



ECMWF is an intergovernmental organisation supported by 34 Member and Co-operating States. It carries out research in numerical weather prediction to develop, produce and disseminate global weather forecast information. ECMWF has partnerships and co-operation agreements with many organisations around the world, such as the WMO, space agencies, research institutes, and weather centres. Its research involves the science underpinning modelling of the Earth system and its forecasts rely on Earth observations.



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GROUP ON EARTH OBSERVATIONS

ECMWF is one of 87 Participating Organisations, which, together with the 96 member nations and the European Union, form the Group on Earth Observations. The GEO community's ambition is to pool Earth observation resources world-wide to enable informed decision-making across multiple Societal Benefit Areas – agriculture, biodiversity, climate, disasters, ecosystems, energy, health, water and weather.

ECMWF contributes to GEO in the fields of research in ensemble forecasting through its activities in TIGGE, TIGGE LAM and S2S, and in environmental information services through its involvement in the EU Copernicus Programme.

EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

ADVANCING RESEARCH IN ENSEMBLE FORECASTING

ECMWF's computing facilities are amongst the largest worldwide for high-performance computing and data archiving dedicated to meteorology. This enables the Centre to provide the scientific community with access to long records of global observations and model-generated analysis and forecast data that enable research to be carried out worldwide to increase knowledge and improve modelling of the Earth system.

ECMWF's data archive includes TIGGE, TIGGE-LAM and S2S that form part of the weather contribution to the Global Earth Observation System-of-Systems (GEOSS) and are accessible through the GEOSS Common Infrastructure (GCI).

TIGGE – global ensemble forecast data

The International Grand Global Ensemble (TIGGE) dataset consists of nine years of multi-model ensemble forecast data from 10 global NWP centres, starting in October 2006 to present time. It contains 1.25 petabytes of data, totalling more than 4.6 billion fields which is made available for scientific research, via data portals at ECMWF and CMA. TIGGE has become a focal point for a range of research projects, including research on ensemble forecasting, predictability and the development of products to improve the prediction of severe weather.

TIGGE-LAM for regional ensemble forecasts

TIGGE-LAM is an extension of TIGGE archive to include weather forecasts from limited-area model ensembles. It has been developed as part of the EU-funded GEOWOW project to improve Earth observation data discovery, accessibility and exploitability. These forecasts are produced on grids with horizontal resolution between 12 and 2 km and provide detailed information for the short range, up to a few days

ahead. Output from eight limited area models is being ingested in the TIGGE-LAM archive daily. TIGGE-LAM enables users to compare models and improve the methodologies for the generation and application of regional ensemble forecasts. It will also provide valuable insight for the development of global ensembles as the resolution of these forecasts is planned to increase significantly in the coming years.

Sub-seasonal to seasonal weather forecasts (S2S)

ECMWF provides forecast data out to 2 months ahead and is also an archiving centre of the S2S database, that includes near real-time forecasts (3-week delay) and also re-forecasts from 7 operational centres currently (11 operational centres by the end of 2015). These data are important to improve our understanding and the representation of physical processes in Earth System Models. The database will be used to assess the potential societal benefits of using sub-seasonal to seasonal forecasts in a wide range of applications, such as agriculture.

CONTRIBUTING TO ENVIRONMENTAL INFORMATION SERVICES

The development of global weather models, such as ECMWF's IFS into more complete Earth system models has created the opportunity to analyse and predict many other aspects of the natural environment than purely the weather. Copernicus is the EU's flagship programme on monitoring the Earth's environment using satellite and in-situ observations. It aims to deliver reliable, validated information services in six areas: land, marine and atmosphere monitoring, emergency management, security, and climate change. ECMWF is implementing the Climate Change and the Atmosphere Monitoring Services and contributes to the Emergency Management Service by operating the computational centre for the European Flood Awareness System (EFAS). In addition ECMWF carries our research in these areas.

Monitoring the atmosphere

At the Earth's surface, aerosols, ozone and other reactive gases determine the quality of the air around us, affecting human health, life expectancy, and ecosystems. Ozone distributions in the stratosphere influence the amount of ultraviolet radiation reaching the surface. Greenhouse gases, aerosols, and chemical species have been introduced into the ECMWF model to enable the forecasting of atmospheric composition. Research in these areas is leading to increased knowledge and improved analysis and forecasting skill.

Understanding climate change

Research at ECMWF focuses on the development of consistent reanalyses of the coupled climate system, including the atmosphere, the land surface, the ocean, sea ice, and the carbon cycle. Reanalysis datasets available from ECMWF cover the past 100 years of weather. These provide a comprehensive assessment of the state of the climate in the

recent past up to the present. In addition ECMWF carries our research and produces seasonal predictions of phenomena such as El Nino; this timescale is at the critical interface between weather and climate prediction.

Informing water management

In support of the European Flood Awareness System (EFAS), and the Global Flood Awareness System (GloFAS), ECMWF is carrying our inter-disciplinary research on meteorology and hydrology to enable flood forecasting to be improved. Also ECMWF supports AIP8-GEOSS Water Services which encourage and help government data providers and research centres to publish water resource time series data. These include observed and modelled variables such as stream flow, stream depth, precipitation, soil moisture, runoff, water quality, and others. These data are important to our understanding of the frequency, variability, and consequences of extreme weather events (storms, floods, and drought).