

# Space Tools for Atmospheric Monitoring: GMES PROMOTE

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and the PROMOTE team

**UN/Austria/ESA Symposium on  
Space Tools and Solutions for  
Monitoring the Atmosphere  
Graz, 11-14 Sept 2007**



# Atmosphere services – an example

- What do air pollution forecasts mean to most people?
  - ◆ Searching relevant numbers in newspaper lists and trying to understand them
  
- What does the PROMOTE AirText service in London do?
  - ◆ Send SMS, voice-mail, e-mail message to affected people only when high air pollution is forecasted:

*“HIGH air pollution Friday. Consider reducing exposure, spend less time outdoors and take reliever medication. If unwell contact your doctor.”*

- 97% users find it useful, 64% changed their behaviour

## Slide 2

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t1

Bild von Handy mit Text Einfügen

terberts, 09/09/2007

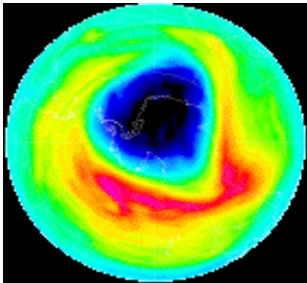
# PROMOTE Mission

- To deliver GMES Service Element for Atmospheric Monitoring by constructing **sustainable & reliable operational services** to support informed decisions on **atmospheric policy issues**
- PROMOTE – Protocol Monitoring for the GMES Service Element Atmosphere
- Funded by ESA among 13 GMES projects
  - ◆ Consolidation Phase 2004-2005 to evaluate mature sat-based services
  - ◆ Implementation Phase 2006-2009 to scale-up services

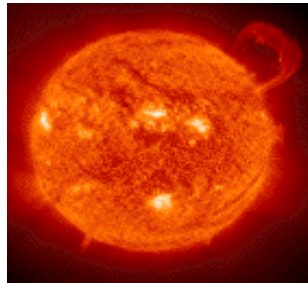
# PROMOTE Portfolio

- 5 themes selected based on user requirements and maturity of satellite and ground-based observations

Ozone



UV



Air Quality



Climate



Special



- Public sector information aimed at mandated bodies
- Citizen information aimed at public

# The PROMOTE Consortium (2007/9)



UN/Austria/ESA Symposium, Graz, 11-14 Sep 2007



## Slide 5

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t2

Add new partners like vdreams or whatever

terberts, 09/09/2007

# The PROMOTE Core Users

- 50+ core users with signed Service Level Agreement
  - ◆ Signature at directors level
- Local, Regional, National Authorities
  - ◆ State and Federal Environment Agencies (D, A, IR, UK, F, B, NL, I, CH,FI)
  - ◆ National weather services (e. g. DWD, KNMI)
- International Organisations
  - ◆ WMO, ECMWF, EEA, EMEP/NILU
- Commercial Niches
- Federating Users



**Slide 6**

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**t3**

**What's EMEP**

terberts, 09/09/2007

# PROMOTE: Information and Product Access

- [www.gse-promote.org](http://www.gse-promote.org)
- All data products and services available freely, online!



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#### Services

- Ozone
- UV
- Air Quality
- GHG-Aerosol
- Special



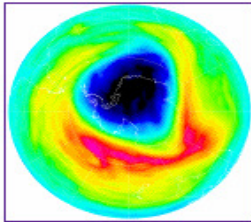
## PROtocol MONiToring for the GMES Service Element: Atmosphere

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

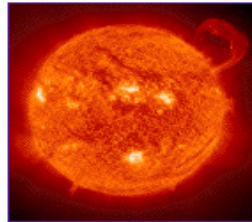
### Mission

**To deliver the Atmosphere GMES Service Element:** *To construct and deliver 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](#)



[Greenhouse Gas and  
Aerosol Service](#)



[Special Services](#)

### Latest News

9 November : The PROMOTE webportal is in the process of an extended upgrade in the coming days/weeks. This can result in temporary missing links. We are sorry for any inconvenience this may cause.



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



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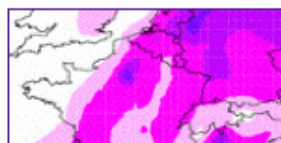
## Air quality service

The PROMOTE air quality service contains the following elements (Click on the images for data access):



### Air Quality Records

**Description :** Air quality conditions and their long term evolution  
**Coverage :** global / European  
**Period :** 1995-2008 / 2002-2008  
**Data type :** images, satellite retrievals (level 2), assimilation analyses



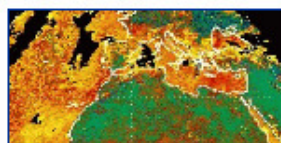
### Integrated Air Quality Platform for Europe

**Description :** This service will provide daily air quality forecasts and analysed maps provided in near real time  
**Coverage :** Europe  
**Period :** Near-real time  
**Data type :** maps (gif) and numerical data (netcdf and other formats)



### Regional/Local Air Quality Forecasts

**Description :** Air quality forecasts for specific cities or regions in Europe  
**Coverage :** Regions/Cities in Europe  
**Period :** Forecasts  
**Data type :** Maps



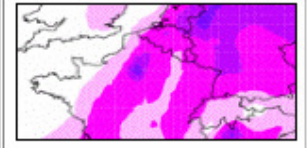
### Desert Dust Awareness

**Description :** A service for the Southern European citizens that will help them to prevent possible exposures to dust based on NRT information.  
**Coverage :** Canary Islands, South of Spain, Portugal and South of Italy  
**Period :** Febr. 2006 - today (SEVIRI lifetime)  
**Data type :** NetCDF Files, HTML Web information and SMS messages

### Satellite-based Particulate Matter Demonstration Service



## Integrated Air Quality platform



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### Integrated air quality platform

This service provides forecasts and analyzed maps of air pollutants concentration throughout Europe. Ground level concentrations of ozone, nitrogen dioxide and particulate matter simulated by numerical models with a near 50km\*50km resolution are available. The results are issued from several chemistry-transport models widely validated. The final products result from an ensemble approach allowing to get the best modelling result from a combination of different models. Up to two days forecasts are provided. The so-called analyzed maps are issued from simulations, corrected assimilating in-situ observations. They are daily available using near-real time measurement data. Daily updates will be envisaged.

### Latest Forecasts (preliminary results)

Pollutant	Latest Forecast Day+0	Latest Forecast Day+1	Latest Forecast Day+2
O <sub>3</sub> Daily Maximum			



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## Archives

Air Quality Forecasts: [Image and Data Archive](#)

## Documentation

Product :

- ◆ Product specification (coming soon)
- ◆ Algorithm specification (coming soon)
- ◆ References (coming soon)

Validation :

- ◆ Score Analysis (coming soon)

## Background information

- ◆ [Link to EURAD documentation](#)
- ◆ [Link to PREV'AIR documentation](#)
- ◆ [Link to SILAM documentation](#)
- ◆ [Link to LOTOS-EUROS documentation](#)

## Core User

- ◆ [AIRPARIF](#)

## Service Providers

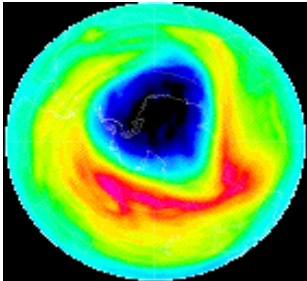
- ◆ [INERIS](#)
- ◆ [DLR](#)
- ◆ [RIU](#)
- ◆ [Meteo-France](#)
- ◆ [TNO](#)
- ◆ [FMI](#)

## Contact

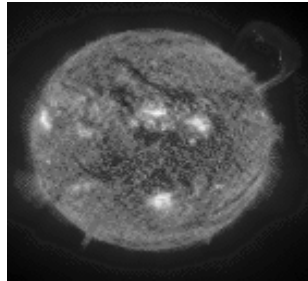
- ◆ [Contact us](#)

# Ozone Services

Ozone



UV



Air Quality



Climate



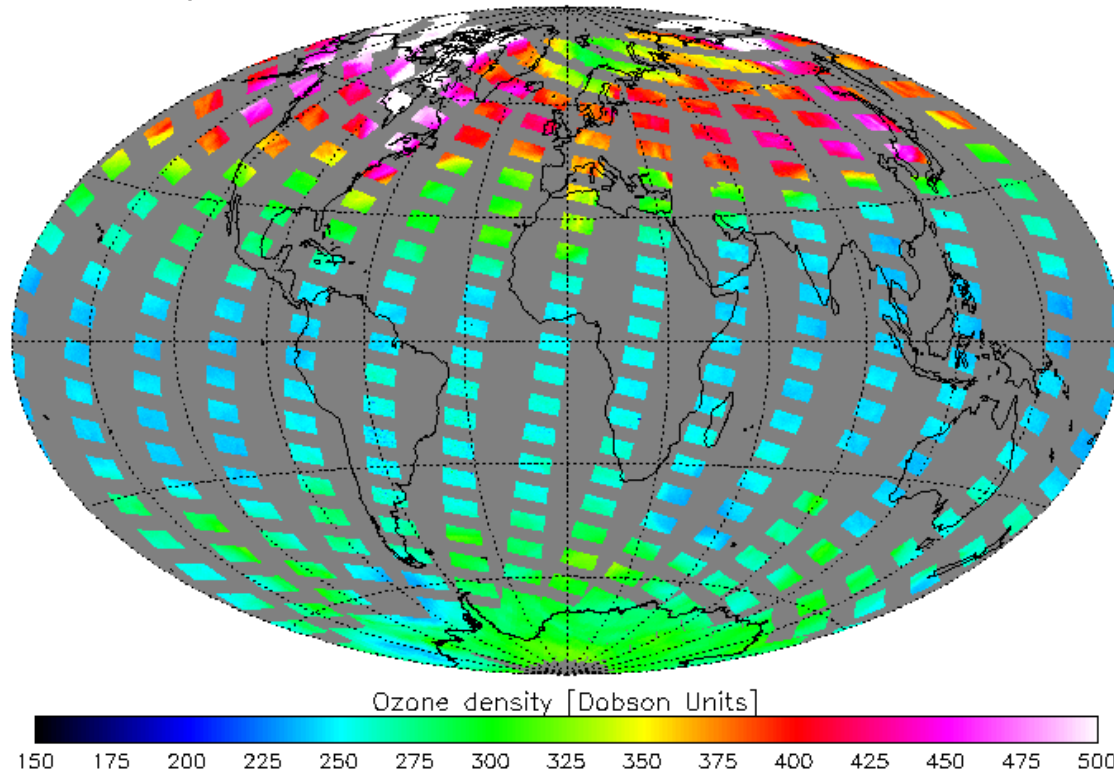
Special



# Global total ozone observations in near-real time

Sciamachy total ozone 06-03-2007

KNMI/ESA



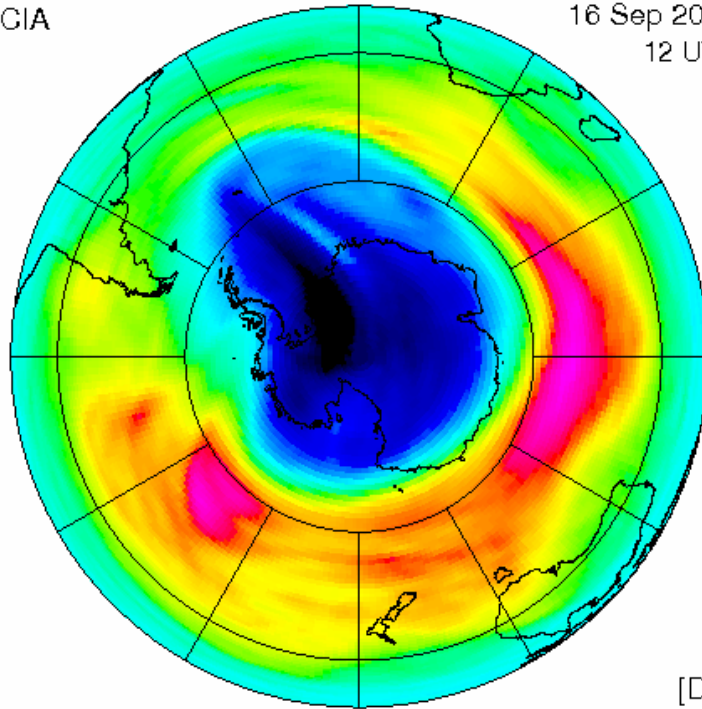
- User: ECMWF - improvement of medium range weather forecast, adoption in operational forecasting scheme



# Global total ozone forecasts (D+9)

KNMI / ESA  
SCIA

Forecast total ozone (D+7)  
16 Sep 2007  
12 UTC

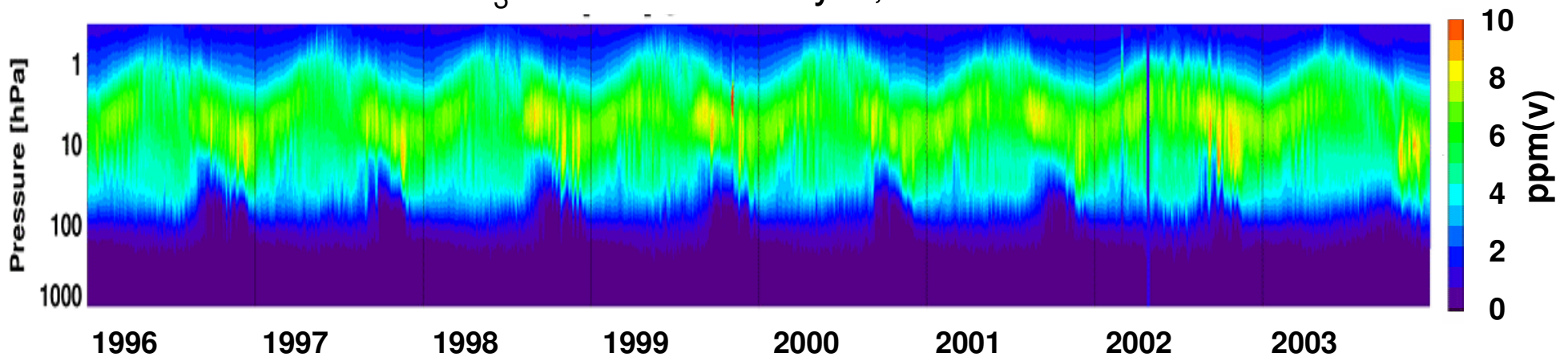


- User: WMO – Inclusion in ‘Antarctic Ozone Hole Bulletin’
- Users: Weather Services – UV forecasting

# Global assimilated ozone profile record

- 4D-Var chemical assimilation of GOME, SCIA, MIPAS, GOMOS and UARS

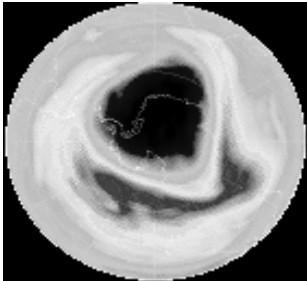
O<sub>3</sub> VMR at Neumayer, Antartica



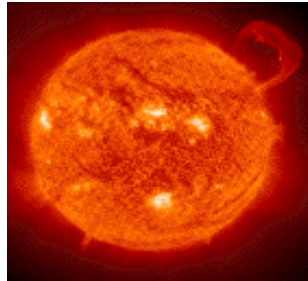
- User: SPARC CCMVal has used ozone profile record to evaluate CCMs used for WMO ozone assessments

# UV Services

Ozone



UV



Air Quality



Climate



Special



# UV Services

- Personalized location-based services that deliver
    - ◆ Individual sunburn time
    - ◆ UV index
    - ◆ recommended sun protection factor
  - via internet or mobile phone
- ... any time, any place in Europe



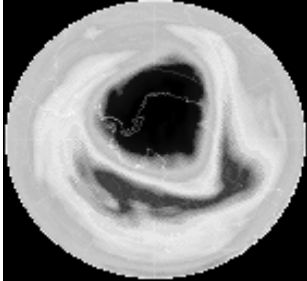
# Feedback on UV Services

- German Association of Dermatologists (BVDD) use PROMOTE UV-Check for awareness building of their patients
- Used by Regional Environmental Agencies in Tuscany, Lombardia, Sicily, Baleares, Corsica

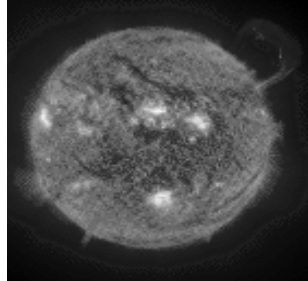


# Air Quality Services

Ozone



UV



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# Air Quality Service

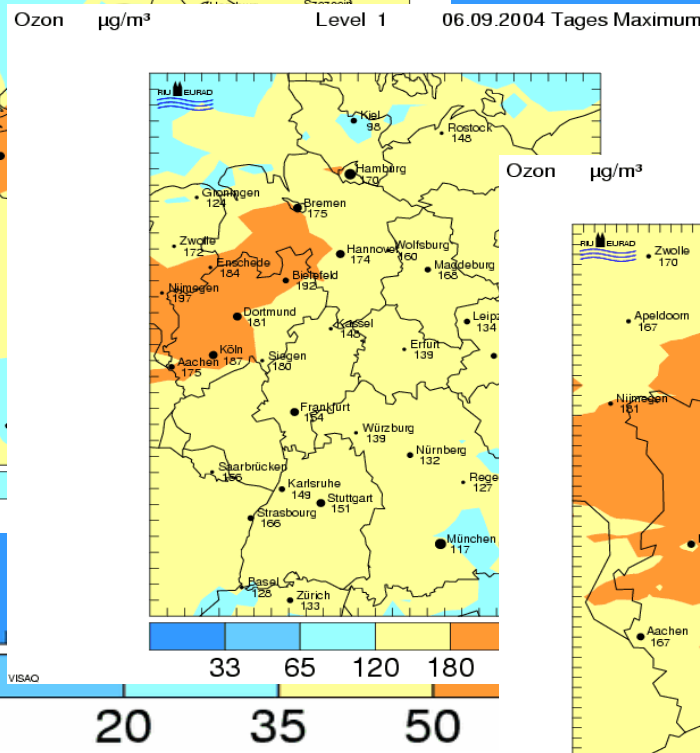
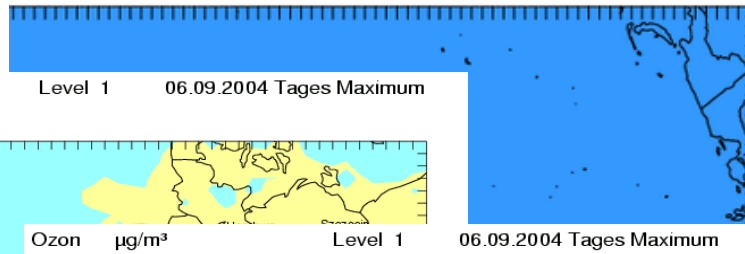
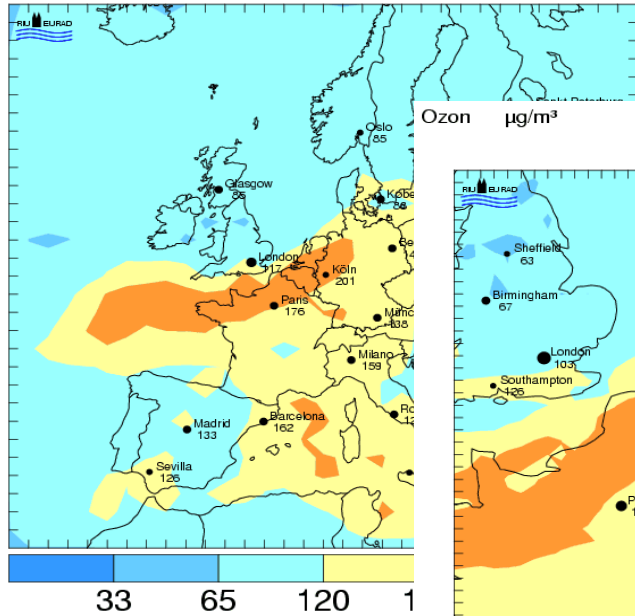
## ➤ Products

- ◆ **Global and European Air Quality records** (NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>)
- ◆ **European-scale Air Quality analyses and forecasts** (daily)
- ◆ **Local/urban-scale Air Quality forecasts, assessments, and scenarios**
- ◆ **Particulate Matter**: desert dust, pollen, ground-level PM

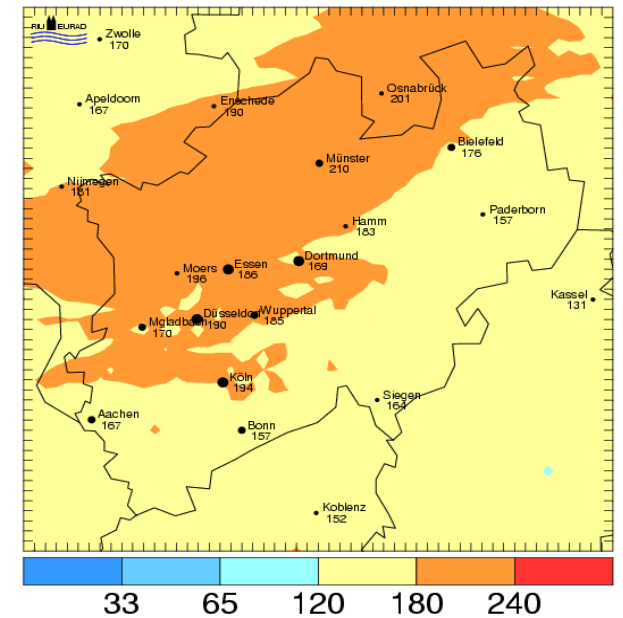
# Air Quality forecasts in Different Domains

Ozon  $\mu\text{g}/\text{m}^3$  Level 1 06.09.2004 Tages Maximum

Level 1 09.03.2005 Tagesmittelwert

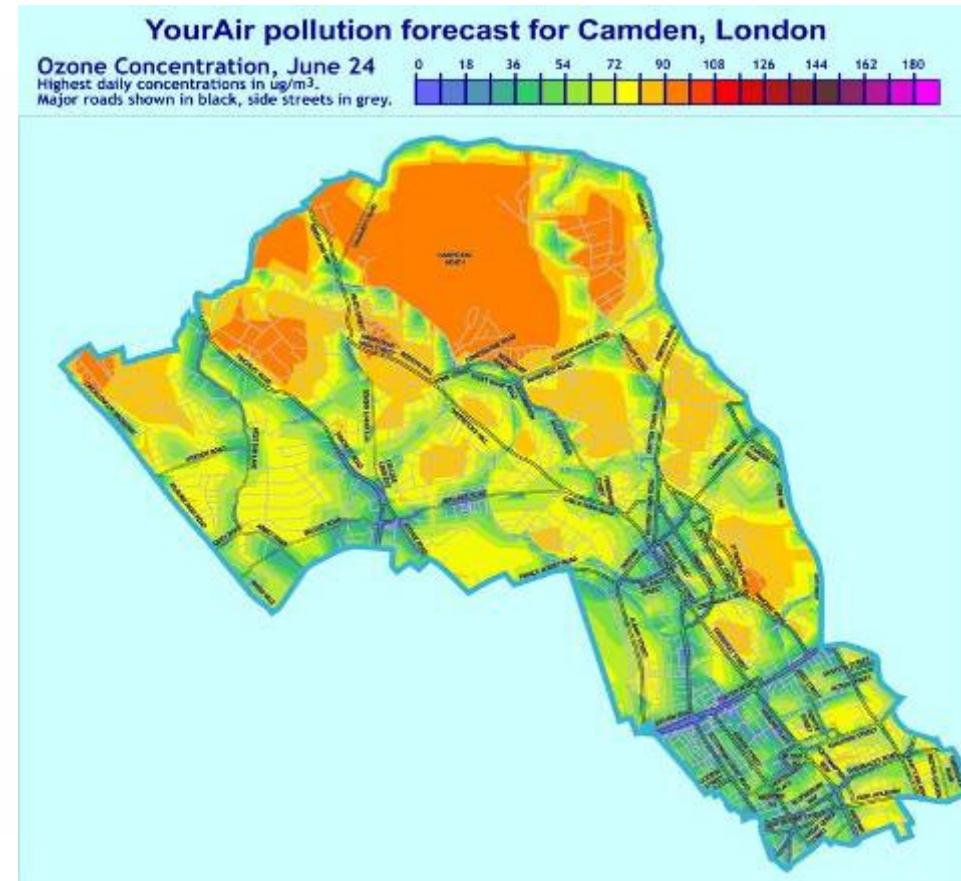
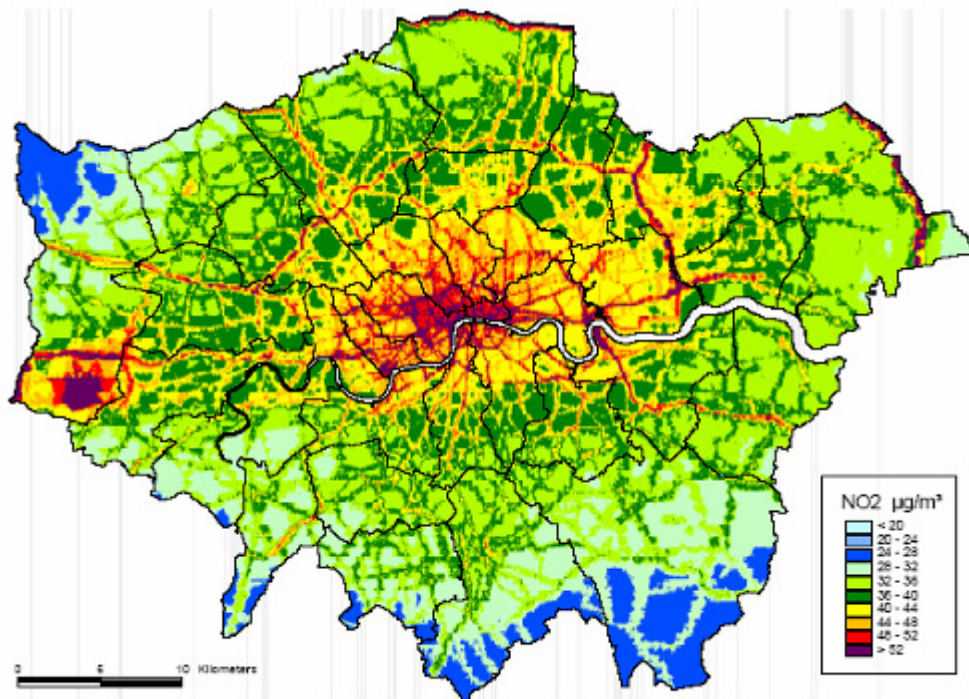


Ozon  $\mu\text{g}/\text{m}^3$  Level 1 06.09.2004 Tages Maximum





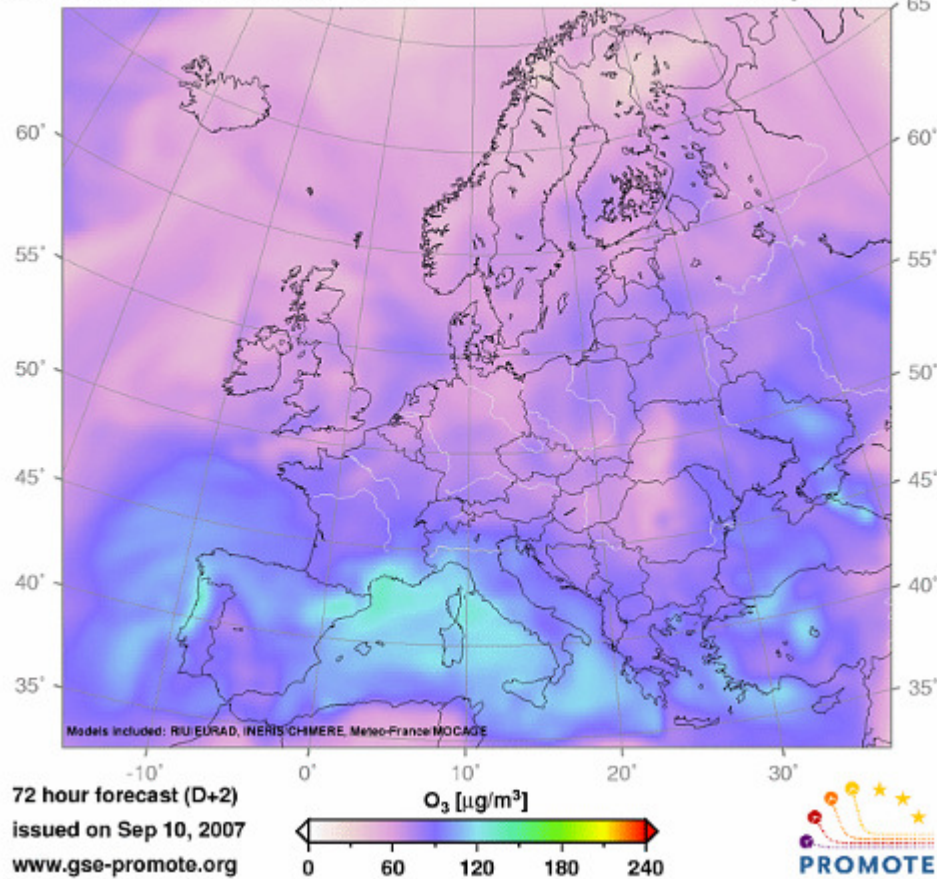
# Example: Local Air Quality forecasts



# Integrated European Air Quality Ensemble

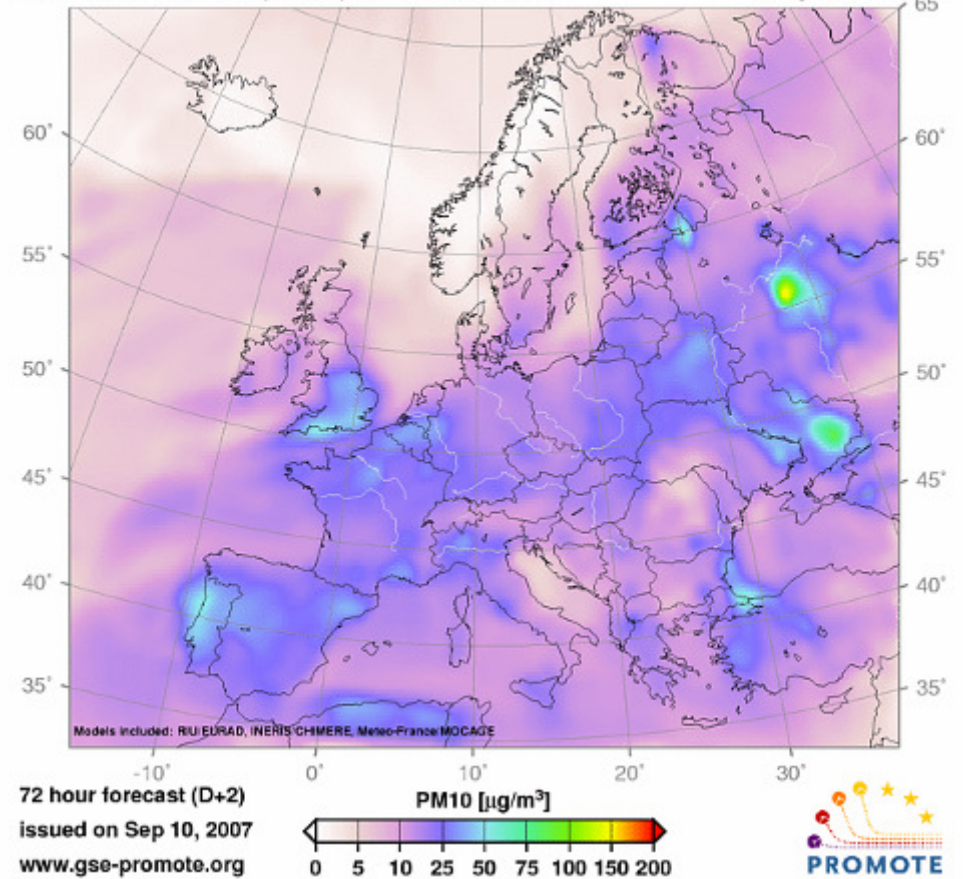
Integrated Air Quality Ensemble  
Ozone Forecast, Surface Level

Sep 12, 2007  
Daily Maximum

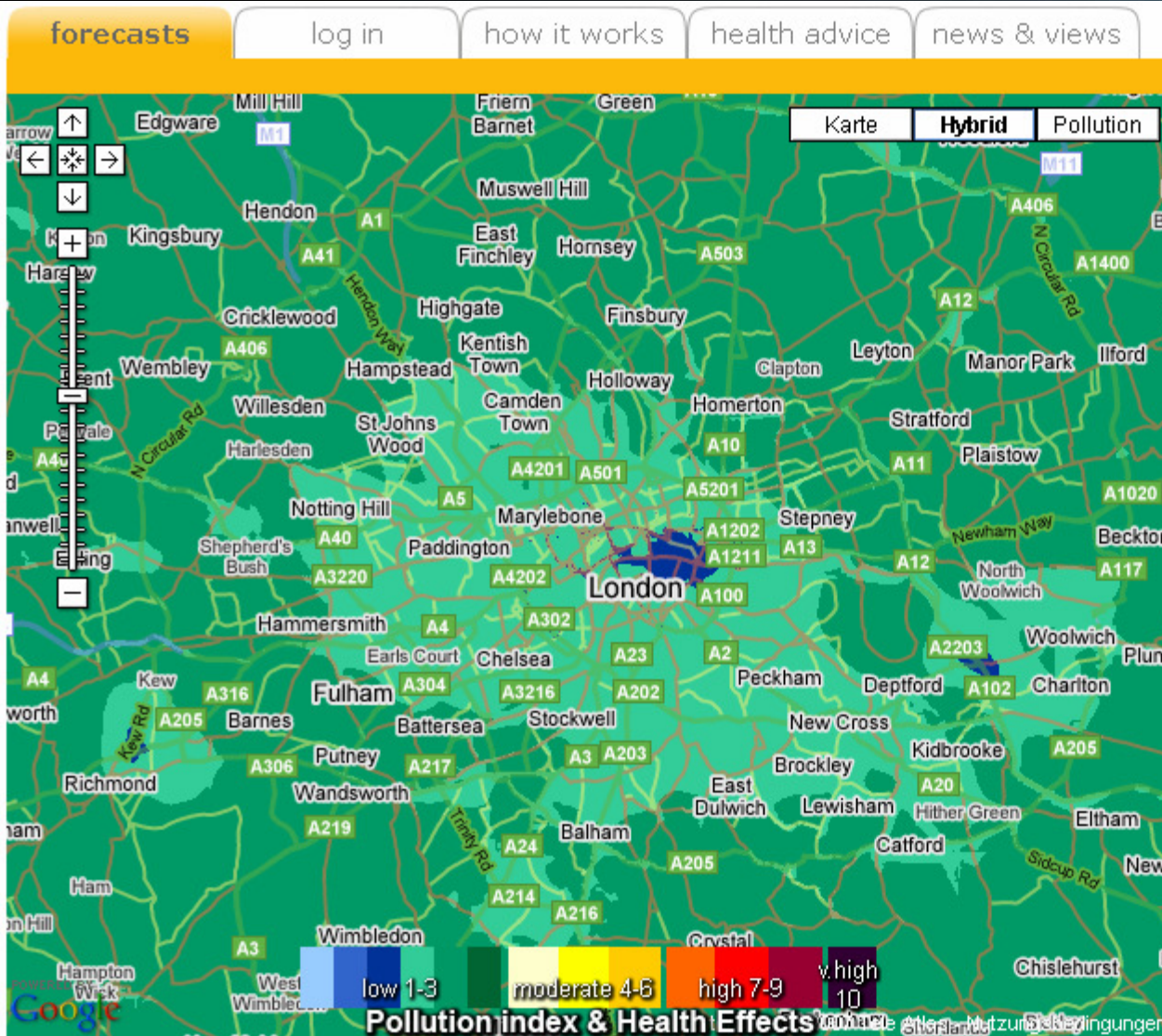


Integrated Air Quality Ensemble  
Particulate Matter (PM10), Surface Level

Sep 12, 2007  
Daily Maximum



# Your Air Service Greater London



Monday September 10th, 2007  
 Central London: **LOW** air pollution expected everywhere. forecast issued, 7am Monday

airTEXT will alert you by SMS, voicemail or email if elevated pollution is expected in your part of London.  
*Sign up now, it's free!*

### Get the forecast

Central London  
 Total Pollution  
 Last Monday

Calendar

Search for postcode:

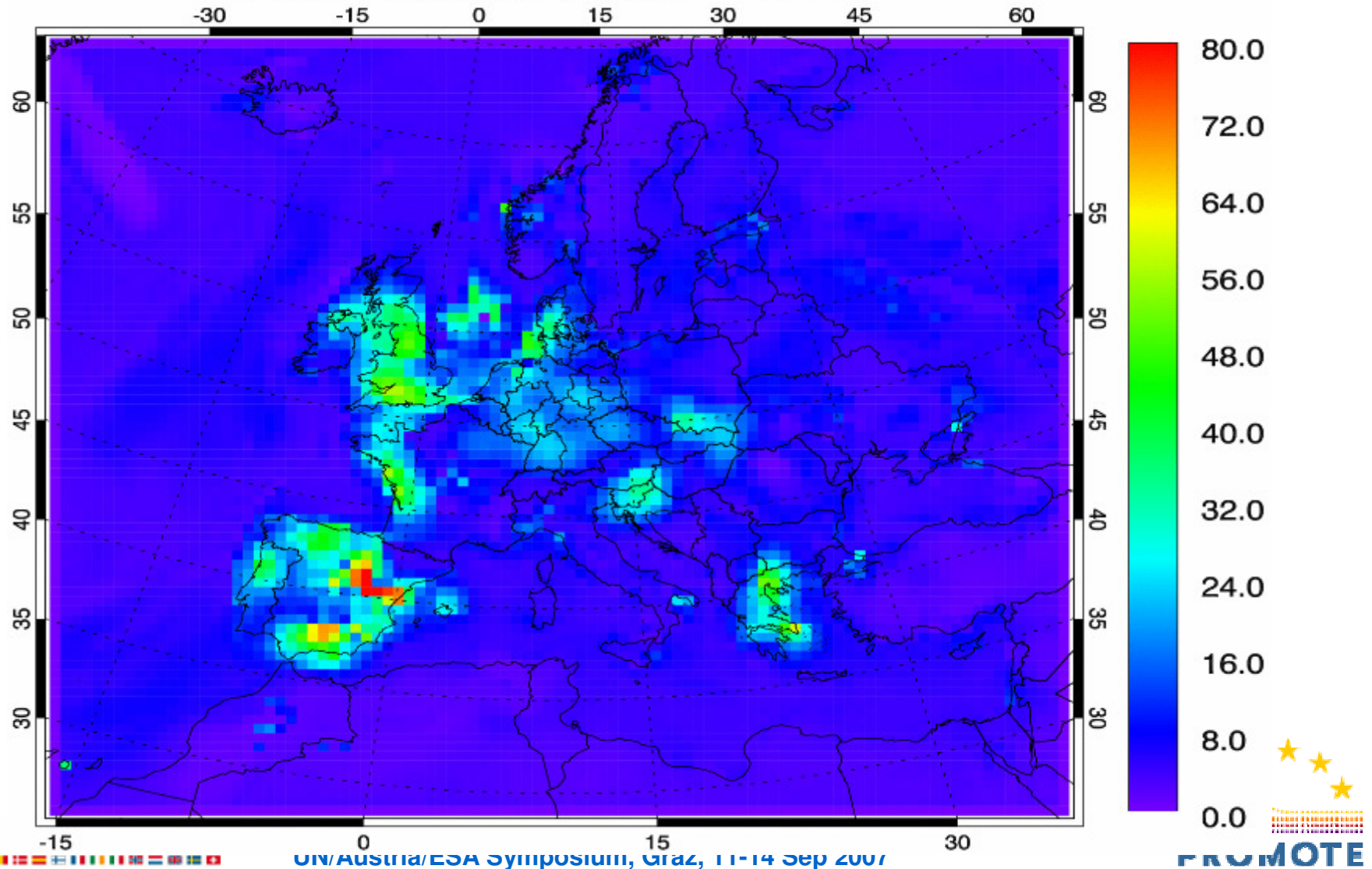
search

The air pollution level is shown by the colour of the map underneath the roads, not the colour of the roads themselves.

Co-operation with 25 London agencies and authorities

# Example: Particulate Matter / Data Assimilation

PM10.0 ; [ $\mu\text{g}/\text{m}^3$ ] Analysis ; level=1

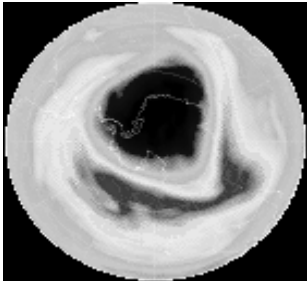


# Feedback on Air Quality

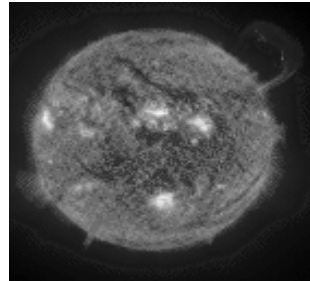
- Global/European Air quality record service (1995 – present)
  - ◆ from focus on satellite tropospheric columns to assimilated near surface concentrations
- Integrated Air Quality Ensemble
  - ◆ Forecast ensemble basis for further downstream air quality services
- Greater London local air quality
  - ◆ Extended from 1 Borough to 25 Boroughs now using the service

# Climate Service

Ozone



UV



Air Quality



Climate



Special

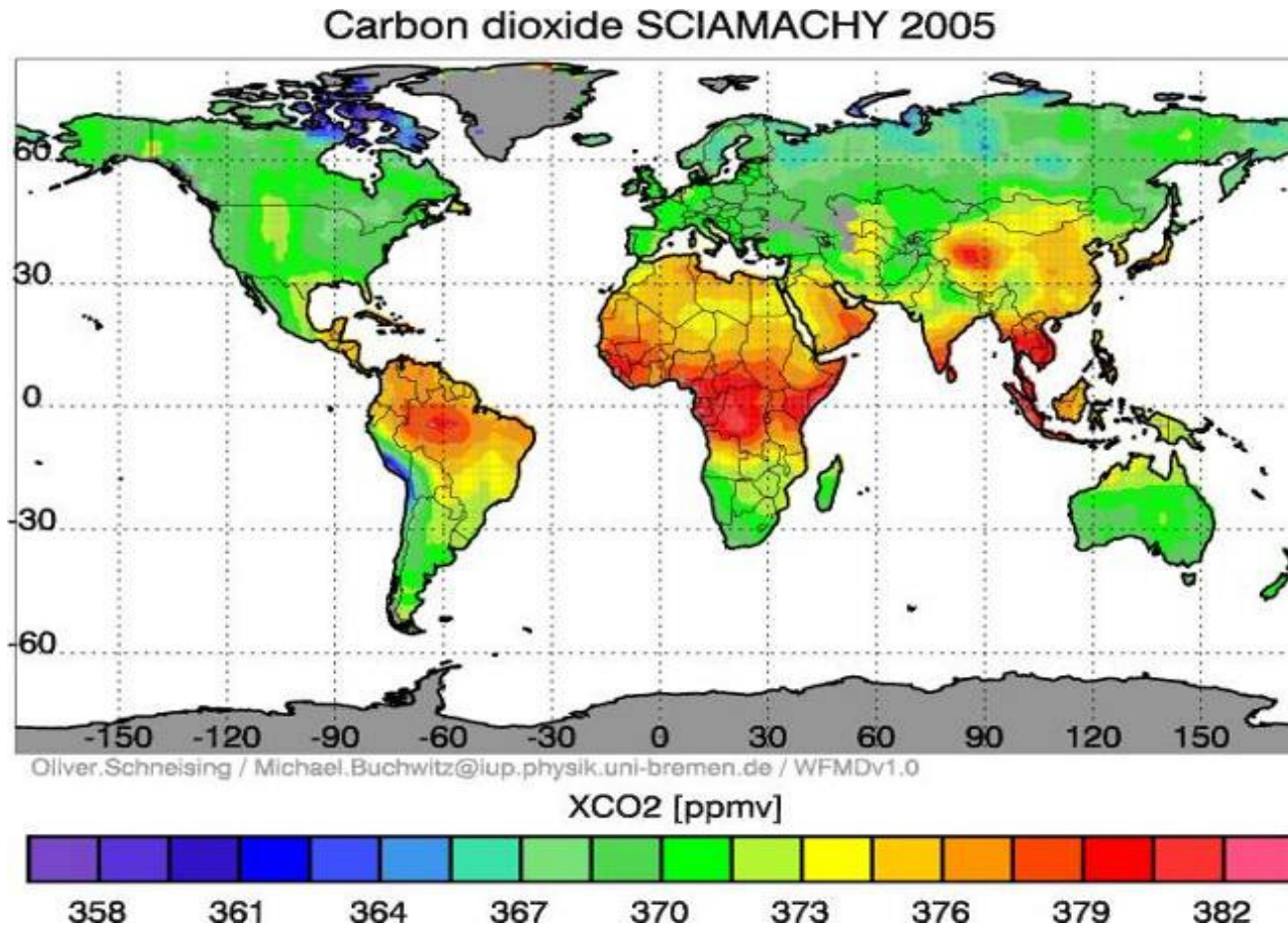


# Climate Service – Greenhouse Gases & Aerosols

## ➤ Products

- ◆ Global **methane** & **carbon dioxide** records from satellite data
- ◆ Global **aerosol** optical depth and speciation

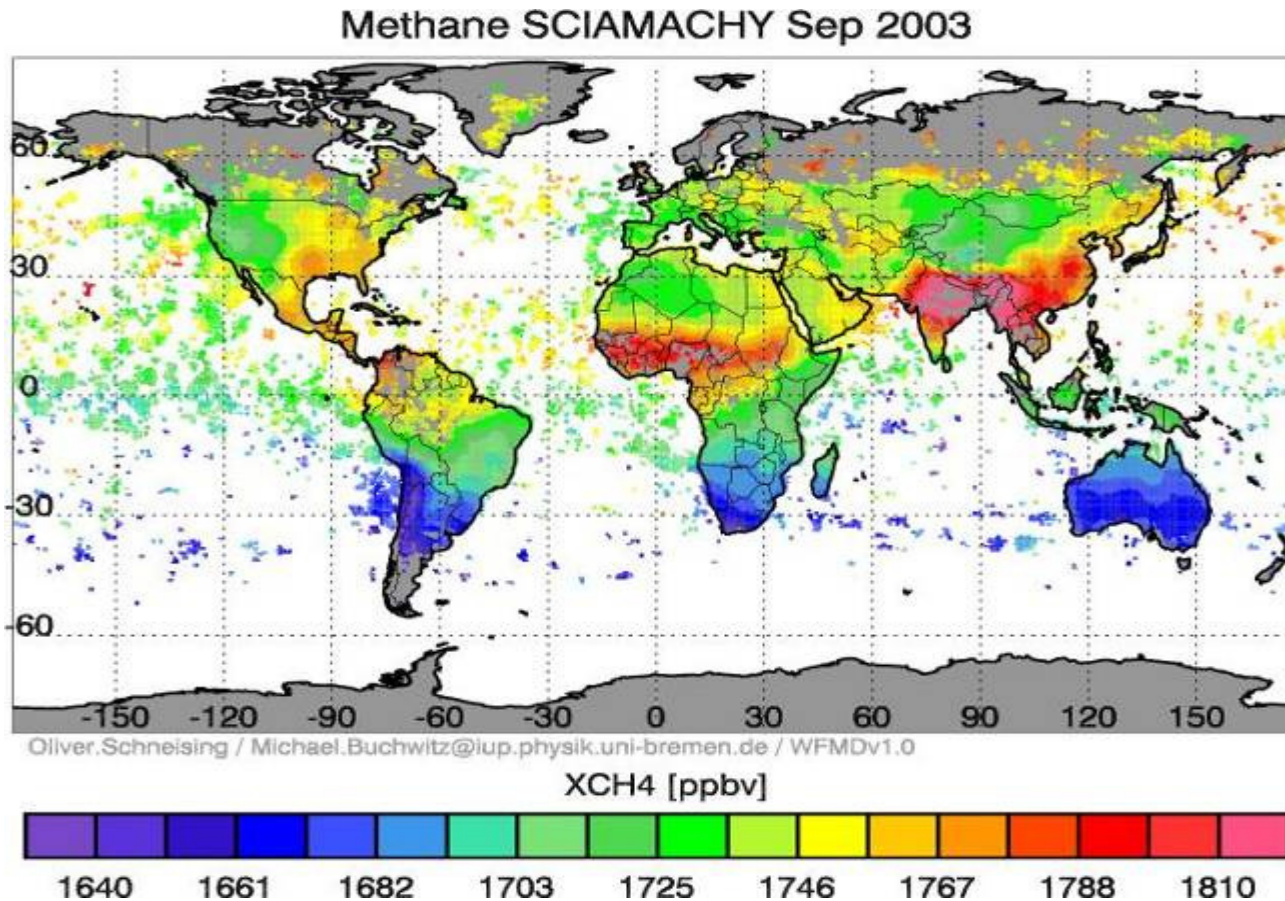
# Greenhouse Gases – CO<sub>2</sub> Global Data Sets



➤ Inputs to and optimizations of Climate Change models



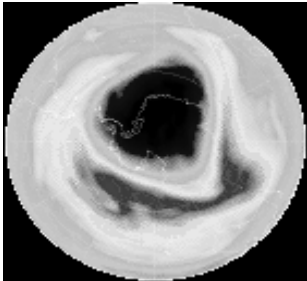
# Greenhouse Gases – CH<sub>4</sub> Monthly Mean



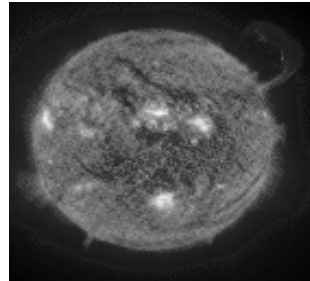
➤ Source and sink apportionment for Greenhouse Gases

# Special Services

Ozone



UV



Air Quality



Climate



Special



# Support To Aviation Control Service

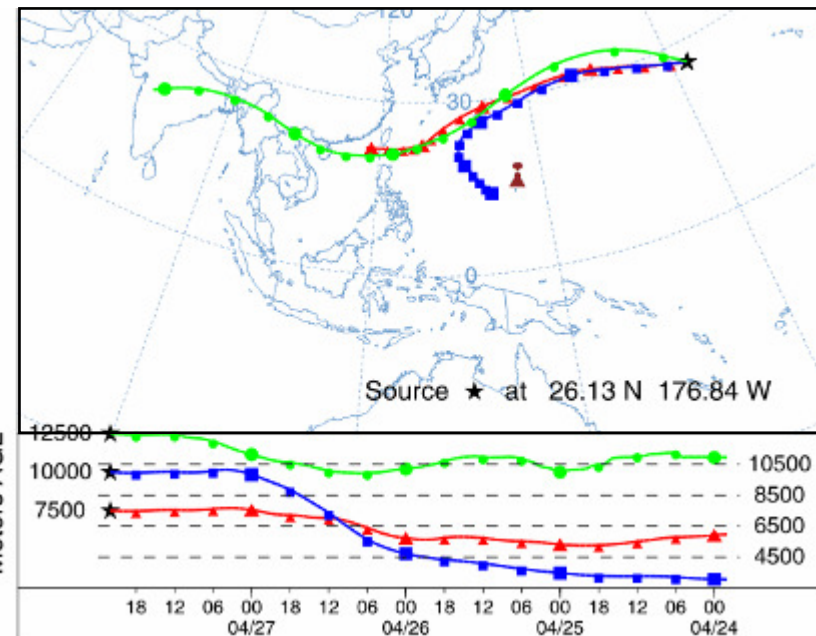
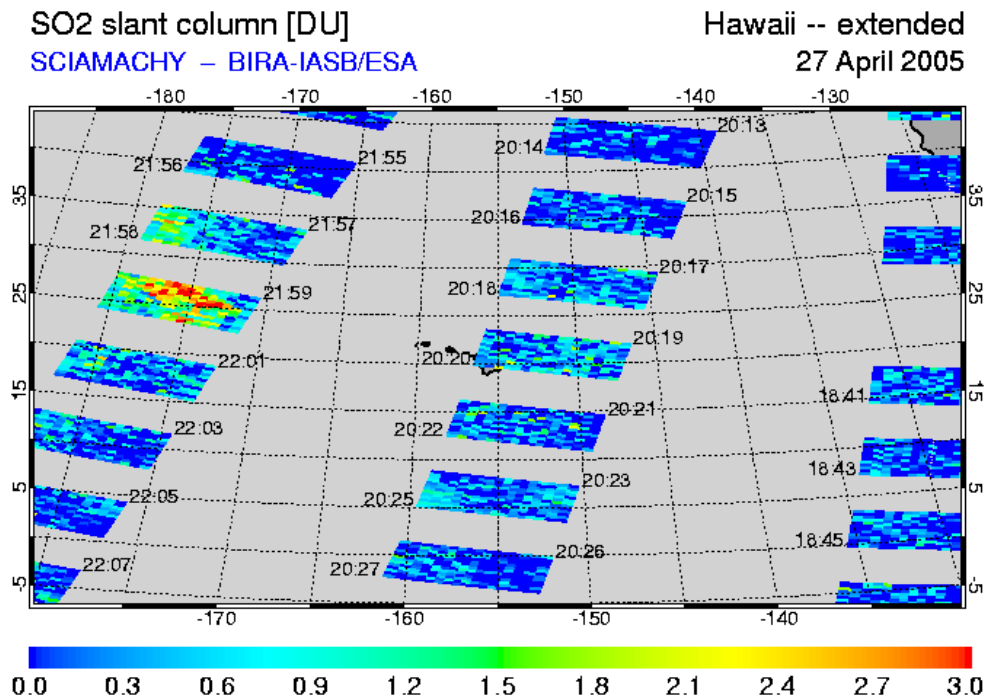
- 90+ aircraft damaged by volcanic ash clouds
- Economic cost of US\$ 250 Million between 1982-2000
- International Civil Aviation Organisation established 9 Volcanic Ash Advisory Centres (VAACs) for rapid warnings
- The aim of PROMOTE SACS is to
  - ◆ assist the VAACs when issuing alerts regarding volcanic activity to air traffic control
  - ◆ deliver in near-real-time data derived from satellite measurements regarding SO<sub>2</sub> and aerosol



Source: C. Witham, UKMO

# Support To Aviation Control Service

- Near-real time SCIAMACHY SO<sub>2</sub>, trajectory analysis



# PROMOTE Validation Office

- To verify the “fitness for purpose” of each service
- To allow efficient co-operation with service developers and end-users
- To set up general standards and working practices following GMES/GEOSS commitments

# PROMOTE Portfolio Sustainability

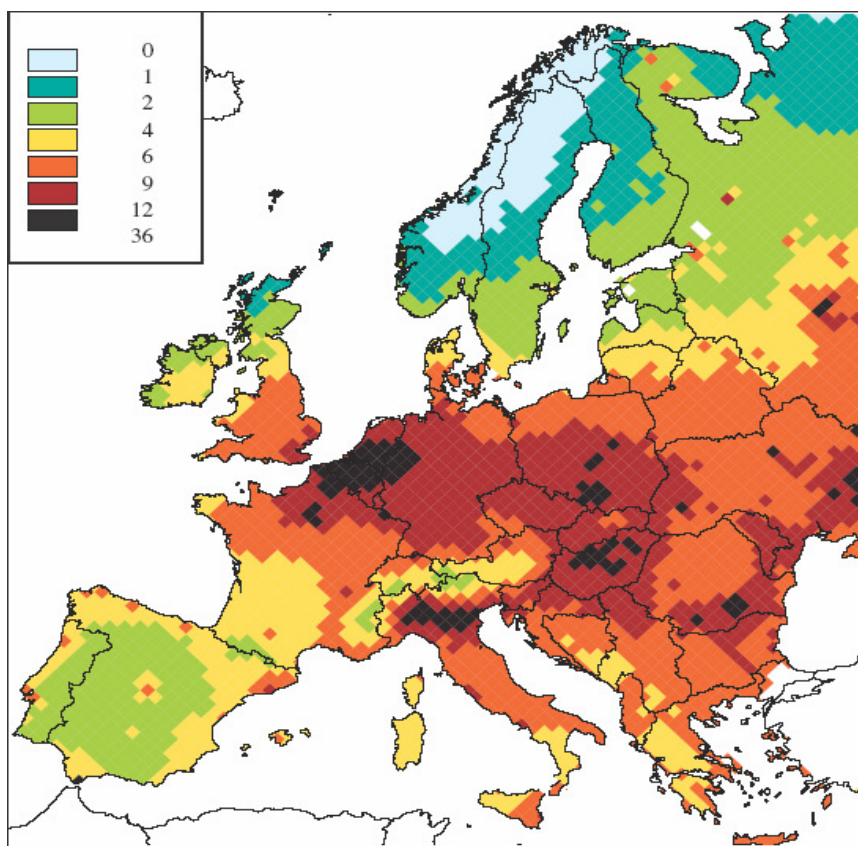
- Operational considerations
  - ◆ Strong dependency on **satellites**
    - ❖ ENVISAT, METOP, MSG; TERRA, AURA
    - ❖ Sentinels 3, 4, 5 are needed
  - ◆ **In-situ data** is required as input to models and for validation
  - ◆ **Data assimilation** is crucial for many user requirements

# Overall User Conclusions

- Constant feedback loop between service providers and users is crucial in order to assure product utility
- Open data access important to achieve acceptance of GMES services in a larger user community

# PROMOTE impact perspective

- Contribute to reduction of such harmful impacts



Loss in life expectancy attributable to fine particulate matter in months  
(M. Amann, International Institute for Applied Systems Analysis)

## The PROMOTE services

- Informing authorities
- Educating people
- Informing people
- Special services

Europe-wide services  
Direct, local access

**European  
de-centralized  
network**



**Want more information?**

**Then take a look at ...**

**[www.gse-promote.org](http://www.gse-promote.org)**

**... with all data, freely available, online**