

Project Officer:
Dr. Gilles Ollier
European Commission - RTD
Brussels, Belgium

Project Co-ordinator:
Prof. Nicola Pirrone
CNR - Institute of Atmospheric Pollution Research
Rome, Italy

Period: 2010-2015

Overarching Goal:

The Global Mercury Observation System (GMOS) is a five year project, funded by the European Commission as part of the FP7, aiming to implement an observation system for monitoring mercury contamination worldwide. GMOS will include ground-based monitoring stations, oceanographic campaigns over the Pacific and Atlantic Oceans and major seas, and Upper Tropospheric/Lower Stratospheric campaigns. GMOS data will be used to validate regional and global scale atmospheric mercury models for policy development and verification. An interoperable system will be developed in order to facilitate the sharing of information, including databases and models, with major stakeholders and policy makers. GMOS represents the major contribution of the European Commission to the GEO Task 09-02d "Global Observation System for Mercury".

Background

Evidence of long-term changes in the atmospheric mercury burden have been derived from chemical analysis of lake sediments, ice cores, peat deposits and firn air records. However, since the first reliable measurement data were published just 30 years ago, it is extremely difficult to determine a global trend from the existing spatially and temporally inchoate air concentration data sets.

Currently, there is no coordinated global observational network for mercury that could be used by the modelling community or to establish recommendations to protect human health and ecosystems on a global scale. Current national monitoring networks are inadequate: they lack, (1) observations of all forms of Hg in the ambient air and in both wet and dry deposition; (2) long-term measurements of Hg and other air pollutants; (3) comprehensive monitoring sites at altitudes which permit the sampling of free tropospheric air; and (4) measurement sites that allow a careful investigation of inter-hemispheric transport and trends of background concentrations.

Recently, as part of the work plan (2009-2011) of the Group on Earth Observations (GEO), the Task 09-02d "Global Monitoring Plan for Atmospheric Mercury" aiming to develop a global observation system for mercury was established. This task supports the achievement of the goals of GEOSS and other on-going international programs (e.g. UNEP Mercury Program) and conventions (i.e., UNECE-LRTAP TF HTAP). Programs such as the World Meteorological Organization's Global Atmosphere Watch (GAW).



Figure-2: Ground-based GMOS stations (in yellow those managed by "Outside GMOS Partners").

Objectives

The overall goal of the GMOS is to develop a coordinated global observation system for mercury, including ground-based stations at high altitude and sea level locations, ad-hoc oceanographic cruises over the Pacific, the Atlantic and the Mediterranean, and free tropospheric mercury measurements. This will then provide high quality data for the validation and application of regional and global scale atmospheric models, to give a firm basis for future policy development and implementation.

The specific objectives of the GMOS are:

- a) To establish a Global Observation System for Mercury able to provide ambient concentrations and deposition fluxes of mercury species around the world, by combining observations from permanent ground-based stations, and from oceanographic and tropospheric measurement campaigns.
- b) To validate regional and global scale atmospheric mercury modelling systems able to predict the temporal variations and spatial distributions of ambient concentrations of atmospheric mercury, and Hg fluxes to and from terrestrial and aquatic receptors.
- c) To evaluate and identify source-receptor relationships at country scale and their temporal trends for current and projected scenarios of mercury emissions from anthropogenic and natural sources.
- d) To develop interoperable tools to allow the sharing of observational and model output data produced by GMOS, for the purposes of research and policy development and implementation as well as at enabling societal benefits of Earth Observations, including advances in scientific understanding in the nine Societal Benefit Areas (SBA) established in GEOSS.

Following the lead of these programs, the incorporation of a well-defined Hg monitoring component into the existing network of sites would be the most expeditious and efficient approach to realise a global Hg monitoring network. Close coordination of the global modelling community with the global measurement community would lead to major advances in the global models, and also advance our understanding of Hg science, while at the same time decreasing the uncertainties in global assessments for Hg entering aquatic and terrestrial ecosystems.

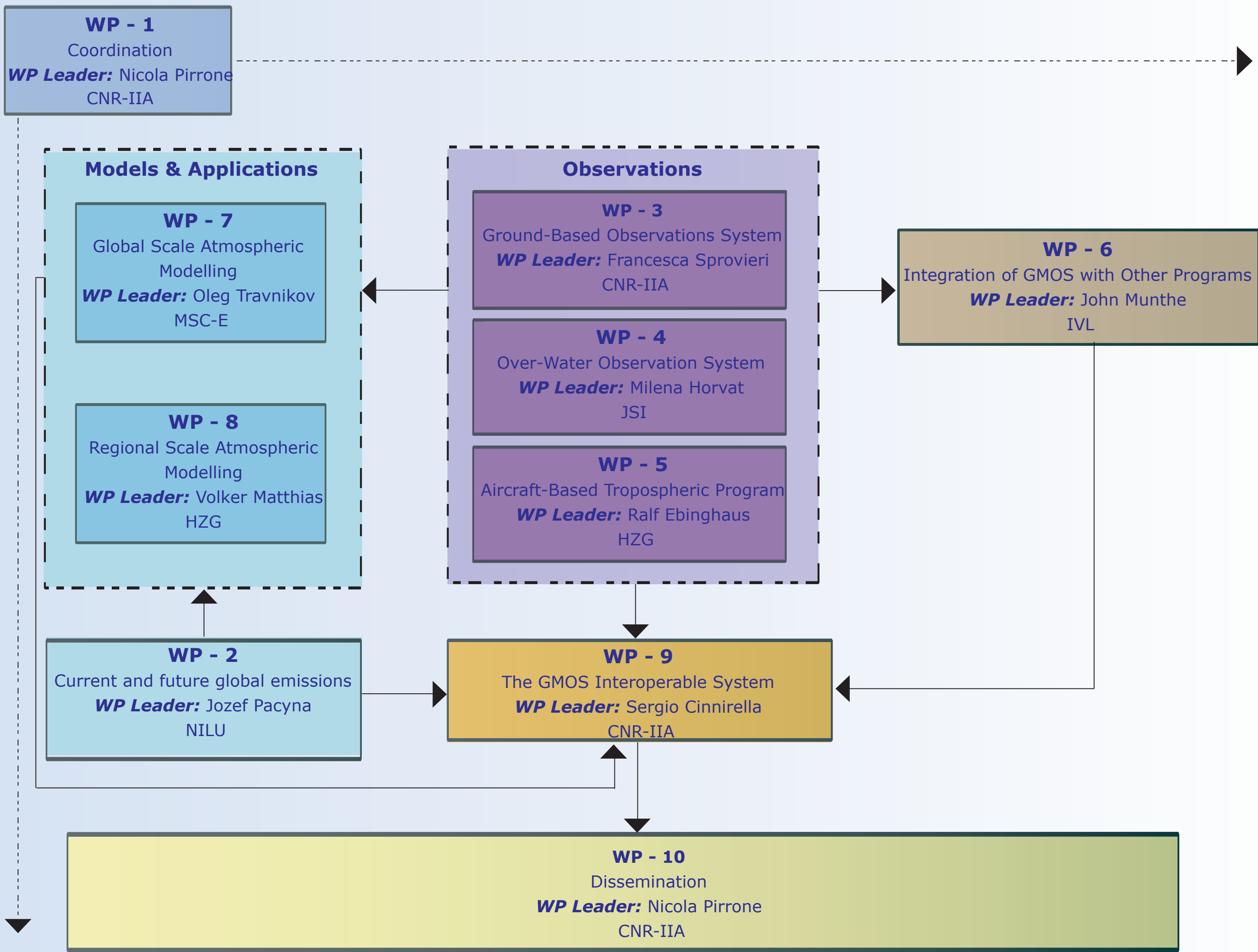


Figure-1: Interlink between Work Packages in GMOS

Work Packages

- WP-1** will include all activities related to the Scientific and Financial coordination of the project.
- WP-2** will update the global emission inventory for mercury released from major natural and anthropogenic sources and provide projected emissions for future scenarios of emission control policy.
- WP-3** will establish the ground-based observation system that will include currently running key monitoring stations in Europe and abroad, and newly established stations at high altitude and sea level locations able to intercept major atmospheric transport patterns of mercury emissions from natural and anthropogenic sources.
- WP-4** will provide key information on mercury concentrations and deposition as well as evasion of mercury species in the Marine Boundary Layer and at the air-water interface.
- WP-5** will focus on measurements on aircrafts of large and medium-range pollution plumes and vertical profiles of mercury up to the upper troposphere in temperate and cold climates.
- WP-6** will develop intercomparison campaigns aiming to develop a unified and commonly accepted Standard Operating Procedures (SOPs).
- WP-7** will improve, validate and apply global scale atmospheric mercury models.
- WP-8** will improve, validate and apply regional scale atmospheric mercury models.
- WP-9** will develop an interoperable system that will make available all data bases reporting global emission inventories, field observations and atmospheric models.
- WP-10** will disseminate the project results to major policy makers and stakeholders as well as to a broader scientific community.

| External Partners | Partner | Country |
|-------------------|---------|---------|
| Noriyuki Suzuki | NIES | Japan |
| Guey-Rong Sheu | NCU | Taiwan |
| Sandy Steffen | EnvCan | Canada |
| David Gay | NADP | USA |
| Daniel Obrist | DRI | USA |
| Dan Jaffe | UoW | USA |
| Kjetil Torseth | NILU | Norway |
| David Schmeltz | U.S.EPA | USA |

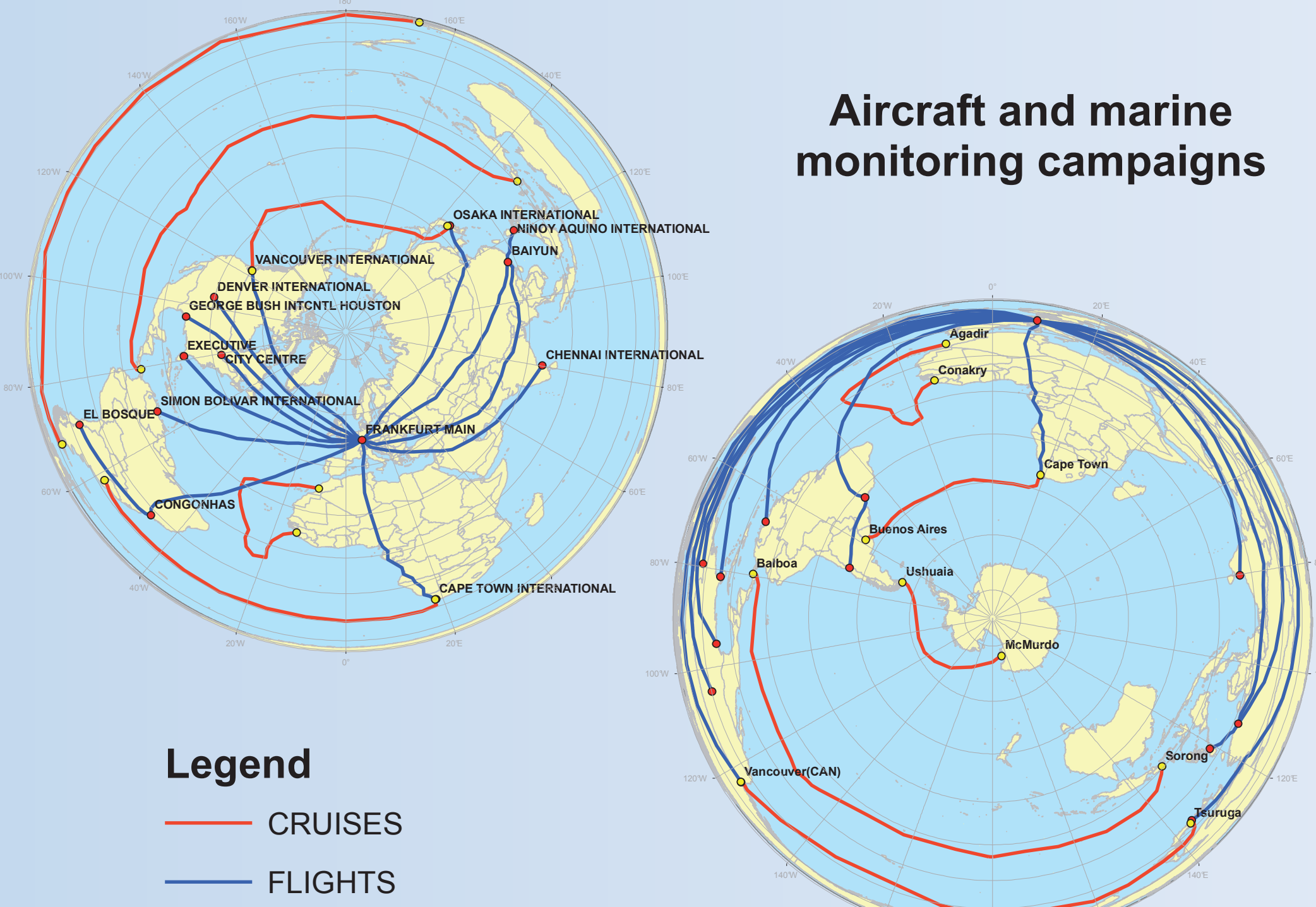


Figure-4: Major Oceanographic cruises and CARIBIC flights planned in GMOS

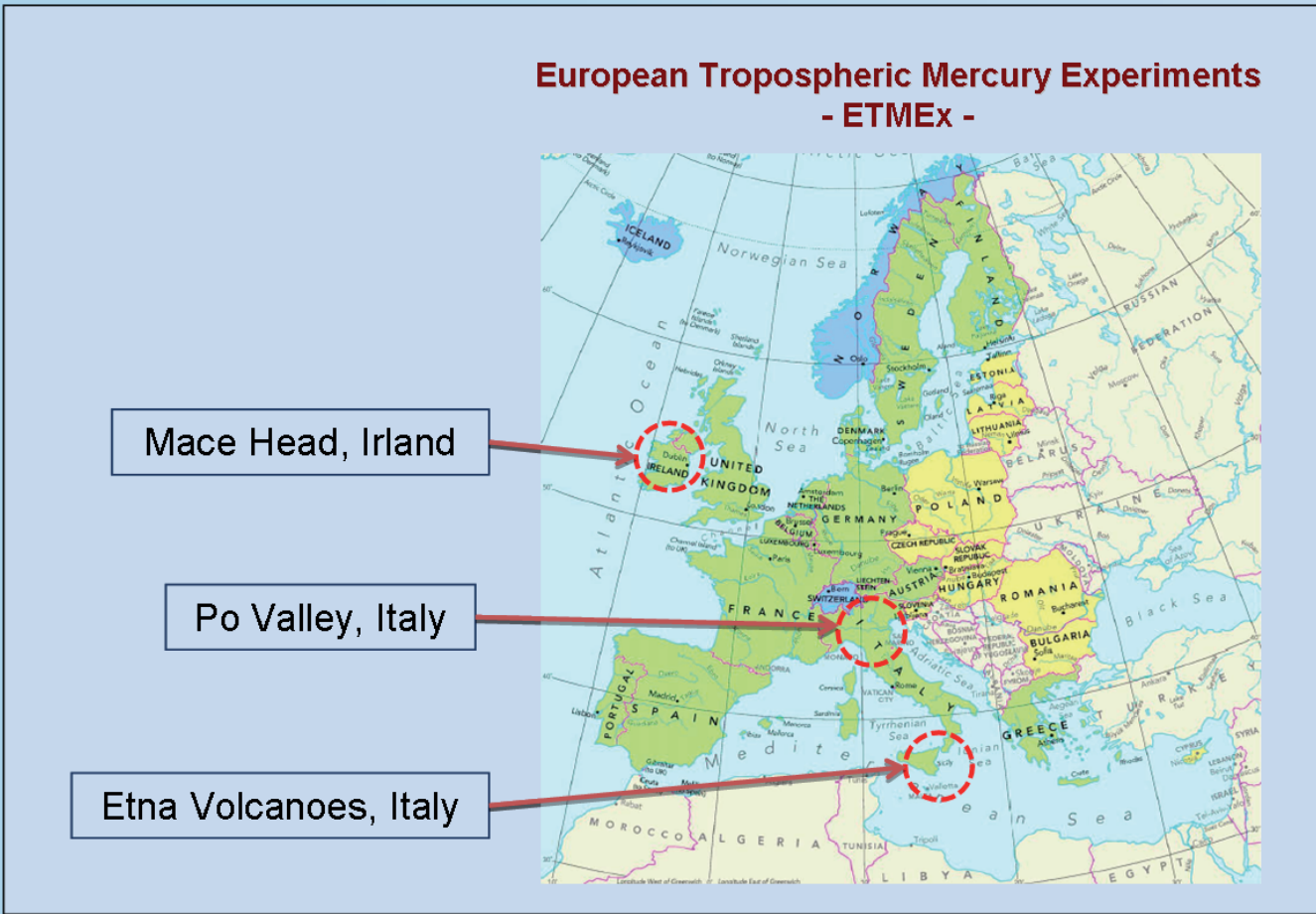


Figure-3: Planned Tropospheric Mercury Experiments

| Participants | Country | Participants | Country |
|--------------|-----------|--------------|----------------|
| CNR-IIA | Italy | IGCAS | China |
| NILU | Norway | UoY | United Kingdom |
| IVL | Sweden | APLBA | Brazil |
| JSI | Slovenia | MSC-E | Russia |
| INIBIOMA | Argentina | MPG | Germany |
| IFREMER | France | JRC | Italy |
| INTEC | Suriname | IOM - AUC | India |
| CHALMERS | Sweden | SAWS | South Africa |
| UNIVE | Italy | INMG | Capo Verde |
| AU | Denmark | HZG | Germany |
| UJF | France | IAPS | Latvia |
| SPBSU | Russia | | |



e-poster