

2.7 Upper Air Temperature and Wind

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Knowledge of the vertical profiles of temperature and wind in the atmosphere is vital for a better understanding of the weather and climate system. Globally, cooling of the upper atmosphere ('stratosphere') and warming of the lower atmosphere ('troposphere') has been observed over recent decades. This is one of the tell-tale indicators of greenhouse gas-enhanced climate change. Globally, measurements of upper air parameters are sparse. Because of its key location in the northeast Atlantic, Ireland makes a significant contribution to such measurements.



Photo: © Keith Lambkin



Map 2.7. Location of upper air observation station.

Measurements

Upper-air measurements have been taken by Met Éireann at Valentia Observatory, Co. Kerry since 1943 by means of a radiosonde – a helium-filled balloon with instruments attached. The balloon is released twice a day into the atmosphere; as it ascends, readings are transmitted back to the surface station. As the balloon rises, it expands until it eventually bursts. The instruments measure temperature, humidity, wind speed and direction and pressure with a vertical resolution of up to 10 m. This enables the production of tephigrams or 'snapshots' of the vertical structure of the atmosphere.

'A slight decrease in upper air temperature has been observed at Valentia Observatory in recent decades; however, the time-series is too short to determine a long-term trend.'

Since the late 1970s satellite-borne microwave sounders have made measurements from which temperature has been derived at different levels in the atmosphere. Although they provide excellent spatial coverage, compared with the sparse coverage of radiosondes, there have been difficulties in integrating measurements from different sensors and ensuring their accuracy and comparability over time. Wind speed and direction can be derived by tracking cloud motion from successive satellite observations.

Time-series and Trends

Figure 2.12 shows an example of annual mean temperature and wind speed measurements at Valentia Observatory from one level in the atmosphere. Observations at this height (300 hPa level) indicate a slight decrease in temperature over recent decades. This is consistent with global observations. Interannual variability is apparent in the upper air wind speed; however, as with the upper air temperature the time-series is too short to determine a long-term trend.

'Staff and resources need to be maintained at Valentia Observatory to ensure the continuation of upper air measurements.'

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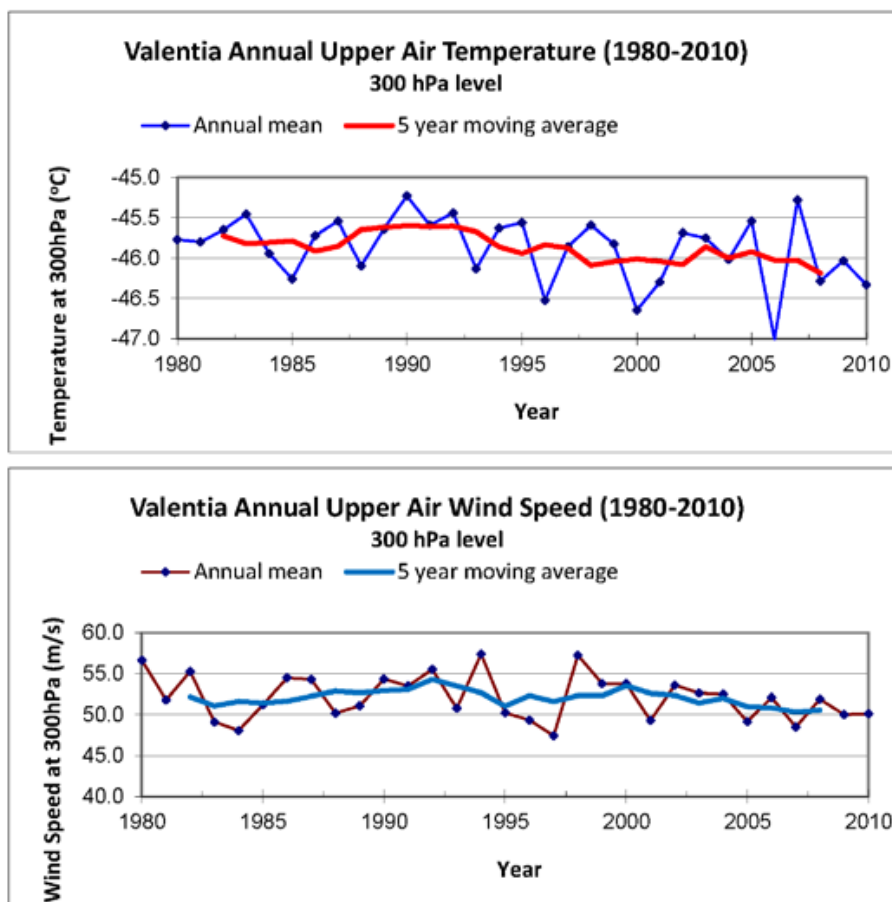


Figure 2.12. Example of annual mean temperature (top) and annual mean wind speed (bottom) at Valentia Observatory from one level in the atmosphere (1980–2010).

Maintaining the Observations

Staff and resources need to be maintained at Valentia Observatory to ensure the continuation of upper-air measurements. Resources are required to retrieve and digitise historical paper upper-air measurements. An advanced technology wind-profile sensor will be part of the European Space Agency's (ESA) Atmospheric Dynamics Mission-Aeolus due for launch in 2014. This will significantly increase the number and density of observations, in particular over ocean areas.

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Further Information and Data Sources

Information on radiosonde measurements at Valentia Observatory: <http://www.met.ie/about/valentiaobservatory/radiosonde.asp>

Information on data availability from Met Éireann: <http://www.met.ie/climate/climate-data-information.asp>

Data, including those from Valentia are available from the Integrated Global Radiosonde Archive: <http://www.ncdc.noaa.gov/oa/climate/igra/index.php>

Information on the advanced microwave sounding unit on the European MetOp satellite: http://www.eumetsat.int/Home/Main/Satellites/Metop/Instruments/SP_2010053152718207?l=en

Information on ESA's ADM-Aeolus mission: <http://www.esa.int/esaLP/LPadmaeolus.html>