

## Story Board 2: Ireland – A Key Location for Global Atmospheric Observations

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### SB2

**Figure SB2.1.** A weather balloon being launched at Valentia Observatory, Co. Kerry (photo: © Met Éireann).

On the margins of western Europe facing the Atlantic Ocean, Ireland is in an ideal location to measure background levels of greenhouse gases and other constituents of the atmosphere, which are transported in predominantly unpolluted air masses by westerly winds. It is also appropriately situated to sample and study polluted air exiting Europe over the Atlantic. Valentia Meteorological and Geophysical Observatory, Co. Kerry and Mace Head Research Station, Co. Galway are recognised worldwide as key locations in the study of climate change, and their data and facilities are being used by dozens of institutions around the Globe. Both stations are part of the Global Atmosphere Watch (GAW) network, a programme of the World Meteorological Organisation involving 80 countries.

### Valentia Observatory

Valentia Observatory was set up in 1868 as one of the first meteorological stations in Britain and Ireland and is now operated by Met Éireann. It is one of 25 synoptic weather stations making a full range of meteorological measurements at the surface, some at minute intervals. In addition, weather balloons (radiosondes) are launched twice a day to make measurements of pressure, temperature, humidity, wind speed and direction up through the atmosphere ([Fig. SB2.1](#)). The observatory is also Met Éireann's national solar and terrestrial radiation facility. By measuring solar radiation at different wavelengths, information on the chemical and physical makeup of the atmosphere can be determined.

Weather balloon ozonesondes and ground-based equipment are used to measure the amount of ozone throughout the atmosphere. Valentia is therefore a key site in monitoring the recovery of the ozone layer. Ground-level ozone which is a danger to humans as well as harmful to agricultural crops is also measured at the observatory.

Valentia also hosts one of the oldest International Phenological Gardens (IPG) in the country. More than 80 IPGs are located in 19 European countries. The idea of the IPGs is to carry out large-scale and standardised phenological observations, for the study of environmental change and climate impacts among others. The phenophases (annual timing of first leaves, first flowers, ripening,



**Figure SB2.2.** Laboratories and observational infrastructure at the Mace Head Atmospheric Research Station, Carna, Co Galway (photo: © National University of Ireland Galway).

leaf fall, etc.) of a number of specially cloned trees have been recorded at the Valentia IPG for over 40 years. These records, when compared to other similar cloned trees around Europe, provide a valuable climate change indicator.

Valentia participates in a number of background-air, precipitation-chemistry and radioactivity-monitoring programmes. Met Éireann's atmospheric chemistry laboratories analyse exposed air filters and collected rain water samples for numerous pollutants. Pollution monitoring on the site includes continuous measurements of nitrogen dioxide ( $\text{NO}_2$ ) since 1989 and sulphur dioxide ( $\text{SO}_2$  and  $\text{SO}_4$ ) since 1981, representing the longest time-series of such measurements in Ireland.

### Mace Head Atmospheric Research Station

The Mace Head Atmospheric Research Station (Fig. SB2.2) was established in 1958 and is operated by personnel from the Centre for Climate & Air Pollution Studies, Ryan Institute and School of Physics of the National University of Ireland Galway in collaboration with several international projects. Since 2002 it has been one of Met Éireann's synoptic weather stations, making surface-level measurements of a range of meteorological variables. However, it is best known internationally for its measurements of atmospheric gases and aerosols. Atmospheric methane ( $\text{CH}_4$ ) and nitrous oxide ( $\text{N}_2\text{O}$ ) concentrations have been measured since 1987, and carbon dioxide ( $\text{CO}_2$ ) since 1992. Ground-level ozone ( $\text{O}_3$ ) has been measured since 1983. Chlorofluorocarbons (CFCs) which contribute to ozone depletion have been measured since 1987, as part of the AGAGE programme. Their replacements, HCFCs, have been measured at Mace Head since 1995. A number of other important reactive gases are also observed (e.g.  $\text{SO}_2$ , OH,  $\text{H}_2\text{SO}_2$ , MSA,  $\text{I}_2$ ).

A wide range of aerosol parameters, such as aerosol size, mass, optical characteristics, water activity and chemical composition are also measured at the site. Additional operational ground-based remote sensing and profiling equipment calculate aerosol optical depth and profiles, cloud properties, air temperature, humidity and water vapour profiles up to 15 km in altitude. Mace Head is one of the most advanced supersites in Europe, covering the most extensive range of greenhouse gases, reactive gases, aerosol properties and cloud properties. Data are webcast every 10 minutes and transmitted to the National University of Ireland Galway's data infrastructure.

Much of the data from these two observatories are made available to the appropriate international data centres, where they contribute to basic research knowledge, as well as improved understanding of climate change. It is vital that all the observation programmes carried out at Valentia and Mace Head are appropriately resourced as it is only with long-term observations that we can interpret how and why our climate is changing.

#### Further Information

A brief history of Valentia Observatory:

<http://www.met.ie/about/valentiaobservatory/default.asp>

Information on and real time data from the Mace Head facility:

<http://www.macehead.org/>