



## GEMS

Global and regional Earth-system  
Monitoring using Satellite and in-situ data

### MONITORING AND FORECASTING OF ATMOSPHERE COMPOSITION

The principal aim of the GEMS project is to develop validated, integrated systems for global and European modelling and data assimilation, in order to monitor and forecast the composition of atmosphere, its dynamics and thermodynamics. Substantial use will be made of both satellite and in-situ data in the formation and validation of products. GEMS will enable successor services to provide routinely:

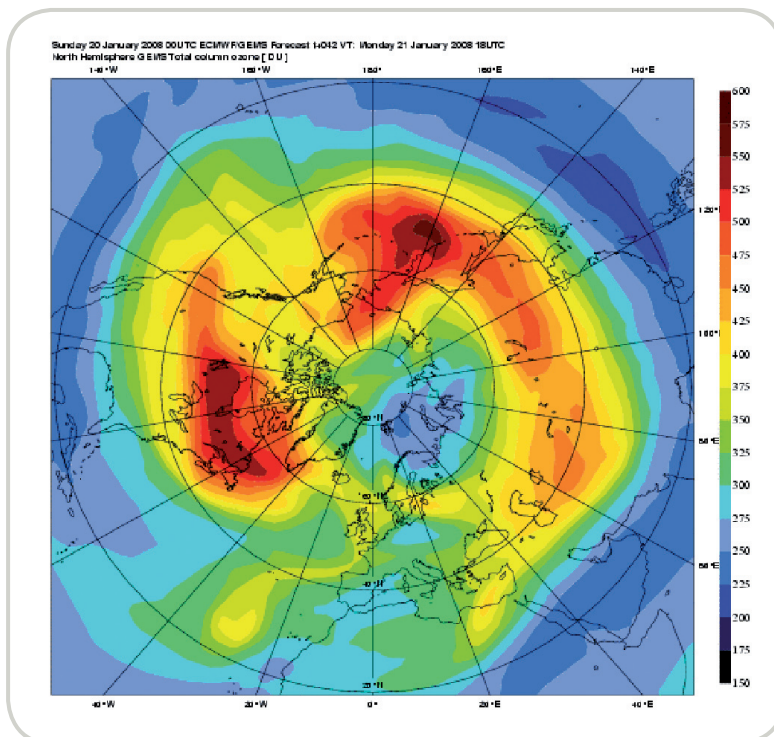
- Air-quality monitoring and forecasting for Europe based on nationally-developed systems;
- Surface solar and UV radiation products related to renewable energy supply and biological impacts;
- Products to support health warnings for conditions such as dust-borne meningitis, pulmonary disorder and pollen allergies;
- Global monitoring of greenhouse gases, reactive gases and aerosols;
- Global medium-range forecasts of reactive gases and aerosols;
- Estimates of emissions and sinks of greenhouse gases and pollutants;
- Estimates of the radiative forcing of climate change.

GEMS is paving the way towards a fully operational core monitoring and forecasting service to be developed under the Global Monitoring for Environment and Security (GMES). GEMS and its successor services will deliver key information relevant to the UN Framework Convention on Climate Change, the Montreal Protocol, the UN Convention on Long-Range Trans boundary Air Pollution, as well as to the work carried out by the Intergovernmental Panel on Climate Change.

### THE GLOBAL WEATHER FORECAST MODEL EXTENDED

The global weather forecast model developed by the European Centre for Medium-Range Weather Forecasts (ECMWF), the coordinator of the project, has been extended in collaboration with partners to include variable greenhouse gases, reactive gases and aerosols, with comprehensive internal representations of key processes for the greenhouse gases and aerosols, and a novel coupling with a chemical transport model to determine the sources and sinks of the reactive gases.

Based on routine numerical weather prediction, the system re-analyses meteorological observations in order to obtain detailed daily records and forecasts of weather and atmospheric composition. The records for ozone spanning over several decades can be examined for evidence of climate variability and change as well as the ozone hole recovery. Samples of forecast information in a map form updated daily from prototype versions of the GEMS system for reactive gases and aerosols are being run on the GEMS website.



Forecasts of the ozone total columns of the northern hemisphere by the GEMS prototype system.  
Source: GEMS/ECMWF

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## LIST OF PARTNERS

- European Centre for Medium-Range Weather Forecasts, International Organisation
- Met Office, UK
- Centre National de la Recherche Scientifique, France
- Commissariat à l'Énergie Atomique, France
- Max-Planck-Institute for Biogeochemistry, Germany
- Max Planck Institut für Meteorologie, Germany
- Royal Netherlands Meteorological Institute, The Netherlands
- Belgian Institute for Space Aeronomy, Belgium
- Finnish Meteorological Institute, Finland
- Danish Meteorological Institute, Denmark
- Deutscher Wetterdienst, Germany
- University of Bremen, Germany
- Université Pierre et Marie Curie, France
- National and Kapodistrian University of Athens, Greece
- Météo-France, France
- National University of Ireland, Galway, Ireland
- Royal Meteorological Institute, Belgium
- ARPA Emilia-Romagna, Italy
- Istituto di Scienze dell'Atmosfera e del Clima Consiglio Nazionale delle Ricerche, Italy
- Meteorologisk Institutt, Norway
- Rheinisches Institut für Umweltforschung, Germany
- Joint Research Centre, Institute for Environment and Sustainability, International Organisation
- Institut national de l'environnement industriel et des risques, France
- Czech Hydrometeorological Institute, Czech Republic
- Irish Environmental Protection Agency, Ireland
- Polish Institute of Environmental Protection, Poland
- Imperial College of Science, Technology and Medicine, UK
- Trinity College Dublin, Ireland

## COORDINATOR

### European Centre for Medium-Range Weather Forecasts (ECMWF)

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## PROJECT INFORMATION

GEMS: Global and regional Earth-system  
Monitoring using Satellite and in-situ data  
Integrated Project  
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Estimated total cost: € 17.445.970

