European Commission

Climate Change

ARISE

At a glance

Title: Atmospheric dynamics Research Infrastructure in Europe

Instrument: FP7 Design Study for Research Infrastructures

Total Cost: 5,620,049 €

EC Contribution: 4,400,000 €

Duration: 36 months

Start Date: 1 January 2012

Consortium: 12 partners from 9 countries

Project Coordinator: Dr. Elisabeth Blanc

Project Web Site: http://arise-project.eu

Key Words: Dynamics of the Atmosphere, Coupling of Atmospheric Layers, Large Scale Atmospheric Disturbances, Extreme Events

The challenge

For a long time, it was considered that there are negligible interactions between the upper layers and the troposphere. However, recent studies have demonstrated the role that dynamics in the middle and upper atmosphere can play in both tropospheric weather and climate. Atmospheric waves, particularly gravity and planetary waves, drive this interaction and much of the large-scale atmospheric global circulation systems in the middle and upper atmosphere. Observations above the stratopause, where measurements are rare, could then provide crucial information for better description of the atmosphere and more accurate longer-term weather forecasts, on timescales up to several weeks ahead.

The challenge of the ARISE project is to integrate complementary measurements to provide updated 3D images of the atmosphere and unresolved disturbances from the ground to the mesosphere with unprecedented spatio-temporal resolution. The main idea is to probe the atmosphere using atmospheric disturbances produced by well identified sources. The considered time scales range from seconds for extreme events (volcanoes, thunderstorms, cyclones, avalanches, meteorites) to minutes or hours for gravity waves, days for planetary waves up to tens of years for long term mean trend studies. The observations cover areas with very different climatic regimes, extending over Europe and outlying regions, including polar and equatorial regions.

Project Objectives

The ARISE infrastructure objectives are:

1) to improve the representation of gravity waves in stratosphere-resolving climate models, crucial to estimating the impact of stratospheric climate forcing on the troposphere,
2) to monitor climate-related phenomena such as severe weather, thunderstorms and sudden stratospheric warmings, over large time periods, in order to characterize their intensity and evolution over time in relation with climate change,
3) to provide a near-real time and continuous monitoring of natural hazards such as large volcanic eruptions, cyclones, avalanches, and meteorites.

Methodology

The infrastructure will include the infrasound networks developed for verification of the Comprehensive Nuclear Test Ban Treaty, the Network for the Detection of Atmospheric Composition Change – using LIDAR (LIght Detection And Ranging) – and the Network for the Detection of Mesopause Change, dedicated to airglow layer measurements in the mesosphere.

The ARISE Design Study project aims to integrate and coordinate scientific communities that have never previously worked together, and to design a large infrastructure that adds significant value for understanding the atmosphere. A large part of the project is dedicated to defining the specifications of advanced data products that can be derived from the different measurement techniques. In addition, there will be a focus on integrated studies, based on simulations using data products obtained through the ARISE network. Topics of specific interest include numerical weather modelling and climate forecasting.

Measurement campaigns integrating co-localized instrumentation are organized at the Observatoire de Haute Provence (OHP) and at Mt Etna in Italy. These campaigns that are helpful in the design of a prototype station, attract other teams providing additional complementary measurements. Similar stations could be installed at other sites in the future.

Expected Results

The expected benefits are a better description of the atmosphere and an improved accuracy in short- and medium-range weather forecasts. The data will be used for monitoring the middle atmosphere dynamics, its long-term mean trends and also the evolution of extreme event characteristics with climate change. Furthermore, the benefits include civil applications related to monitoring of natural hazards. It concerns for example remote monitoring of volcanoes for civil aviation in case of ash injections in the atmosphere.

The demonstrator of the ARISE data base will use data from the 3 participating networks, the ARISE campaign measurements and additional satellite observations. It will be used as a platform for advanced products and simulations.

The success of ARISE is already visible through the increasing number of associated members and cooperation with international groups involved in climatological and environmental studies. Another indication is the large number of ARISE-funded presentations at the European Geosciences Union as well as the summer school organized at the project midterm. ARISE already promotes cooperation with several African countries. As the integrated networks are international, an impact beyond Europe is also expected.

Project Partners	
Commissariat à l'Energie Atomique et aux Energies alternatives (FR)	Koninklijk Nederlands Meteorologisch Instituut (NL)
Deutsches Zentrum für Luft- und Raumfahrt (DE)	Stiftelsen Norwegian Seismic Array (NO)
Laboratoire Atmosphères-Milieux-Observations Spatiales (FR)	Ustav Fyziky Atmosfery (CZ)
Bundesanstalt für Geowissenschaften und Rohstoffe (DE)	Institutet för RymdFysik (SE)
University of Reading (GB)	Institut d'Aéronomie Spatiale de Belgique (BE)
Universita Degli Studi Di Firenze (IT)	Laboratoire Mécanique Fluides et Acoustique (FR)