a satellite-based mapping tool for PM threshold exceedances**
- **Develop standard techniques to assess likelihood in the next few days of exceedances being caused by a natural phenomenon**
- **Cooperation: environmental agencies (LANUV, RIVM, ARPAs), meteorological agencies (AEMET)**

Local Model Evaluation Support

- develop, demonstrate and evaluate a **methodology / toolbox for evaluation** of local air quality forecasting models
- Apply **harmonized evaluation criteria and protocols** for performance and uncertainties
- **Harmonise interfaces** for local input data sets based on common practises. Supporting **accountability / apportionment** studies to evaluate mitigation measures
- **Cooperation** with 7 local city authorities as test cases together with FAIRMODE and HARMO.

PASODOBLE – Services and Committed users*



Map of Europe showing the regions and cities covered by PASODOBLE Downstream Services for Committed Users

*at time of proposal preparation

PASODOBLE - Committed Users*

Black Sea Commission INT

European Environment Agency (EEA)INT

Joint Research Centre (JRC) INT

airTEXT Consortium UK

Belgian Interregional Environment Agency (IRCEL-CELINE) BE

Ben-Gurion University / National Water Company (Mekorot) IL

Central Institute for Meteorology and Geodynamics (ZAMG) AT

City Development Authority (URM Prague) CZ

Conseil Général des Alpes-Maritimes FR

Eidgenössische Materialprüfungsanstalt (EMPA) CH

Environmental Protection Agency Rijnmond (DCMR) NL

European Pollen Information (epi) EU

Austrian Pollen Information AT

Executive Environmental Agency Bulgaria (EEA - BG) BG

Geriatric Cluster of CHU de Nicelsabel Bereder FR

Health Protection Agency (HPA) UK

Hellenic Ministry of Environment EL

Helsinki City Council FI

Landesamt für Natur, Umwelt und

Verbraucherschutz NRW (LANUV) DE

Medical University of Vienna (MUW) AT

National Environmental Research Institute (NERI-ATMI) DK

National Institute for Public Health and the Env (RIVM) NL

Naturpark Scout GbR DE

Naturschutzzentrum Ruhstein DE

Paediatric Cluster of CHU de NiceFR

Ph@re NetworkFR

Province of Zeeland NL

Regional Agency for Env Prevention (ARPA) Emilia Romagna IT

Regional Agency for Env Prevention (ARPA) Lombardia IT

Regional Agency for Env Prevention (ARPA) Piemonte IT

Region of Central Macedonia (RCM) EL

Slovak Hydrometeorological Institute (SHMU) SK

State Meteorological Agency of Spain (AEmet) ES

System of Emergency Medical Assistance in F(SAMU) FR

Umweltbundesamt (UBA-Austria) AT

University of Turku, Aerobiological group FI

***at time of proposal preparation**

PASODOBLE - Consortium

DLR - Deutsches Zentrum für Luft- und Raumfahrt e DE (coordinator)

ACRI – ST FR

AEA Technology UK

AUTH – Aristotle University of Thessaloniki EL

ARGOSS – BMT ARGOSS NL

IASB – Institut d’Aeronomie Spatiale de Belgique BE

BAS – Bulgarian Academy of Sciences, GPhI BG

CERC – Cambridge Environmental Research Consultants UK

CGS – Carlo Gavazzi Space IT

CHU – Centre Hospitalier Universitaire Nice FR

MUW/EAN – Medical Uni Vienna / European Aeroallergen Network AT/INT

EMA – European Medical Association INT

FMI – Finish Meteorological Institut FI

KNMI – Koninklijk Nederlands Meteorologisch Instituut NL

NILU – Norsk Institutt for Luftforskning NO

FRIUUK – Rheinisches Institut für Umweltforschung an der Uni zu Köln DE

TAS-F - Thales Alenia Space France FR

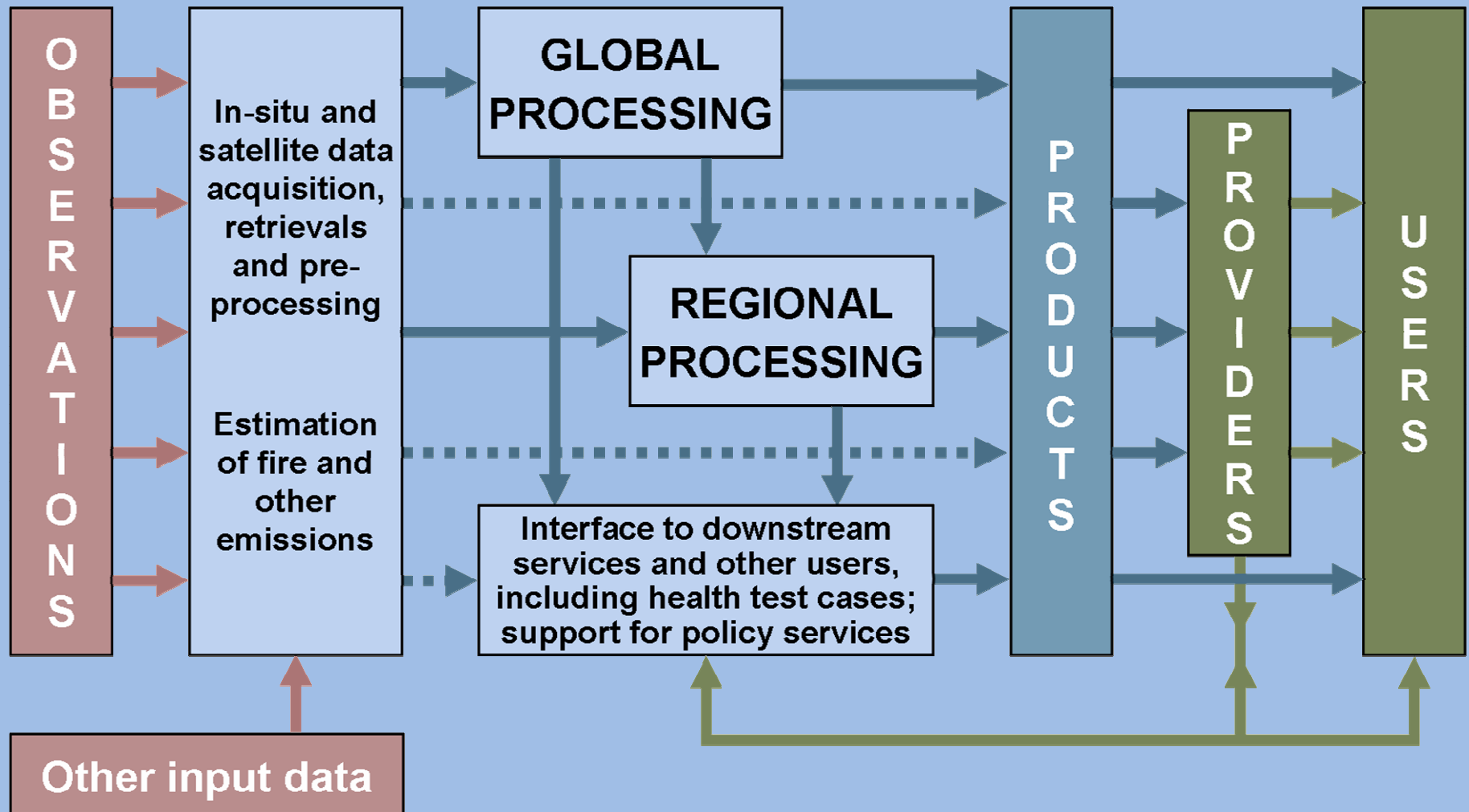
TNO – Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek NL

VITO – Vlaamse instelling voor technologisch onderzoek BE

Nowcasting International IE

Outdoor Concepts DE

The MACC Project Architecture



MACC - Consortium

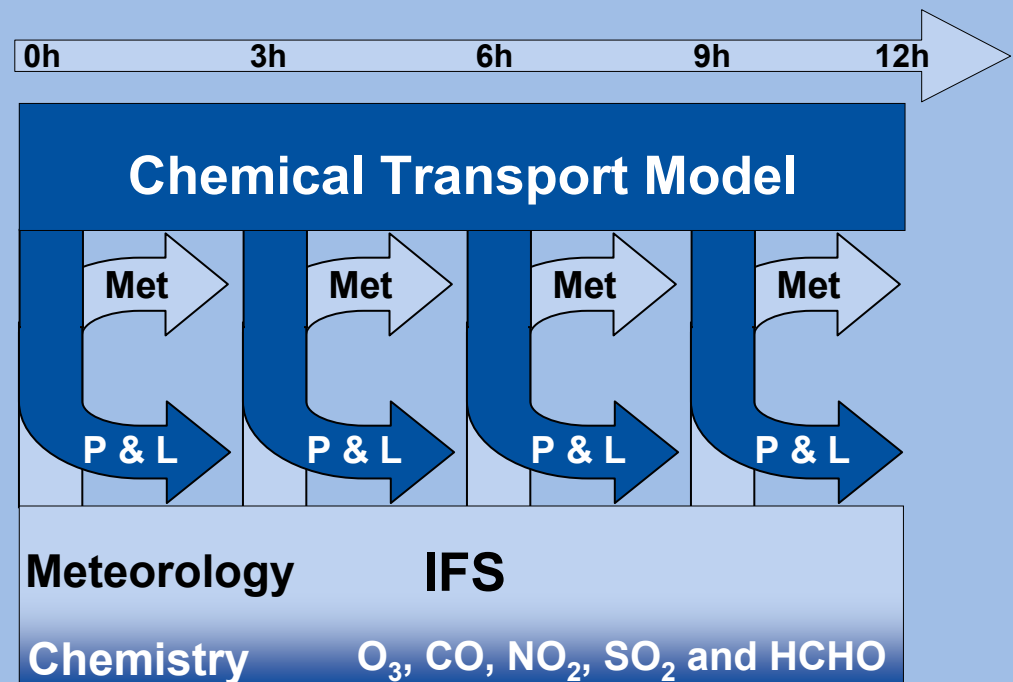
- **European Centre for Medium-Range Weather Forecasts**
- **Met Office**
- **Centre National de la Recherche Scientifique-INSU,**
- **Commissariat à l’Energie Atomique**
- **Deutsches Zentrum für Luft- und Raumfahrt e.V.**
- **Max-Planck-Gesellschaft zur Förderung der Wissenschaften e. V.**
- **Royal Netherlands Meteorological Institute**
- **Institut d’Aéronomie spatiale de Belgique**
- **Ilmatieteen Laitos - Finnish Meteorological Institute**
- **Danish Meteorological Institute**
- **Deutscher Wetterdienst**
- **University of Bremen**
- **Université Pierre et Marie Curie - Paris 6**
- **National and Kapodistrian University of Athens**
- **Météo-France - Centre National de Recherches Météorologiques**
- **National University of Ireland, Galway**
- **Swedish Meteorological and Hydrological Institute**
- **ARPA Emilia Romagna**
- **Agencia Estatal de Meteorología**
- **Meteorologisk Institut**
- **Rheinisches Insti. für Umweltforschung an der Universität zu Köln**
- **European Commission - Joint Research Centre**
- **Institut National de l’Environnement Industriel et des Risques**
- **Czech Hydrometeorological Institute**
- **National Meteorological Administration, Romania**
- **Institute of Environmental Protection**
- **Imperial College of Science, Technology and Medicine**
- **Forschungszentrum Jülich GmbH**
- **Environmental Agency of the Republic of Slovenia**
- **Association pour la recherche et le développement des méthodes et processus industriels**
- **Netherlands Institute for Space Research**
- **University of Leeds**
- **King’s College London**
- **Vrije Universiteit, independent entity of “Vereniging voor Christelijk hoger onderwijs, wetenschappelijk onderzoek en patientenzorg”**
- **Umweltbundesamt GmbH**
- **Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek**
- **Cambridge Environmental Research Consultants Ltd**
- **Carlo Gavazzi Space S.p.A.**
- **Flyby s.r.l.**
- **Centre Européen de Recherche et Formation avancée en Calcul Scientifique**
- **Centre National d’Etudes Spatiales**
- **Norsk Institutt for Luftforskning**
- **National Research Council**
- **National Environmental Protection Agency**
- **University of the West of Scotland**

GEMS/MACC global data assimilation system

- Based on ECMWF numerical weather analysis and prediction system (The Integrated Forecasting System - IFS)
- Long-lived greenhouse gases (CO_2 and CH_4) and aerosols have been incorporated in IFS and data assimilation developed for AIRS and IASI radiances, SCIAMACHY retrievals, MODIS aerosol optical depth, ...

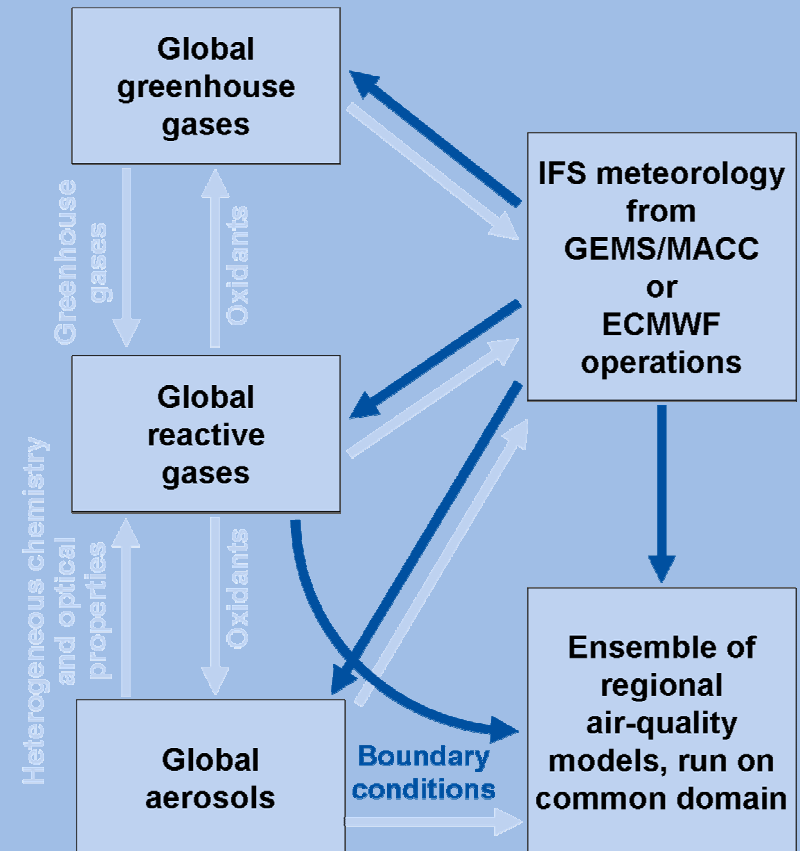
- For reactive gases, IFS carries O_3 , CO , NO_2 , SO_2 and HCHO , and takes chemical production and loss a coupled CTM, either MOCAGE, MOZART or TM5.

Data for assimilation come from GOME, GOME-2, IASI, MIPAS, MLS, MOPITT, OMI, SBUV/2, SCIAMACHY, ...

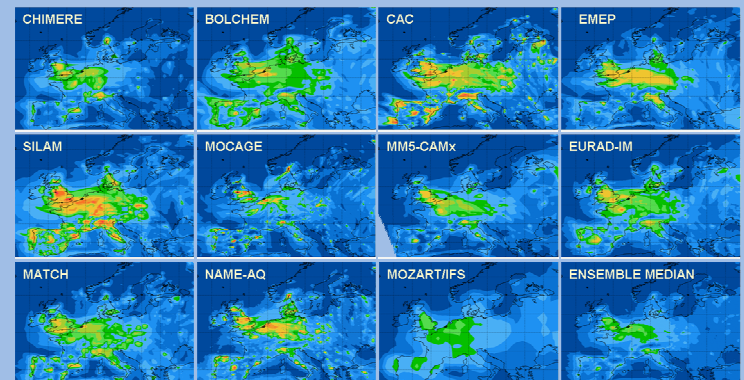


Global/regional system

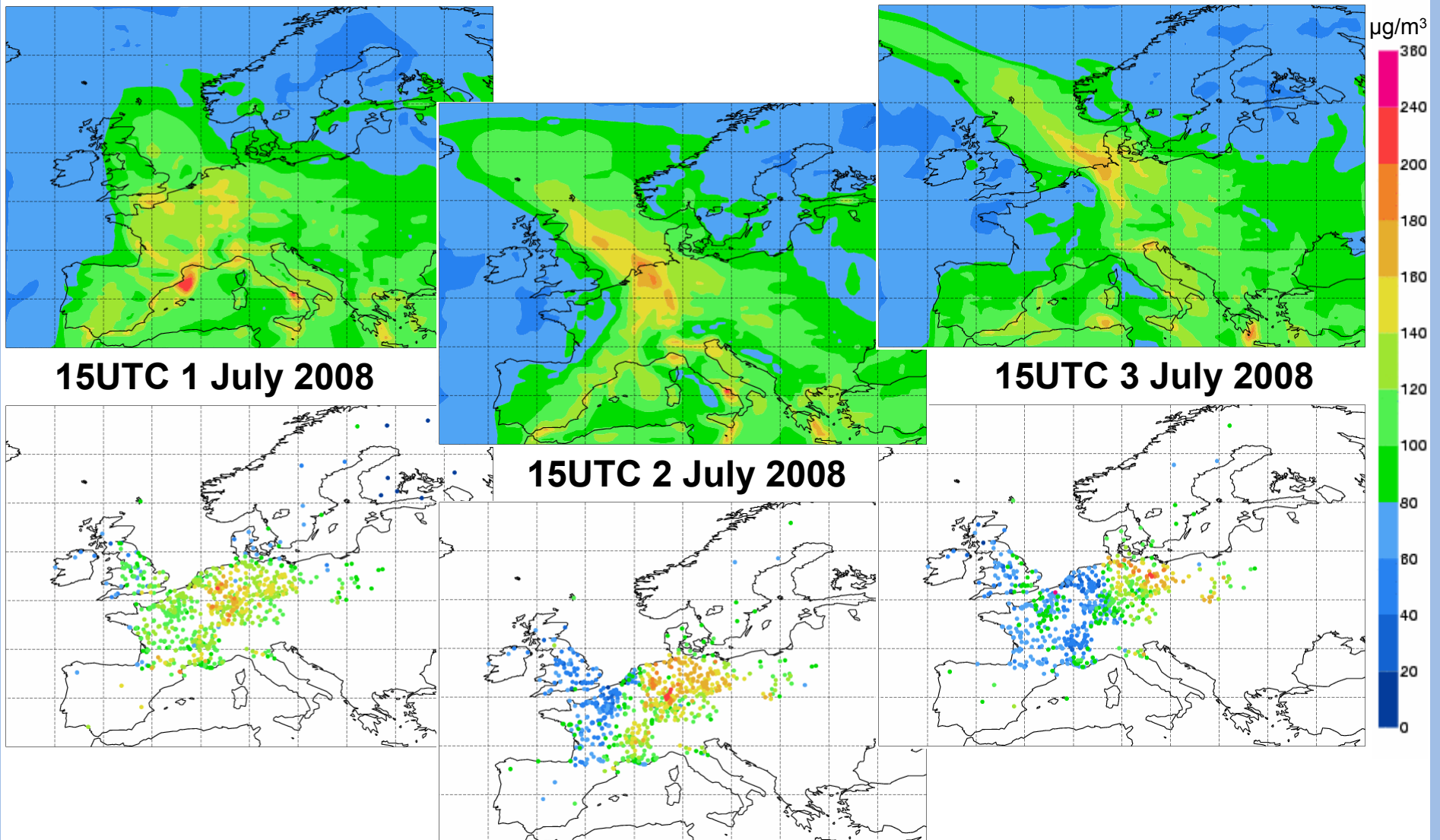
- **6 or more regional air-quality models run daily**
 - on common European domain
 - with common emissions
 - with common output format
- **Output currently sent to ECMWF for**
 - archiving
 - deriving ensemble forecast products
 - web display
 - validation
- **ECMWF operations provides higher-resolution driving meteorology**
- **Interactions between components will be gradually increased**
- **Regional data assimilation and retrospective assessments are a focus of MACC**



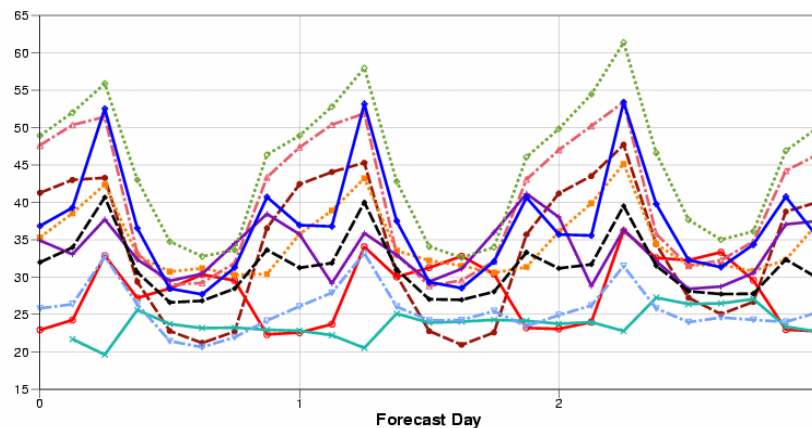
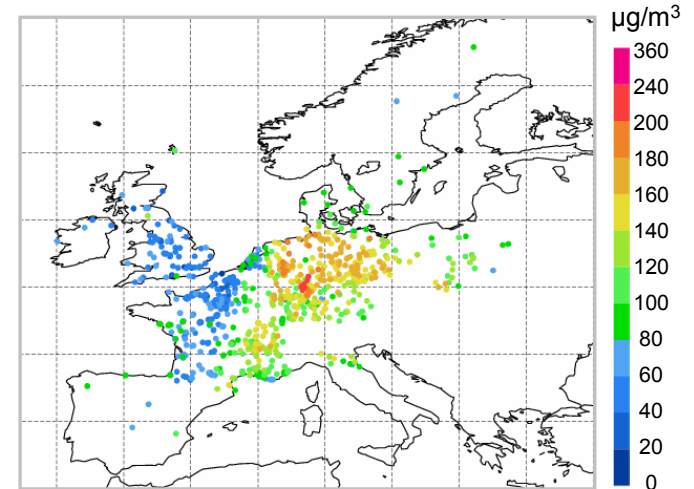
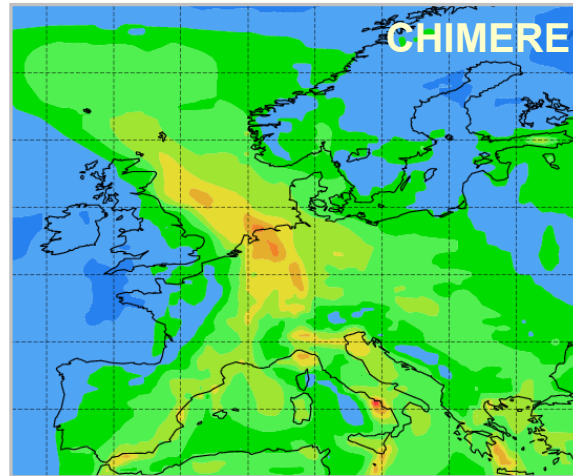
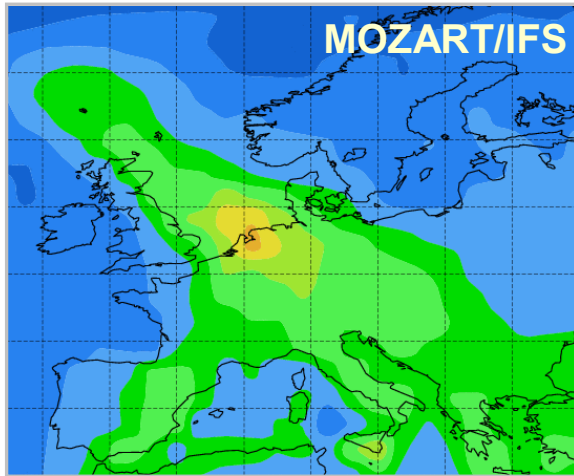
Daily maximum NO₂ (µg/m³)
24 December 2008 from 00UTC 22 December



Successive 63h surface ozone forecasts from CHIMERE and verifying observations



63h ozone forecasts from MOZART/IFS and CHIMERE and verifying observations, for 15UTC 2 July 2008

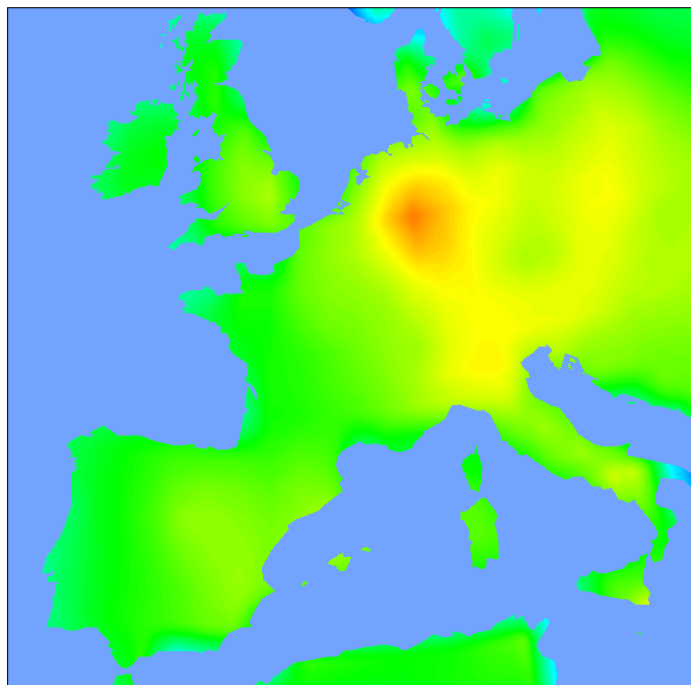


GEMS-RAQ Verification
Surface Ozone [$\mu\text{g}/\text{m}^3$]
Root mean square error forecast
Europe
20080713 00UTC to 20080719 00UTC

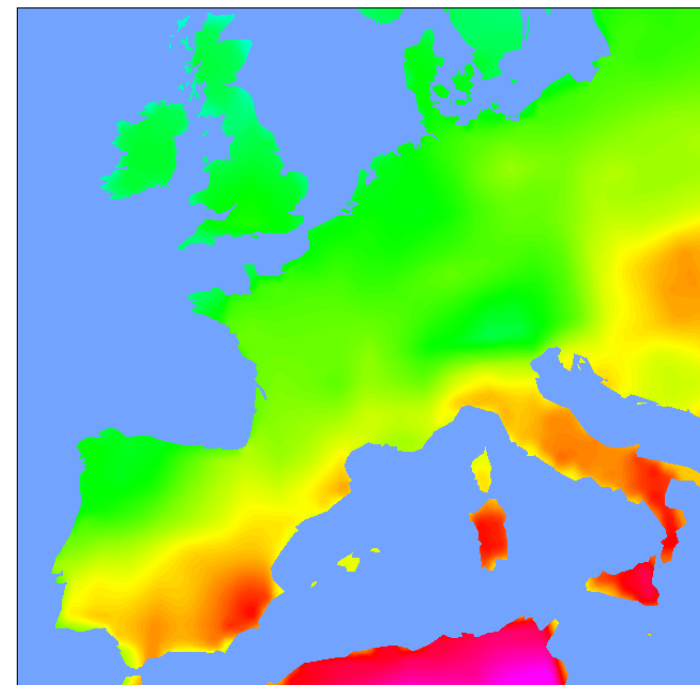
- CHIMERE
- BOLCHEM
- CAC
- EMEP
- MOCAGE
- MOZART/IFS
- MM5-CAMx
- EURAD-IM
- MATCH
- ENSEMBLE MEDIAN

August 2003 heat-wave (from 2003-2007 reanalysis)

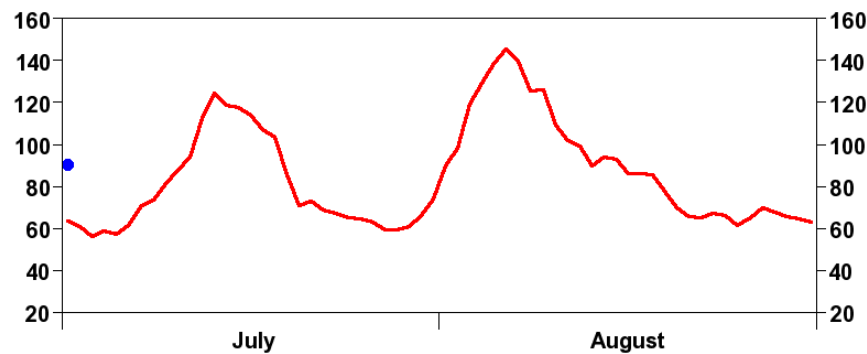
7-day averages for 15UTC centred on 2003/07/01



Ozone ($\mu\text{g}/\text{m}^3$)



Temperature (C)



7d-mean measured ozone ($\mu\text{g}/\text{m}^3$) 14-16UTC
Bottesford, Leicestershire
www.airquality.co.uk

August 2003 heat-wave

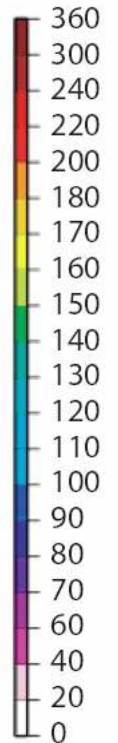
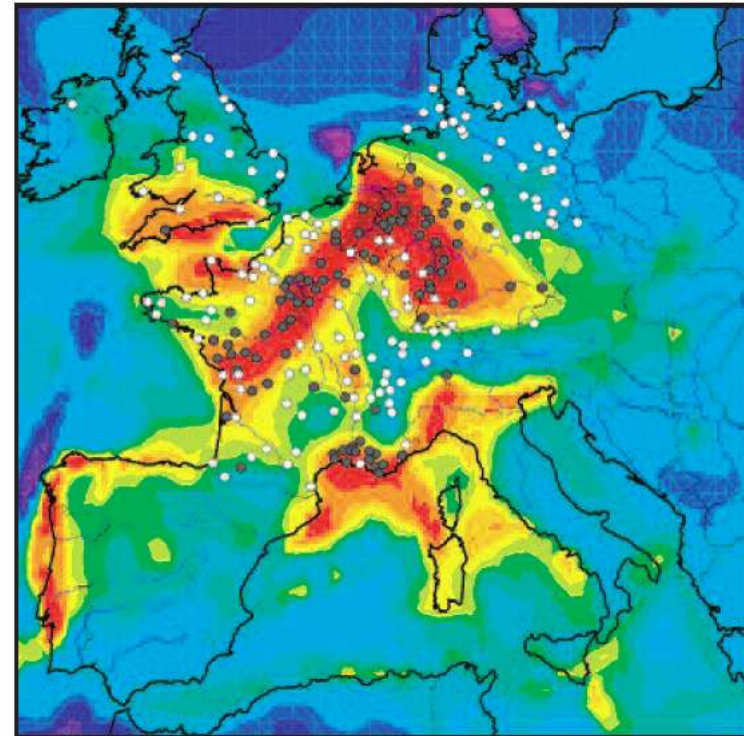
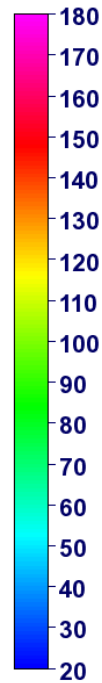
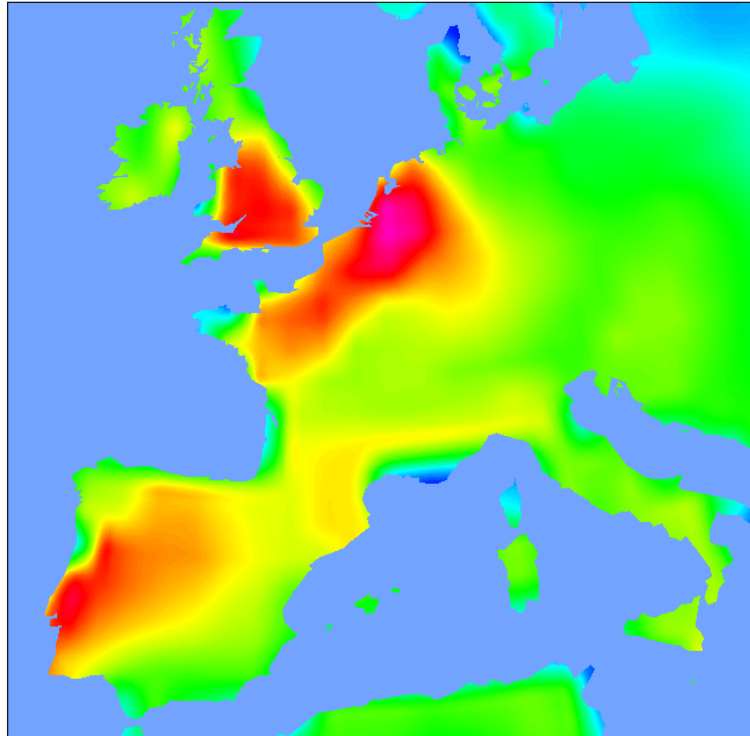
15UTC

GEMS

8 August 2003

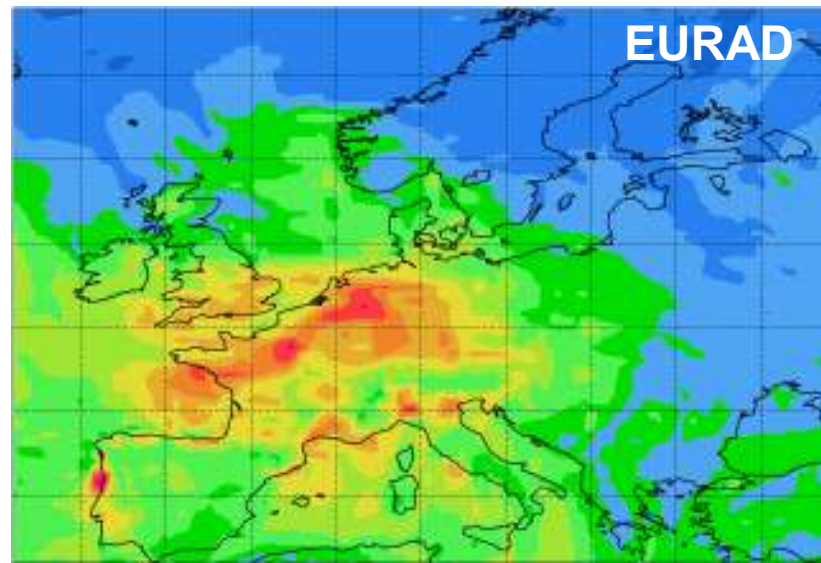
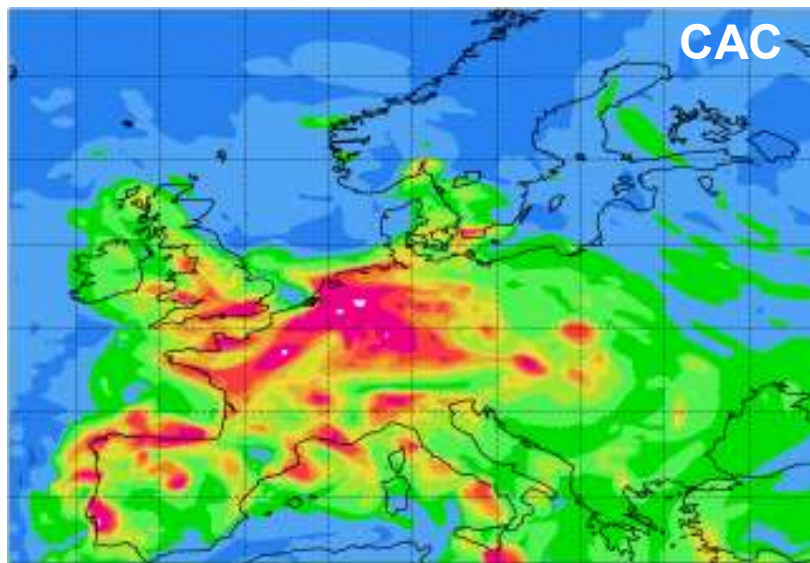
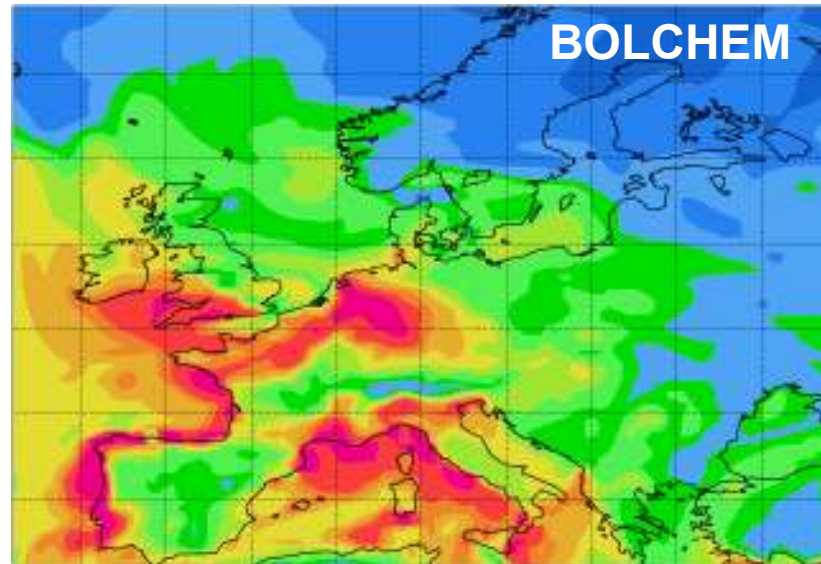
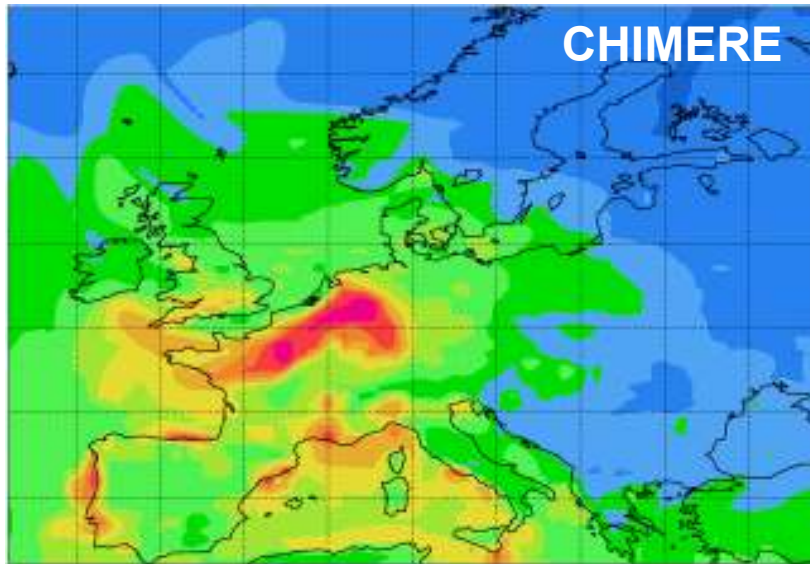
CHIMERE

14UTC



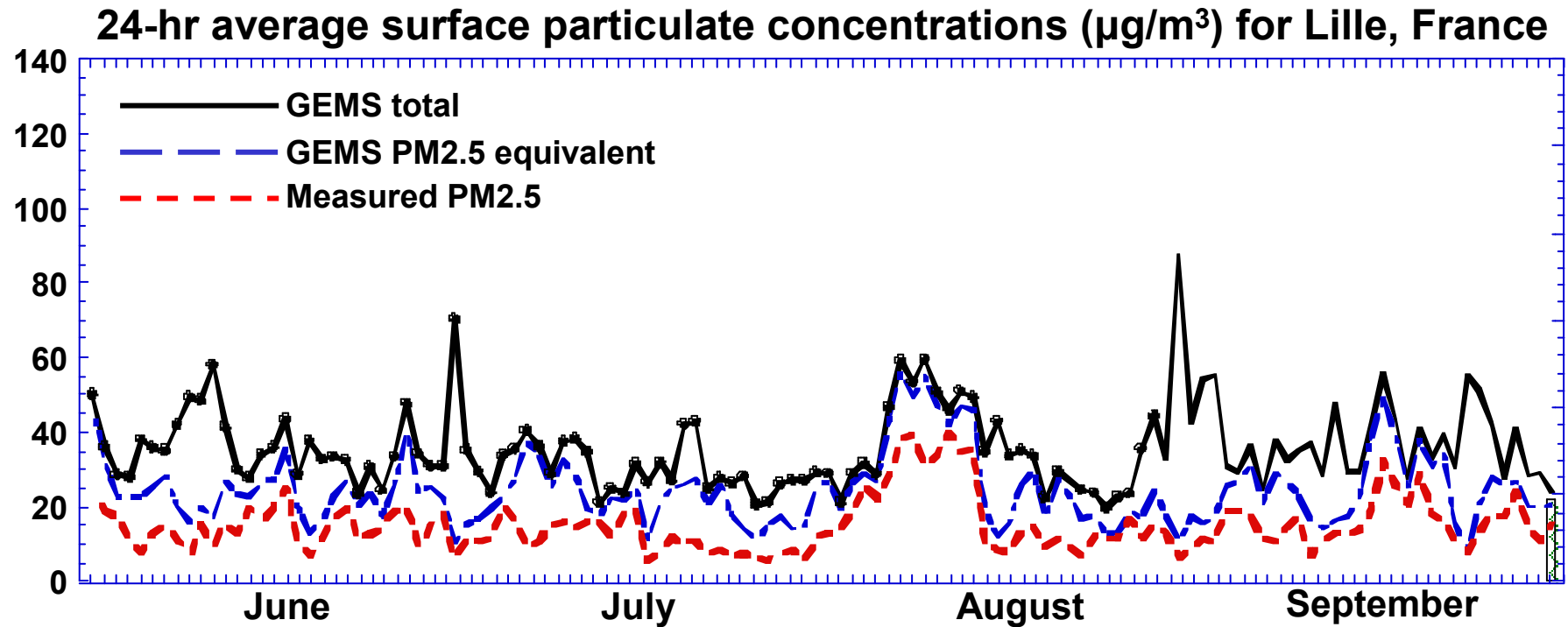
Ozone ($\mu\text{g}/\text{m}^3$)

8 August 2003 (from four of GEMS regional models)

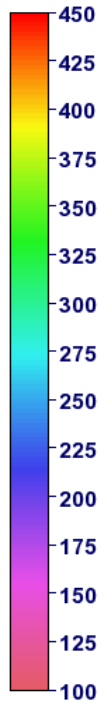
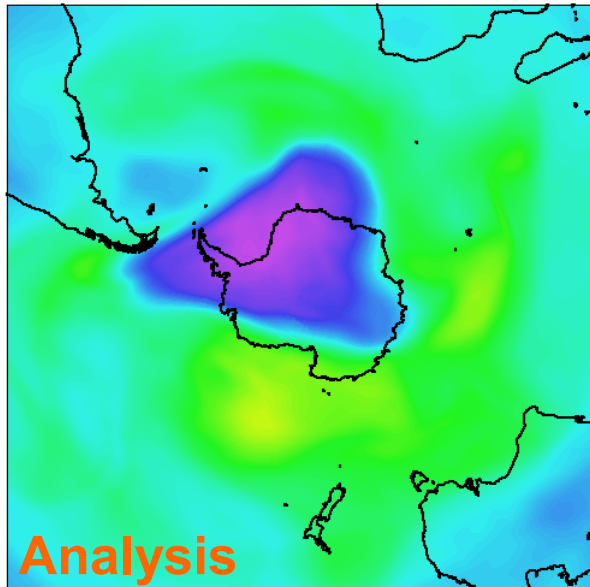
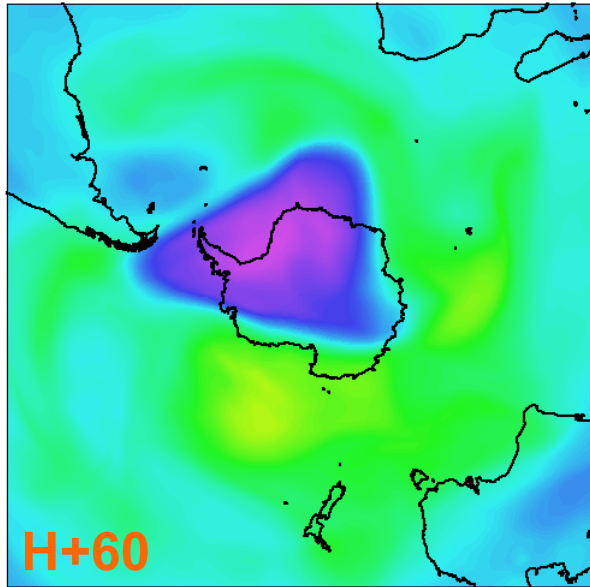


Maximum ozone ($\mu\text{g}/\text{m}^3$)

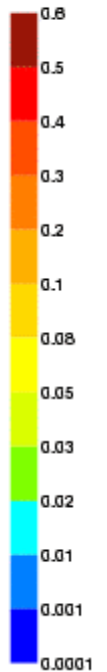
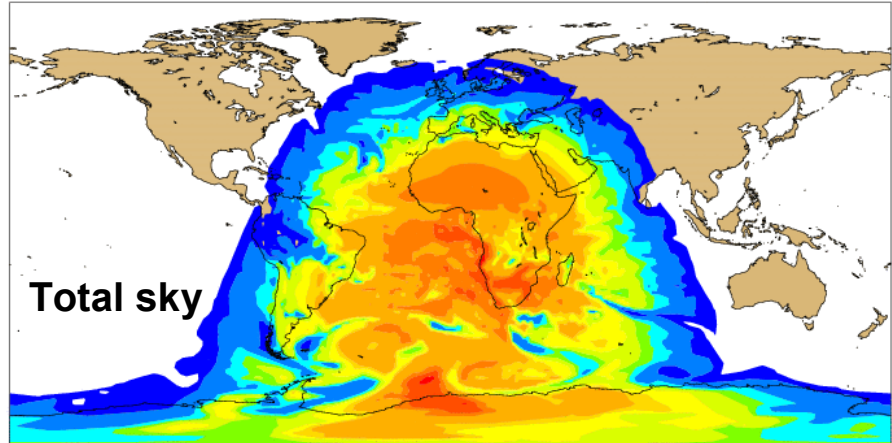
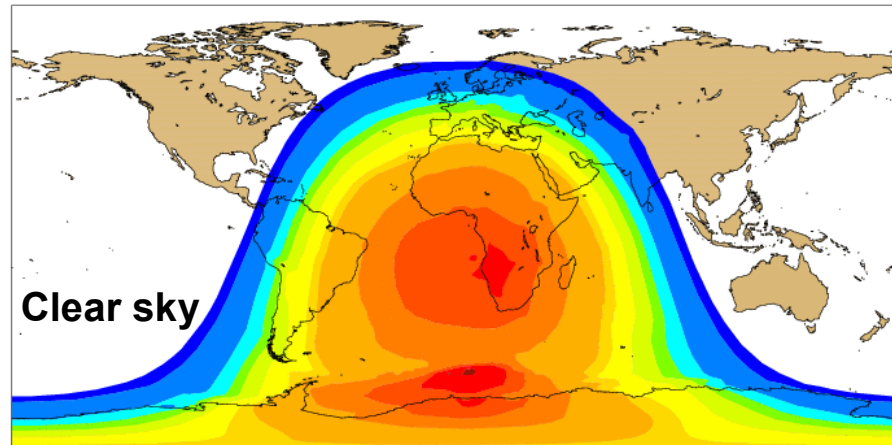
August 2003 heat-wave (from 2003-2007 reanalysis)



Total column ozone, and biologically-effective dose of surface UV radiation

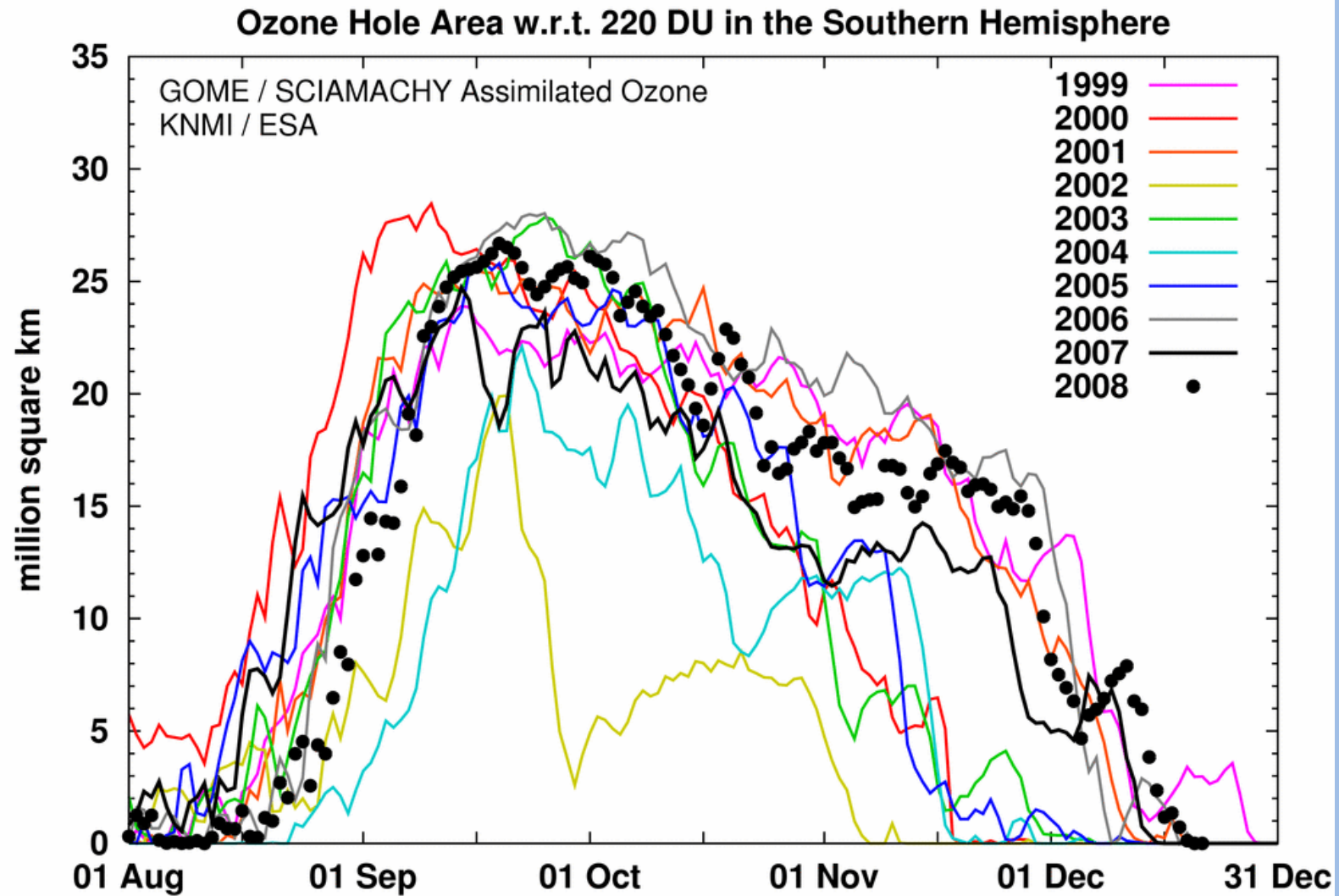


H+60 valid 12UTC 27 November 2008



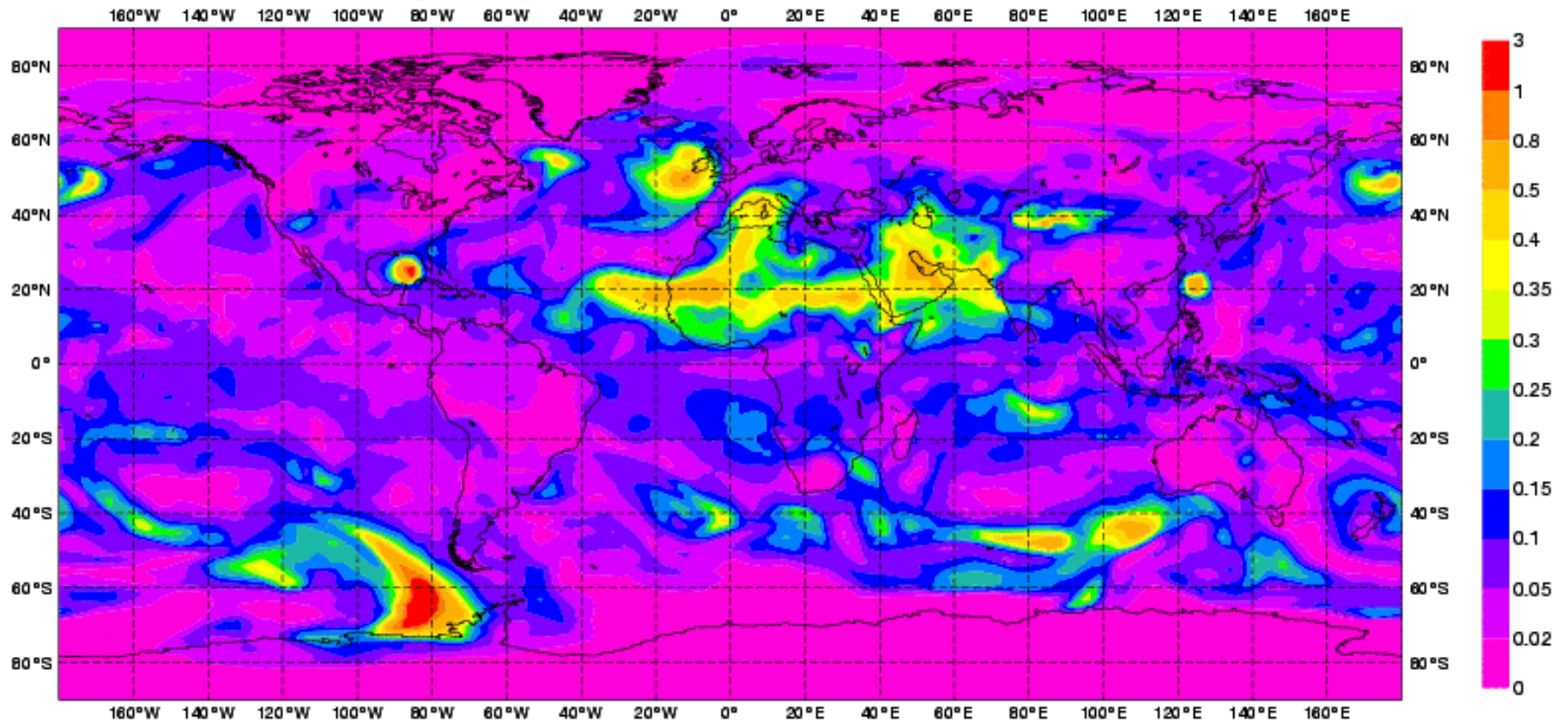
Ozone monitoring from GMES Service Element PROMOTE

To be incorporated in MACC

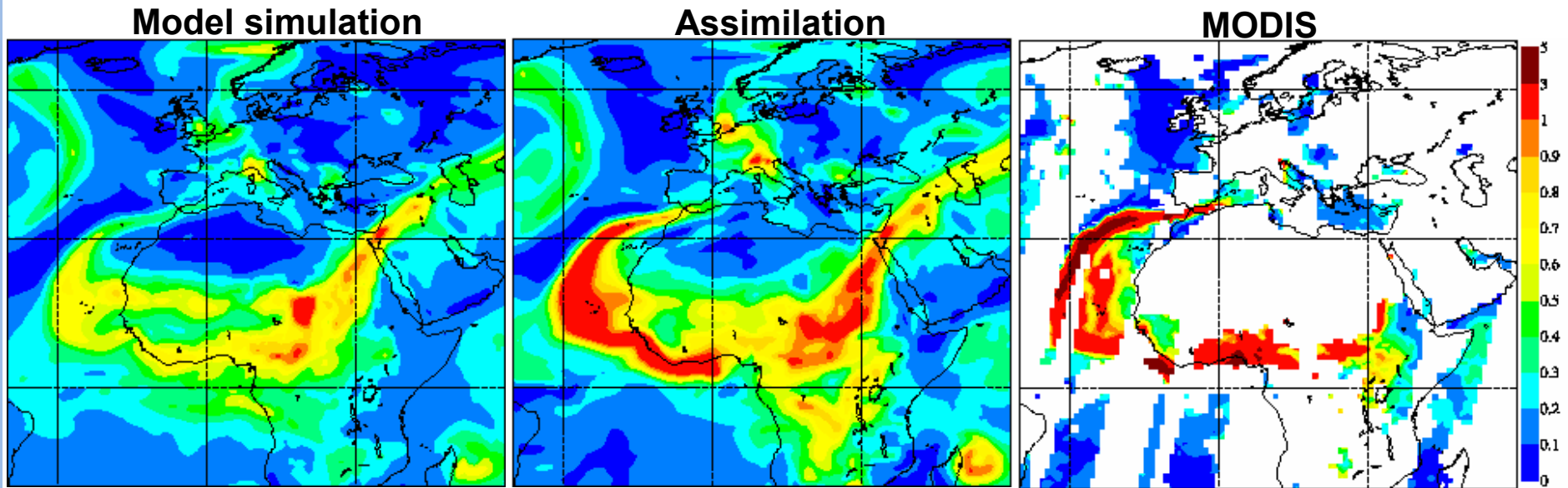


Real-time aerosol forecasts

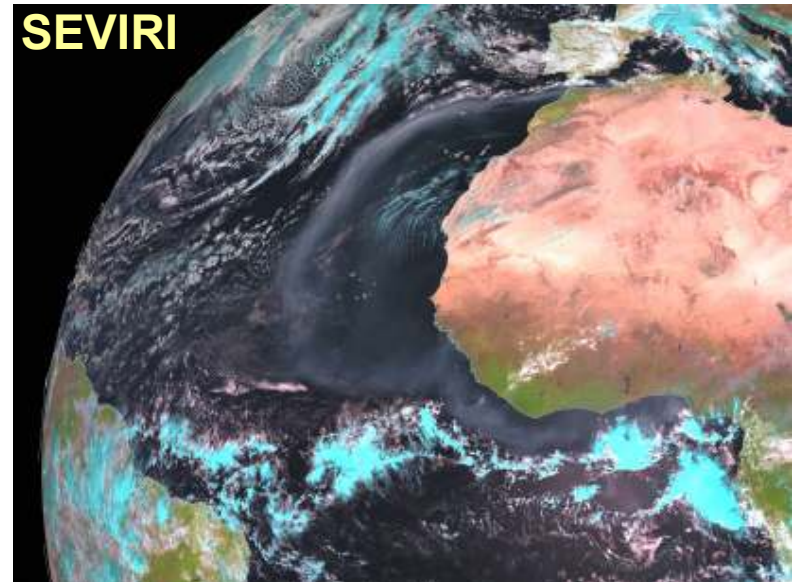
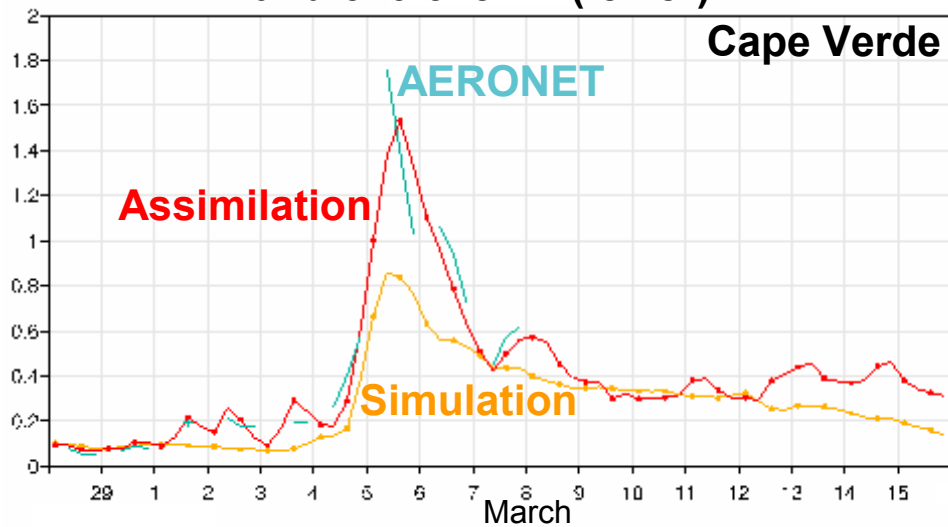
Thursday 11 September 2008 00UTC ECMWF/GEMS Forecast t+003 VT: Thursday 11 September 2008 03UTC
Sea-salt and Dust Aerosols Optical Depth at 550 nm



Saharan dust outbreak: 6 March 2004

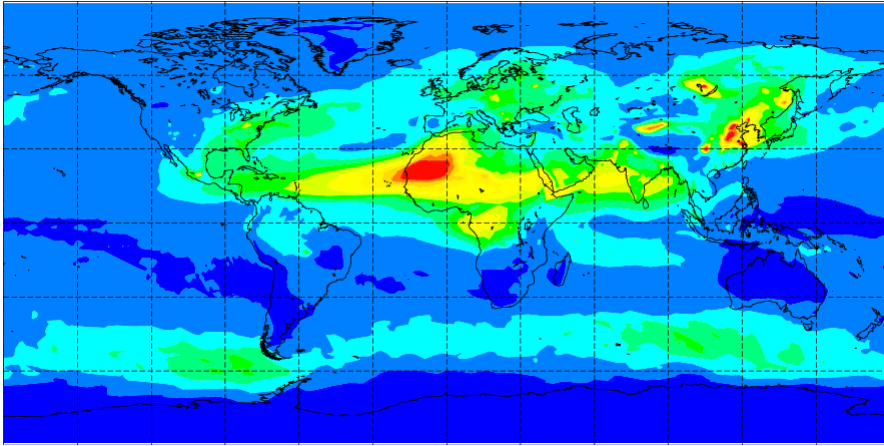


Aerosol optical depth at 550nm (upper) and 670/675nm (lower)

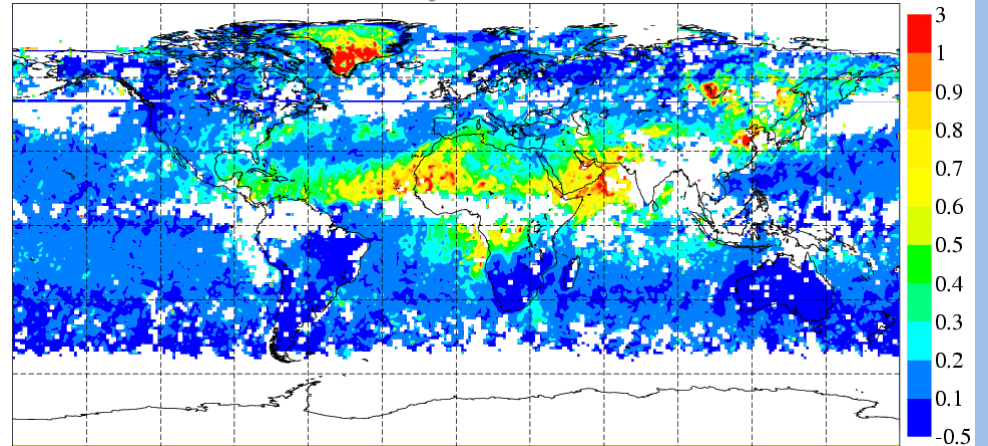


Comparison of GEMS simulated and analysed aerosol optical depth with MODIS and MISR for July 2003

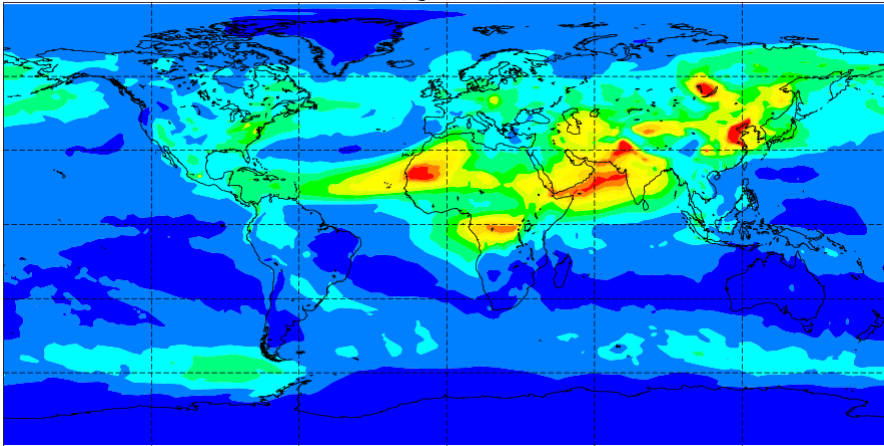
Aerosol Optical Depth at 550 nm from Unconstrained Model Run
July 2003



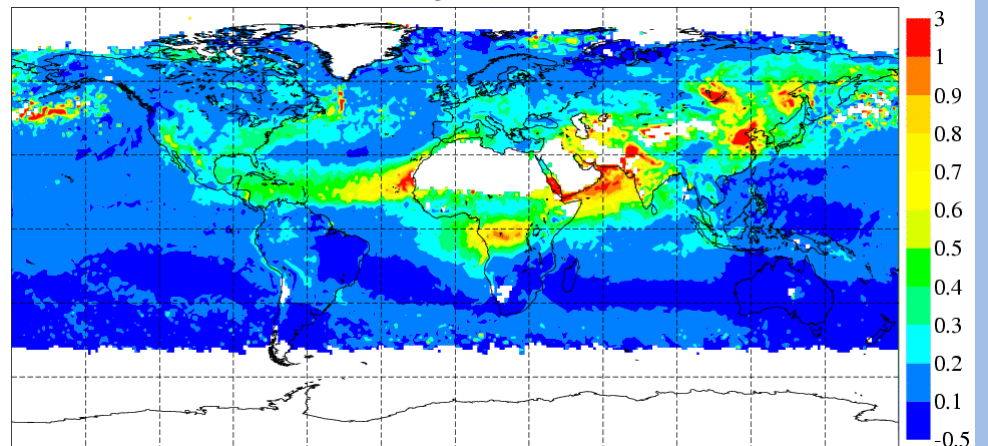
MISR Terra Aerosol Optical Depth at 557.5 nm [unitless]
July 2003



Aerosol Optical Depth at 550 nm for Reanalysis using MODIS AOD
July 2003



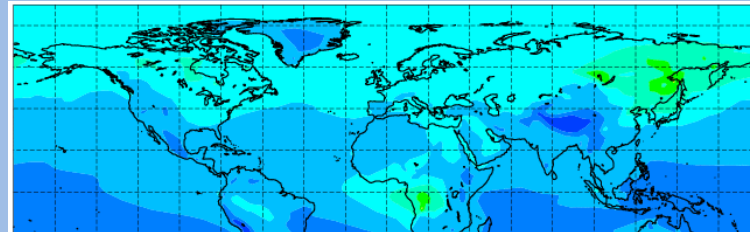
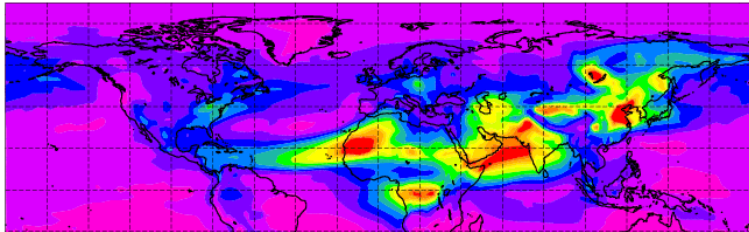
MODIS Terra MOD08-M3.005 Aerosol Optical Depth at 550 nm [unitless]
July 2003



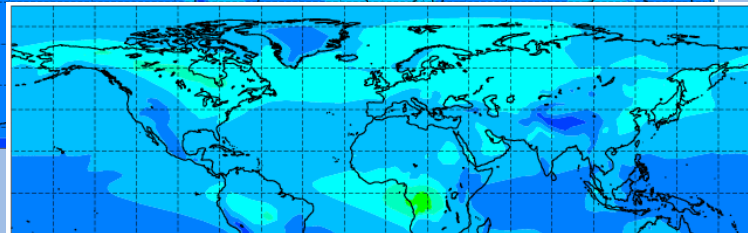
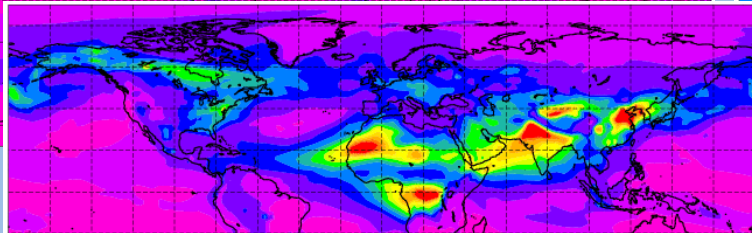
GEMS reanalysis for 2003-7

Aerosol optical depth at 550nm

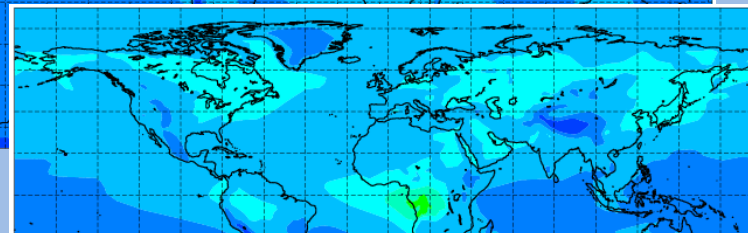
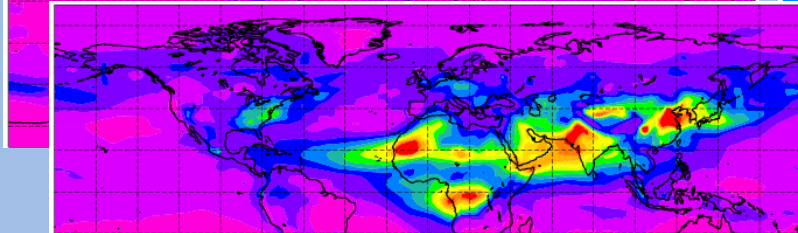
Total column carbon monoxide



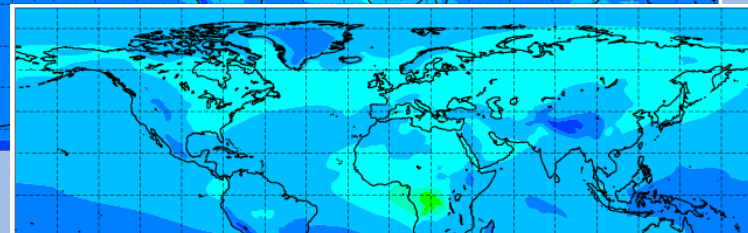
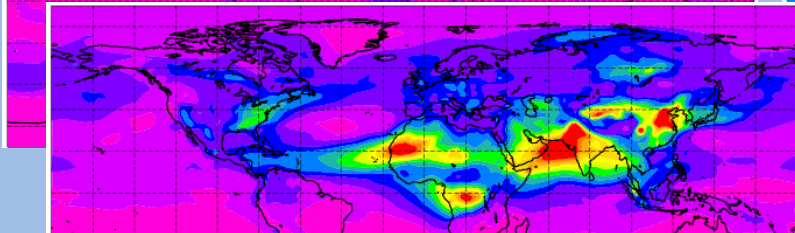
July 2003



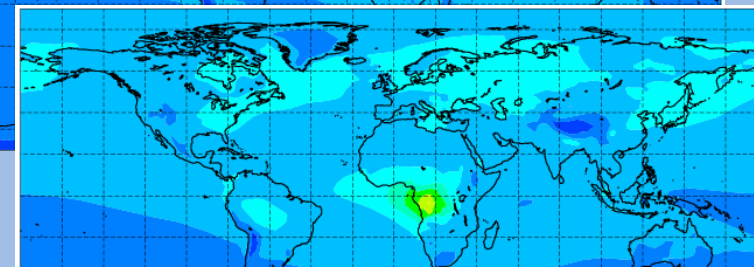
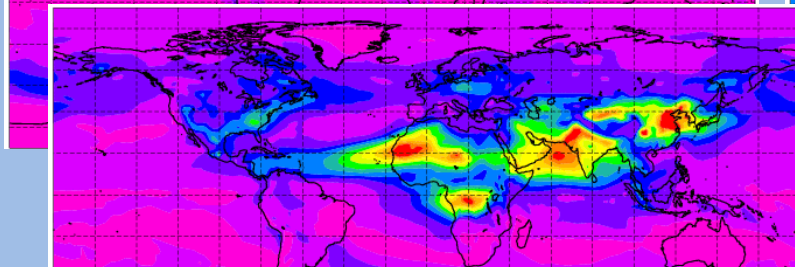
July 2004



July 2005



July 2006



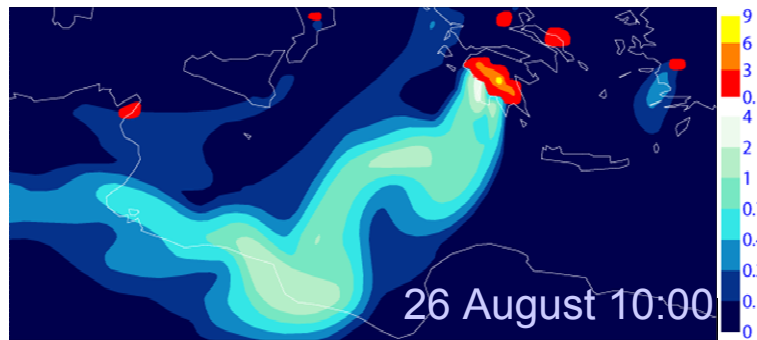
July 2007

Emissions from Mediterranean fires in Summer 2007

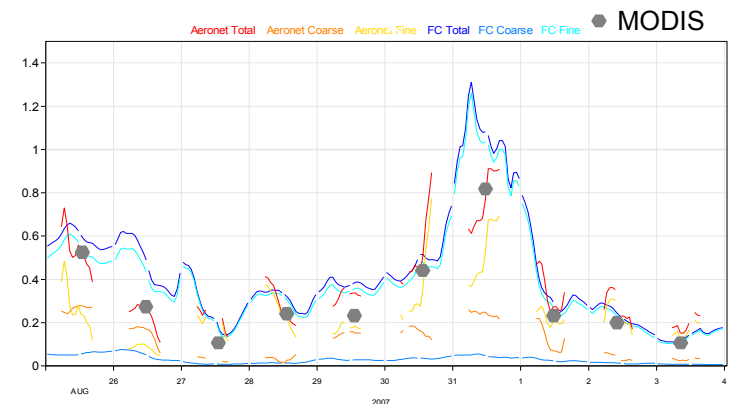
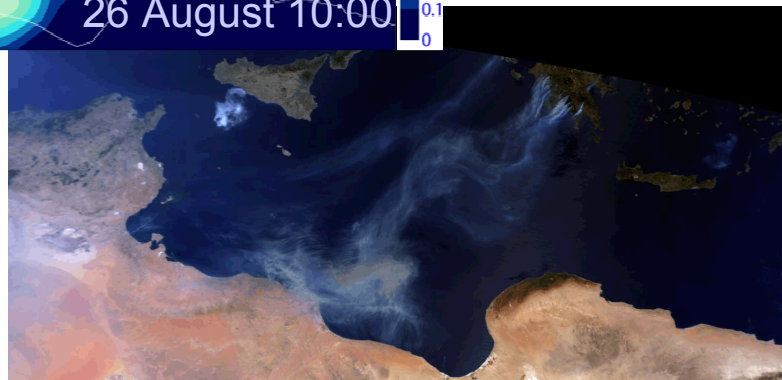


Observed Fire Radiative Power (from SEVIRI on Meteosat) is converted to emitted aerosol.

Run at 25km global resolution rather than 125km standard GEMS global resolution.



Joint work with Eumetsat-funded FREEVAL project (M. Wooster, G. van der Werf, ...).



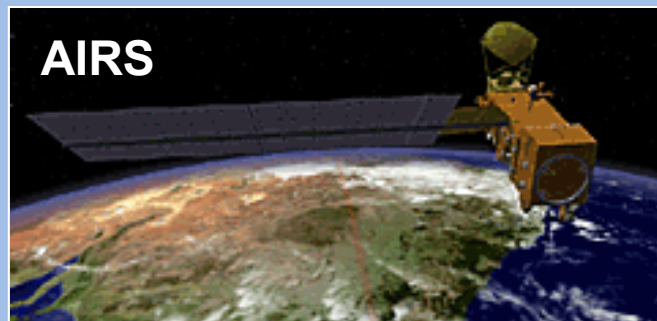
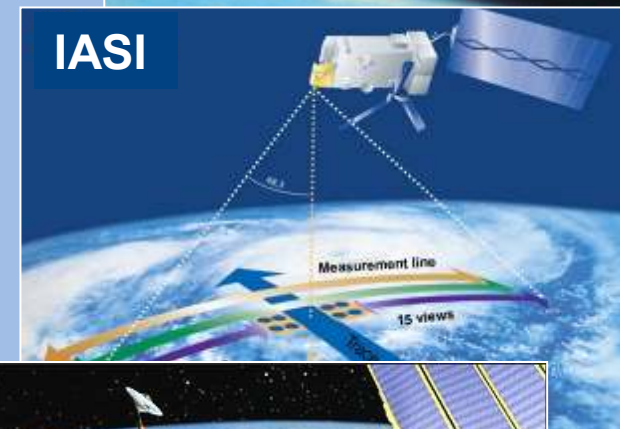
Satellite data for analysis of CO₂ and CH₄

- **Aims:**

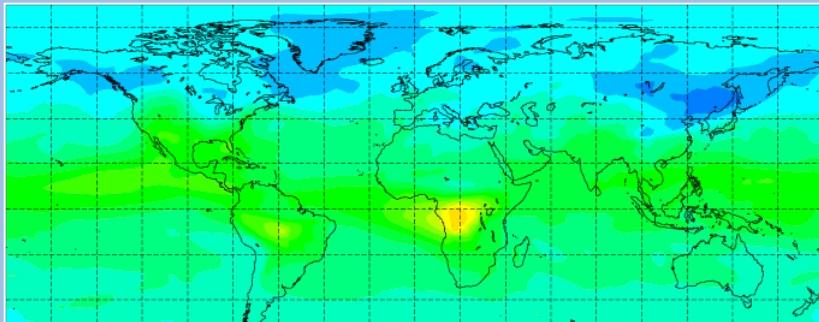
- improved estimation of surface fluxes, inferred from evolving atmospheric distributions of CO₂ and CH₄
- detection of potential anomalous changes in atmospheric CO₂ and CH₄ at an early stage

- **Assimilating data from**

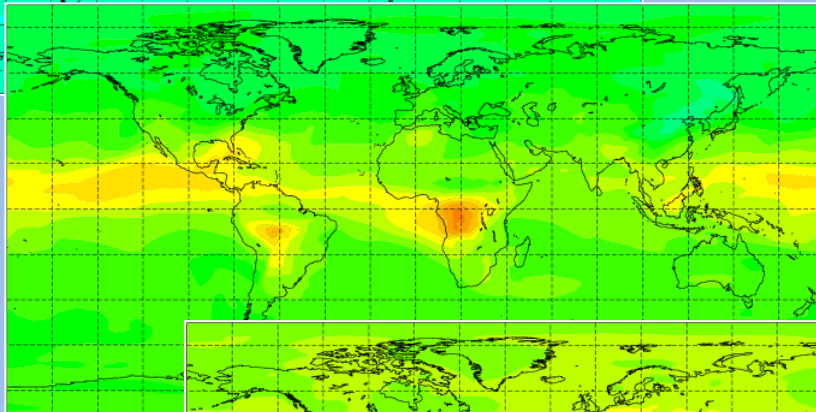
- AIRS for CO₂
- SCIAMACHY for CH₄
- IASI for CO₂ and CH₄
- GOSAT for CO₂ and CH₄
(first data for cal/val received 29 May 2009)



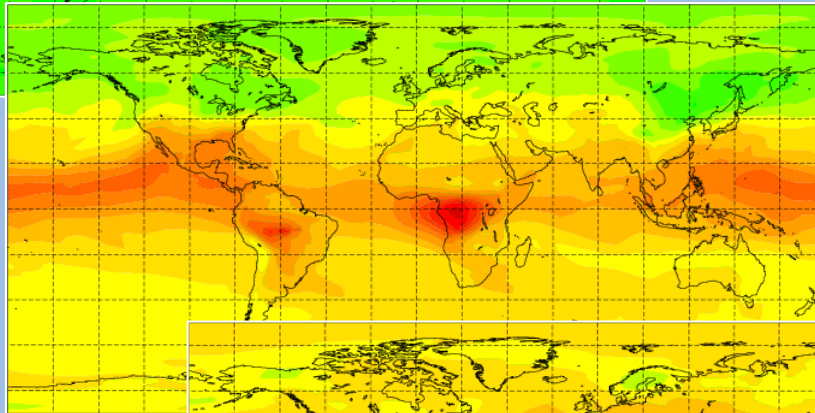
GEMS analysis of CO₂ from AIRS radiances



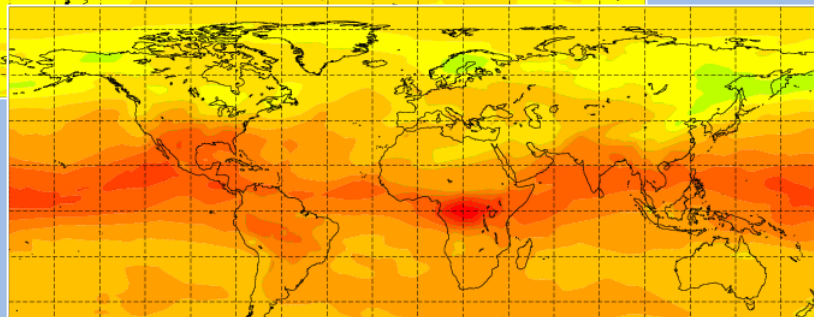
Aug 2003



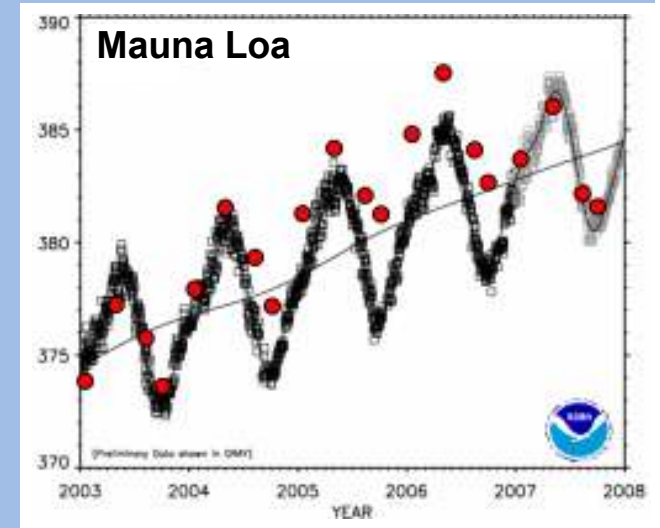
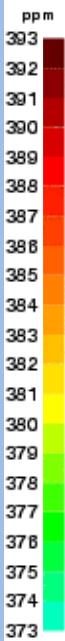
Aug 2004



Aug 2005



Aug 2006



Downloadable data

GEMS Re-analysis 2003-2007 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://data-portal.ecmwf.int/data/t/gems_reanalysis/levtype=pl/

Most Visited ECMWF

ECMWF Home Your Room Login Contact Feedback Site Map Search:

About Us Products Services Research Publications News&Events
 Overview Forecast Computing Modelling Newsletters Calendar
 Getting here Order Data Archive PrePFS Reanalysis Manuals Employment
 Committees Order Software PrePFS Seasonal Reanalysis Open Trainers

GEMS Re-analysis 2003-2007 -

GEMS Re-analysis 2003-2007

Note: In order to retrieve data from this server, you first have to accept the [conditions of use](#).

Type of level
 Model levels
 Pressure levels
 Surface

GEMS fields
 Near real-time
 Re-analysis

Personal
 Your Requests

Data usage
 Conditions

Select date
 Select a date range between 2003-01-01 and 2007-05-23:
 start date: End date:

Select a list of month:

2003	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2004	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2005	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2006	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2007	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2008	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Select Time
 00:00:00 06:00:00 12:00:00 18:00:00

Select Level
 1 2 3 5 7 10 20 30 50 70 100 150 200 250
 300 400 500 600 700 800 850 900 925 950 1000

Select Parameter
 Carbon Dioxide Carbon monoxide Divergence Formaldehyde
 GEMS Ozone Geopotential Methane Nitrogen Oxides
 Ozone mass mixing ratio Potential vorticity Relative humidity Specific humidity
 Sulphur dioxide Temperature Vertical velocity Vorticity (relative)

Done

GEMS Integrated Near Real-time Analysis/Forecast - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://data-portal.ecmwf.int/data/t/gems_nrealtime/levtype=pl/

Most Visited ECMWF

ECMWF Home Your Room Login Contact Feedback Site Map Search:

About Us Products Services Research Publications News&Events
 Overview Forecast Computing Modelling Newsletters Calendar
 Getting here Order Data Archive PrePFS Reanalysis Manuals Employment
 Committees Order Software PrePFS Seasonal Reanalysis Open Trainers

GEMS Integrated Near Real-time Analysis/Forecast-

GEMS Integrated Near Real-time Analysis/Forecast

Note: In order to retrieve data from this server, you first have to accept the [conditions of use](#).

Type of level
 Model levels
 Pressure levels
 Surface

GEMS fields
 Near real-time
 Re-analysis

Personal
 Your Requests

Data usage
 Conditions

Select date
 Select a date range between 2008-08-30 and 2009-03-01:
 start date: End date:

Select a list of month:

2008	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2009	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Select Time
 00:00:00 12:00:00

Select Level
 1 2 3 5 7 10 20 30 50 70 100 150 200 250
 300 400 500 700 850 925 1000

Select Parameter
 Carbon monoxide Formaldehyde GEMS Ozone Nitrogen Oxides Sulphur dioxide

Select Step
 0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48
 51 54 57 60 63 66 69 72

Done

Future

- **MACC and PASODOBLE will deliver (and continue to deliver) pre-operational services**
- **The key to GMES are the users – we are looking forward to any collaboration and to supporting you where possible.**
- **Dedicated meetings where all interested parties will be invited.**
- **Further calls for Downstream Services will follow**
- **Operational GMES Atmosphere Service (GAS) is planned for 2014**