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**A DIRECTORY OF HYDROGRAPHIC AND  
ATMOSPHERIC DATASETS FOR THE  
NORTH EAST ATLANTIC AND UK SHELF SEAS**

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# CONTENTS

Page

<b>1.</b>	<b>Introduction</b> .....	<b>5</b>
1.1	Direct observations and proxy variables .....	5
1.2	Data formats .....	5
1.3	Spatial and temporal data coverage .....	5
<b>2.</b>	<b>Basic Level III Surface Data Set – European Centre for Medium-Range Weather Forecasts (ECMWF)</b> .....	<b>7</b>
<b>3.</b>	<b>Central England Temperatures</b> .....	<b>8</b>
<b>4.</b>	<b>Classical Hydrographic Station Data Set for the United Kingdom, compiled by the ICES Oceanographic Data Centre</b> .....	<b>9</b>
<b>5.</b>	<b>Climatological Atlas of Salinity and Temperature for the North Sea (1968-1985) – Institut für Meereskunde, Hamburg, Germany</b> .....	<b>11</b>
<b>6.</b>	<b>Coastal Sea Temperature Stations - Ministry of Agriculture, Fisheries and Food, United Kingdom</b> .....	<b>12</b>
<b>7.</b>	<b>Comprehensive Ocean-Atmosphere Data set (COADS)</b> .....	<b>13</b>
<b>8.</b>	<b>Global Mean Sea-Level Pressure (GMSLP) – Meteorological Office, United Kingdom</b> .....	<b>15</b>
<b>9.</b>	<b>Global Sea Ice Coverage and Sea Surface Temperature Data – Meteorological Office, United Kingdom</b> .....	<b>16</b>
<b>10.</b>	<b>Gulf Stream North Wall (GSNW)</b> .....	<b>17</b>
<b>11.</b>	<b>Jenkinson Objective – Lamb Daily Synoptic Weather Index</b> .....	<b>19</b>
<b>12.</b>	<b>Marsdiep Sea Surface Temperature and Salinity Time Series – Netherlands Institute for Sea Research (NIOZ)</b> .....	<b>21</b>
<b>13.</b>	<b>National Data Buoy Centre, United States</b> .....	<b>22</b>
<b>14.</b>	<b>NCEP/NCAR Reanalysis data, provided by the Climatic Research Unit, United Kingdom</b> ....	<b>23</b>
<b>15.</b>	<b>North Atlantic Oscillation (NAO)</b> .....	<b>24</b>
<b>16.</b>	<b>Real Time Marine Data – National Centers for Environmental Prediction (NCEP), United States</b> .....	<b>25</b>
<b>17.</b>	<b>Reconstructed Reynolds Sea Surface Temperatures</b> .....	<b>26</b>
<b>18.</b>	<b>Remote Sensing Data Analysis Service (RSDAS) – Plymouth Marine Laboratory, Plymouth, United Kingdom</b> .....	<b>27</b>
<b>19.</b>	<b>Reynolds Sea Surface Temperatures</b> .....	<b>29</b>
<b>20.</b>	<b>Sea Surface Temperature and Salinity Data Set (ship routes to and from the UK, 1963 to 1990) – Ministry of Agriculture, Fisheries and Food, United Kingdom</b> .....	<b>31</b>
<b>21.</b>	<b>Sea Surface Temperatures for the North Sea - Bundesamt für Seeschifffahrt und Hydrographie (BSH), Germany</b> .....	<b>32</b>
<b>22.</b>	<b>Sea Temperature, Salinity and Nutrient Data Set ‘Cypris Station’ – Port Erin, Isle of Man, United Kingdom</b> .....	<b>33</b>

<b>23. World Ocean Database – National Oceanographic Data Center (NODC), United States</b>	<b>34</b>
<b>24. United Kingdom Land Surface Observations Station Data – Meteorological Office, United Kingdom</b>	<b>35</b>
<b>25. United Kingdom National Databank of CTD/STD profiles (1975 - present)</b>	<b>36</b>
<b>26. References</b>	<b>37</b>
<b>Appendix 1. MAFF Coastal Sea Temperature Stations</b>	<b>39</b>
<b>Appendix 2. Address list</b>	<b>41</b>
<b>Appendix 3. Availability of useful data processing utilities</b>	<b>44</b>

# 1. INTRODUCTION

Environmental data have been applied to numerous short and long term studies of marine systems. In biological studies, the use of such data have provided invaluable information about the natural fluctuations of species and communities, and the possible causes of these fluctuations. For example, wind speeds have been related to fluctuations in phytoplankton productivity in the Southern Bight of the North Sea (Dickson and Reid, 1983), and more recently, interannual fluctuations in spring Sea Surface Temperatures (SST), have been correlated to variations in cod recruitment (O'Brien *et al.*, 2000).

A range of environmental variables are available for use in studies of the marine environment, including both direct (e.g. Sea Surface Temperature, salinity etc.) and indirect (e.g. air temperatures, pressure etc.) observations of the state of the marine system. It is intended that this catalogue of environmental datasets will enable researchers to identify and obtain the most appropriate data for the Northeast Atlantic and UK shelf sea regions. However, it should be noted that this directory is not intended to be exhaustive, and concentrates on physical parameters (e.g. temperature, salinity). Sources of biological data are not considered here. In addition, the inclusion of a particular data set in this directory depended upon whether it was considered that the data were suitable for incorporation into studies of the Northeast Atlantic and UK shelf sea areas, taking into account factors such as the temporal and spatial coverage of the data etc.

## 1.1 Direct observations and proxy variables

The data sets listed in this directory\* may be divided into two general categories. The majority of data listed in this directory are from direct measurements of the physical state of the marine environment (e.g. sea surface temperature). However, some of the variables act as proxies for the physical state of the marine system. These include large scale climatic indicators such as the North Atlantic Oscillation index. Such climatic variables serve as a useful index of meteorological conditions at a large spatial scale, and have previously been related to changes in biological variables at an equally large spatial range (e.g. Fromentin and Planque, 1996). At finer spatial scales, proxy variables include meteorological observations of air temperatures, wind speeds etc., taken from both terrestrial and marine stations. Such data are useful, not only because they can act as an indicator of weather conditions over the local marine region, but also because some of these data are available with high temporal resolution (e.g. 6 hourly observations are available for

NCEP/NCAR reanalysis data). However, care needs to be taken in extrapolating terrestrial observations to the marine environment, since topography and land-sea interface phenomena (e.g. sea fogs) may effect the results.

## 1.2 Data formats

Much of the data are available for download from the internet as plain text or ASCII files. In some cases these may be in a compressed format to reduce download times (e.g. \*.zip format, see Appendix 3). ASCII (or 'human readable') files can often be easily imported into spreadsheets or databases with little or no additional processing. An alternative data format, commonly used in the United States, is netCDF (network Common Data Format). This format has developed with the multidimensional nature of many environmental data sets, and is designed to be architecture independent. However, its complexity requires the use of external programs (see Appendix 3) to convert these data into ASCII format, and further processing may be required to prepare these data for analysis.

## 1.3 Spatial and temporal data coverage

The temporal and spatial coverage and resolution of the listed datasets in this report varies considerably. The longest covers the period 1659 to the present day (Central England Temperatures) and is available as a monthly series. The shortest series are usually satellite derived observations (e.g. RSDAS offer data from June 1993). However, these series tend to have a higher spatial and temporal resolution (satellite SSTs and indexes of chlorophyll are available as daily series with a 1 km spatial resolution). In some cases, the recording of observations may be variable, particularly those where data has been gathered together from a multitude of sources (e.g. the ICES Oceanographic data set). In these cases, care needs to be exercised when calculating annual or monthly means. Data should be weighted in proportion to temporal (e.g. a particular season) or spatial (e.g. a particular area) coverage. Although the majority of datasets in this directory may be classified as retrospective datasets, a few of the series available are continually updated in near real-time (e.g. RSDAS, Plymouth).

In addition we provide details of a number of remote observation systems operating at fixed sites in UK waters. In the near future these facilities are likely to provide multi-parameter measurements at extremely high temporal resolution. However, spatial coverage will be limited and methods for interpolation and interfacing with other data sources (such as satellite observation) will need to be developed.

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\* Note that the inclusion of such data sets or products in this catalogue does not necessarily suggest that such data or products are recommended or endorsed by CEFAS.

This directory has been constructed in the form of alphabetically sorted 'information sheets' and covers the variables available within each data set, temporal and spatial range and resolution of each data set, availability, cost and data formats available. In some cases, examples

of output produced by each series are given in some cases along with background information on the dataset and its accessibility. Sources of each dataset are given, and potential users should contact these sources directly, rather than CEFAS.

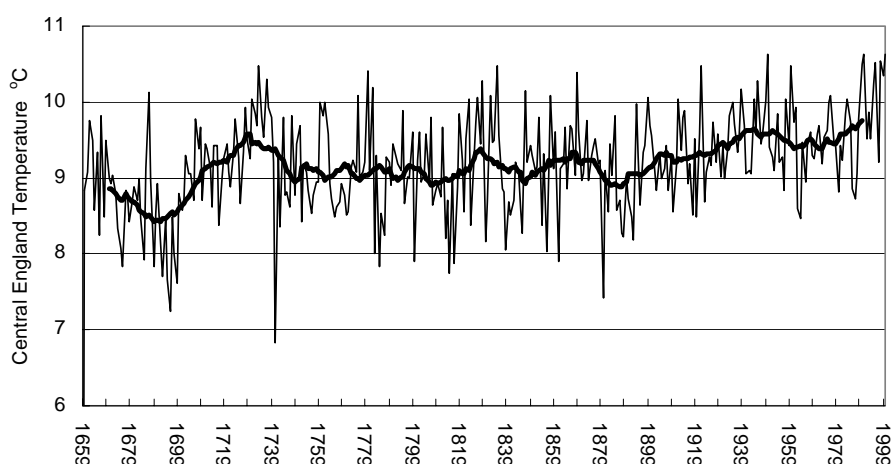
## 2. BASIC LEVEL III SURFACE DATA SET – EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS (ECMWF)

<b>Variables available:</b>	Surface pressure Soil temperature Mean Sea Level pressure u- and v- wind components Air temperature (at 2 m) Dew point (at 2 m) Surface geopotential
<b>Temporal range:</b>	1 Jan. 1985–present
<b>Temporal resolution:</b>	Twice daily
<b>Spatial range:</b>	Global
<b>Spatial resolution:</b>	2.5 degree latitude x longitude grid
<b>Depth range/resolution:</b>	Surface (parameters measured at 2 to 10 metres above sea surface)
<b>Data available from:</b>	European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom.
<b>Data cost:</b>	Access for data is charged at ‘marginal cost’
<b>Data restrictions:</b>	Data are non-transferrable to a third party, and must not be used for any commercial purposes, without a commercial licence agreement
<b>Data via:</b>	Further details and order forms are available by writing to The Director at ECMWF
<b>Data format:</b>	As requested

### **Notes:**

The European Centre for Medium Range Weather Forecasts (ECMWF) has created and maintains an archive of atmospheric data in support of projects associated with the World Climate Research Programme (WCRP). The temporal and spatial resolution, and variables required can be specified down to the limits of the data as indicated above.

### 3. CENTRAL ENGLAND TEMPERATURES



**Figure 1.** *Interannual variation in Central England Temperatures, with a 20 year centred moving average to emphasise the long term trend*

<b>Variables available:</b>	Central England Temperatures
<b>Temporal range:</b>	1659–present
<b>Temporal resolution:</b>	Monthly and annual means
<b>Spatial range:</b>	Central England (see below)
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	N/A
<b>Data available from:</b>	Climate Research Unit, University of East Anglia, United Kingdom
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at: <a href="ftp://ftp.cru.uea.ac.uk/people/mikehulme/outgoing/micellaneous/cet.dat">ftp://ftp.cru.uea.ac.uk/people/mikehulme/outgoing/micellaneous/cet.dat</a>
<b>Data format:</b>	Tabulated ASCII text file with years as rows and months as columns. The last column includes annual means.

**Notes:**

This time series represents monthly mean, surface air temperatures that are representative of a triangular area of England approximately bounded by Preston, London and Bristol. This series, which starts in 1659 is the longest available instrumental record of temperature in the world, and is still routinely updated by the Hadley centre.



#### 4. CLASSICAL HYDROGRAPHIC STATION DATA SET FOR THE UNITED KINGDOM, COMPILED BY THE ICES OCEANOGRAPHIC DATA CENTRE

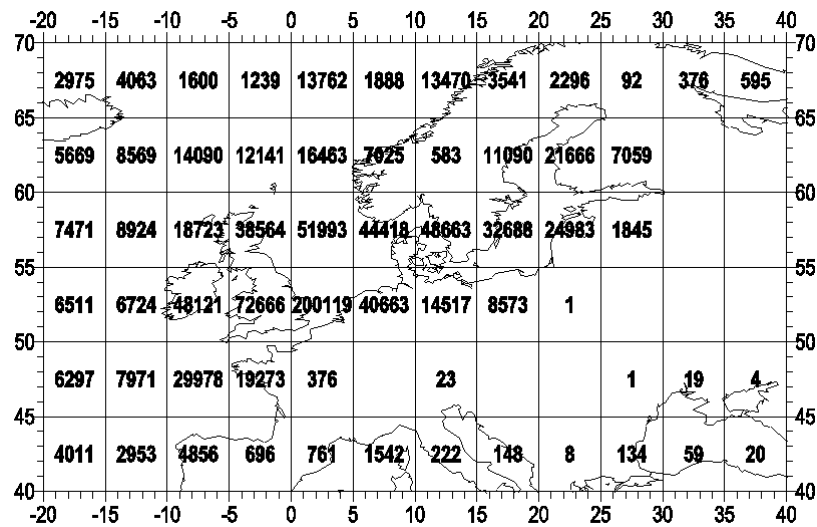


Figure 2. Distribution of Stations in the ICES Oceanographic dataset over the 1900-1989 period by Marsden Square

<b>Variables available:</b>	Temperature Salinity Nutrients Oxygen pH Alkalinity
<b>Temporal range:</b>	1893–present
<b>Temporal resolution:</b>	Variable, but mainly monthly
<b>Spatial range:</b>	Primarily UK shelf seas and North-east Atlantic, but with some global coverage
<b>Spatial resolution:</b>	Irregular
<b>Depth range/resolution:</b>	Variable
<b>Data available from:</b>	British Oceanographic Data Centre (BODC), Birkenhead, United Kingdom International Council for the Exploration of the Sea (ICES), Copenhagen, Denmark
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Data can be requested from BODC (via email) or downloaded directly from the ICES web site ( <a href="http://ices.dk/ocean">http://ices.dk/ocean</a> ) as part of the larger ICES Oceanographic Data Set. Data obtained via the ICES web site is downloaded separately for each Marsden Square, by selecting the relevant box (see Figure 2).
<b>Data format:</b>	Data may be downloaded via the ICES website as a zipped ASCII *.csv file.

**Notes:**

United Kingdom research and naval vessels have routinely collected oceanographic data since the beginning of the twentieth century. This data has been compiled by the ICES Oceanographic Data Centre and comprises some 90,939 profiles. It includes the classical oceanographic parameters of temperature and salinity, plus nutrients, oxygen, pH, alkalinity and chlorophyll – a. Physical data has been collected via thermometers, water bottles, salinometers, and most recently, CTD. All of the profiles in this data set have been quality checked and cross checked against original documentation.

## 5. CLIMATOLOGICAL ATLAS OF SALINITY AND TEMPERATURE FOR THE NORTH SEA (1968-1985) – INSTITUT FÜR MEERESKUNDE, HAMBURG, GERMANY

<b>Variables available:</b>	Sea temperature Salinity
<b>Temporal range:</b>	1968–1985
<b>Temporal resolution:</b>	Variable
<b>Spatial range:</b>	North Sea, Skaggerak and Kattegat
<b>Spatial resolution:</b>	12' latitude by 20' longitude grid
<b>Depth range/resolution:</b>	Water column divided into 13 layers
<b>Data available from:</b>	British Oceanographic Data Centre, Birkenhead, United Kingdom
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Disk or ftp over internet from BODC by request. Alternatively it is available from the Institut für Meereskunde, Hamburg.
<b>Data Format:</b>	As requested

### **Notes:**

The data set comprises files of temperature and salinity observations for the years 1968 to 1985, collected from a variety of sources. The data are available cover the North Sea including the Skaggerak and Kattegat regions, and are available at a relatively high spatial resolution of 12' latitude by 20' longitude compiled by the Institut für Meereskunde, Hamburg.

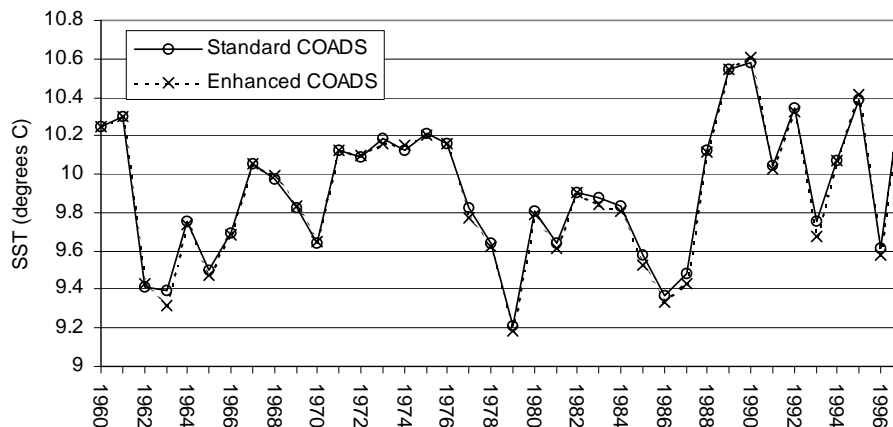
## 6. COASTAL SEA TEMPERATURE STATIONS – MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, UNITED KINGDOM

<b>Variables available:</b>	Sea temperature
<b>Temporal range:</b>	Varies according to each station (see Appendix 1), some stations have data from the late 19th century, although data collected before 1939 were collected in whole degrees Fahrenheit and the accuracy of such data is not known (Jones and Jeffs, 1991).
<b>Temporal resolution:</b>	Varies according to station, mostly readings are taken from 8 to 12 times per month, although daily readings are available for some stations.
<b>Spatial range:</b>	English, Welsh and Irish coastal waters of the North Sea, English Channel and Irish Sea. 99 stations in total (Appendix 1)
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	Sea surface or near surface
<b>Data available from:</b>	Centre for Environment, Fisheries & Aquaculture Science laboratory, Lowestoft, United Kingdom
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	e-mail: <a href="mailto:Cefas@cefas.co.uk">Cefas@cefas.co.uk</a> Data also published in Jones and Jeffs (1991) and updated in Norris (2001)
<b>Data format:</b>	As requested

### Notes:

Measures of coastal sea temperatures have been taken at a total of 99 stations from the English, Welsh and Irish coastal waters of the North Sea, the English Channel and the Irish Sea over much of the 20th Century. Most stations started recording in the 1960s, although the temporal resolution of the data varies considerably. The number of stations currently continuing to record temperature has dropped with the introduction of automatic unmanned lighthouses and lightvessels, but currently approximately 30 stations continue to take temperature readings (Norris, 2001).

## 7. COMPREHENSIVE OCEAN – ATMOSPHERE DATA SET (COADS)



**Figure 3.** Time series of annual means in Sea Surface Temperature for the North Sea (ICES area IV) calculated from the Standard and Enhanced COADS datasets

**Variables available:**

Observed variables:

Air temperature  
SST  
Sea level pressure  
u and v-wind  
Scalar wind  
Cloudiness  
Humidity

Derived variables:

Latent heat parameter  
Relative humidity  
Sensible heat parameter  
u-wind stress  
v-wind stress

**Temporal range:**

1854–1997

**Temporal resolution:**

Monthly means

**Spatial range:**

Global ocean coverage

**Spatial resolution:**

Differs according to time period:  
1854-1949 COADS Release 1. 2 degree latitude x longitude grid  
1950-1997 COADS 2 degree latitude x longitude grid  
1960-1997 COADS 1 degree latitude x longitude grid

**Depth range/resolution:**

Surface only

**Data available from:**

National Oceanographic Data Center, Climatic Diagnostics Center, Boulder, United States

**Data cost:**

Free

**Data restrictions:**

None

**Data via:**

Internet at:  
[http://www.cdc.noaa.gov/coads/coads\\_cdc\\_netcdf.shtml](http://www.cdc.noaa.gov/coads/coads_cdc_netcdf.shtml)

**Data format**

The data are separately grouped by each variable on the website according to the time period, spatial domain covered, and grid size. Data are provided for download as netCDF

**Notes:**

The Comprehensive Ocean-Atmosphere Data Set (COADS) is an extensive collection of surface marine data with a global ocean coverage that have been collected since the mid-19th century. The COADS dataset provides monthly means derived from quality controlled marine surface observations from ships (both merchant and naval vessels of international origin), which have been supplemented in recent decades by observations from moored environmental buoys, drifting buoys, and near-surface measurements from oceanographic profiles (Woodruff *et al.*, 1998).

COADS data are quality controlled, which involves trimming individual observations according to upper and lower quality control limits. In the 'standard' COADS data set, these limits are set to 3.5 standard deviations, whereas in the enhanced dataset, observations are trimmed to 4.5 standard deviations. However, the 'standard' dataset omits observations made from platforms other than ships, whereas the 'enhanced' dataset includes those observations made from automated platforms. In contrast to the Reynolds and Reconstructed Reynolds SST datasets, no blending or interpolation procedures have been applied to the data, and thus, missing data are present. Although the Climate Diagnostics Center (CDC) currently only offers COADS data up to 1997, the National Centre for Environment Prediction (NCEP) offer near-real time updates to this data set (see relevant entry), although these are limited to a 2 degree spatial resolution.

## 8. GLOBAL MEAN SEA-LEVEL PRESSURE (GMSLP) – METEOROLOGICAL OFFICE, UNITED KINGDOM

<b>Variables available:</b>	Sea level pressure readings
<b>Temporal range:</b>	1871–1994
<b>Temporal resolution:</b>	Monthly
<b>Spatial range:</b>	Global ocean coverage
<b>Spatial resolution:</b>	5 degree latitude x longitude grid
<b>Depth range/resolution:</b>	Surface
<b>Data available from:</b>	British Atmospheric Data Centre, (BADC), Didcot, United Kingdom
<b>Data cost:</b>	Free (registration required)
<b>Data restrictions:</b>	None for academic users
<b>Data via:</b>	Internet on: <a href="http://www.badc.rl.ac.uk/data/gmslp/">http://www.badc.rl.ac.uk/data/gmslp/</a>
<b>Data format:</b>	Each ASCII file consists of one year of monthly data. Rows within each file refer to latitudes and columns to longitudes. Further file format information is present on the BADC website.

### Notes:

This data set is a fully global historical mean sea-level pressure (GMSLP) data set developed in collaboration with the Centre for Scientific and Industrial Research for Australia (CSIRO), Australia and the National Institute of Water and Atmospheric Research (NIWA), New Zealand.

## 9. GLOBAL SEA ICE COVERAGE AND SEA SURFACE TEMPERATURE DATA – METEOROLOGICAL OFFICE, UNITED KINGDOM

<b>Variables available:</b>	Sea Surface Temperatures Sea Ice coverage Night Marine Air temperature climatologies
<b>Temporal range:</b>	1856–present
<b>Temporal resolution:</b>	Monthly
<b>Spatial range:</b>	Global ocean coverage
<b>Spatial resolution:</b>	Sea Surface Temperature and Sea Ice data are available as 1 degree grids (1871–present) Night marine air temperature anomalies as 5 degree grids (1856–present)
<b>Depth range/resolution:</b>	Surface
<b>Data available from:</b>	British Atmospheric Data Centre, Birkenhead, United Kingdom
<b>Data cost:</b>	Free (registration required)
<b>Data restrictions:</b>	None for academic users
<b>Data format:</b>	Each ASCII file consists of one year of monthly data, with rows as latitude and column as longitudes. Further file format information is present on the BADC website.

### Notes:

This data set includes measurements of Sea Surface Temperature (SST) climatologies, Night Marine Air temperatures, and global sea ice coverage data from 1871 to the present.

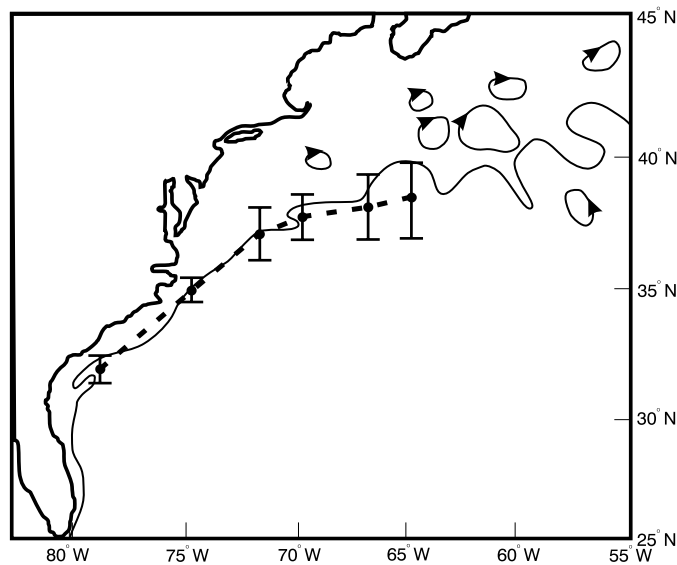
The data available at the BADC are grouped into four sections and files:

- Global Ocean Surface Temperature (GISSTv2.3b), a set of SST data in monthly, 1 degree area grids, for 1871 to the present.
- Global sea Ice content (GICE), monthly, 1 degree grids of ice coverage for 1871 to the present.
- Meteorological Office Historical Night Marine Air Temperature Anomalies (MOHMATN4), monthly, 5 degree grids of marine air temperature anomalies for 1856 to the present
- Meteorological Office Historical Sea Surface Temperature Anomalies (MOHSST6), monthly, 5 degree grids of sea surface temperature anomalies for 1856 to the present.

These data are also available on the GOSTAplus (Global Ocean Surface Temperature Atlas) CD-ROM (see <http://www.badc.rl.ac.uk/data/gosta> for further details).



## 10. GULF STREAM NORTH WALL (GSNW)



**Figure 4.** The position of The Gulf Stream North Wall off the east coast of the USA during August 1984 (solid line), and its mean position ( $\pm$  95% confidence limits shown at the six positions along which its longitude is calculated), between 1966 and 1993. Adapted from Taylor (1996)

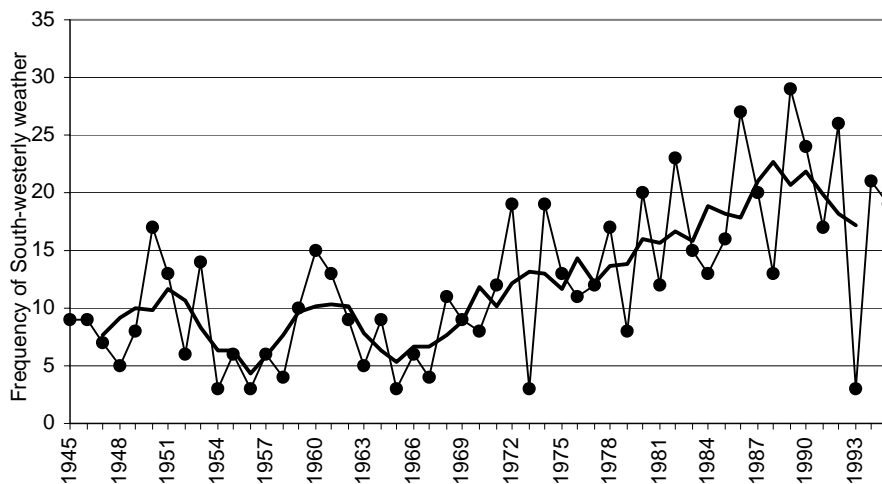
<b>Variables available:</b>	Position of the Gulf Stream North Wall (GSNW)
<b>Temporal range:</b>	1966–present
<b>Temporal resolution:</b>	Monthly (but see below)
<b>Spatial range:</b>	Changes in the latitude of the GSNW are an indicator of weather patterns over the North Atlantic and western Europe (Taylor, 1996)
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	N/A
<b>Data available from:</b>	Plymouth Marine Laboratory, Plymouth, United Kingdom
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at: <a href="http://www.pml.ac.uk/gulfstream/inetdat.htm">http://www.pml.ac.uk/gulfstream/inetdat.htm</a>
<b>Data format:</b>	Tabulated text file with years as rows and months as columns

### Notes:

The Gulf Stream originates from the Gulf of Mexico, flowing northwards along the eastern US seaboard, diverging from the coast at Cape Hatteras, and moving across the North Atlantic in a north-easterly direction (Thurman, 1987), becoming the North Atlantic Drift at 55°W (Taylor and Stephens, 1980). The current is prone to meandering which changes the latitude across which it flows (Figure 4). Such changes in the latitude of the north wall of the Gulf Stream current have been correlated with shifts in wind, temperature, atmospheric pressure and salinity patterns across the North Atlantic and in western Europe (Taylor, 1996). In addition, changes in Gulf Stream position have also been related to zooplankton abundances over the NE Atlantic area (Taylor and Stephens, 1980; Taylor *et al.*, 1992), and in Lake Windermere, Cumbria, UK (George and Taylor, 1995).

Monthly charts of the latitude of the North Wall of the Gulf Stream, which are derived from aircraft, satellite and surface observations, are published by the U.S. Naval Oceanographic Office. The monthly time series available from the Plymouth Marine Laboratory is the calculated First Principal Component of the latitude of the North Wall of the Gulf Stream at six longitudes: 79°W, 75°W, 72°W, 70°W, 67°W and 65°W (see Figure 4). Principal Components Analysis is used to determine the common pattern of variation in the path of the Gulf Stream across these six longitudes. The Gulf Stream index contains a high level of monthly variability due to the meandering of the Gulf Stream, and it is usually advisable to apply smoothing by calculating average values over several months before use in further analyses (A.H. Taylor pers. comm., Plymouth Marine Laboratory, Plymouth).

## 11. JENKINSON OBJECTIVE – LAMB DAILY SYNOPTIC WEATHER INDEX



**Figure 5.** *Interannual variation in the frequency of the South-Westerly (SW) weather type over the 1945 to 1995 period, with a 5 year centred moving average to emphasise the long term trend*

<b>Variables available:</b>	Lambs weather index
<b>Temporal range:</b>	1880–present
<b>Temporal resolution:</b>	Daily
<b>Spatial range:</b>	British Isles. Approx. 50-60°N, 10-2°E.
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	N/A
<b>Data available from:</b>	Climate Research Unit, University of East Anglia, United Kingdom
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at: <a href="http://www.cru.uea.ac.uk/cru/data/lwt.htm">http://www.cru.uea.ac.uk/cru/data/lwt.htm</a>
<b>Data format:</b>	Tabulated text file. Months and years as rows, days as columns.

### Notes:

Professor H.H. Lamb (UK Meteorological Office) subjectively classified each day's weather over the British Isles from 1861 to February 1997 according to the pattern of pressure distribution present over the British Isles each day (Jones and Kelly, 1982). The classification is based on the character and general steering of weather patterns prevailing over the British Isles. Each weather type (Table 1) is associated with a general form of meteorology of the British Isles, although this changes between the seasons. However, the Lamb classification scheme has been improved by Jenkinson and Collison (1977), with the new objective scheme using daily grid-point mean sea level pressure data. The objective and the original subjective Lamb scheme have been compared by Jones *et al.* (1993).

Time series of the frequency of a particular weather type (for an example see Figure 5) over a particular time period may be constructed from the data which can act as a proxy for the general meteorology over the British Isles. In addition, such time series have been compared against fluctuations in biological series (e.g. Dickson and Brander, 1993).

**Table 1. Definitions of the primary British Weather Types  
(taken from Lamb, 1972)**

Weather type	Description
Anticyclonic	Mainly dry with light winds. Warm in summer and cold in winter
Cyclonic	Mainly wet weather. Mild in autumn and early winter, cold in spring and summer
Westerly	Unsettled weather, cool in summer, mild in winter with frequent gales
North-westerly	Unsettled weather, sometimes with gale-force winds. Cooler than the W type and milder than the N type
Northerly	Cold disturbed weather
Easterly	Cold in autumn, winter and spring, warm in summer, sometimes thundery
Southerly	Warm and thundery in spring, mild in autumn. In winter it is mild or cold depending on whether the air mass is oceanic or continental in origin

## 12. MARSDIEP SEA SURFACE TEMPERATURE AND SALINITY TIME SERIES – NETHERLANDS INSTITUTE FOR SEA RESEARCH (NIOZ)

<b>Variables available:</b>	Sea Surface Temperature Salinity
<b>Temporal range:</b>	1860–present
<b>Temporal resolution:</b>	Daily
<b>Spatial range:</b>	Single station at approx. 53°N, 4°42'E
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	Surface only
<b>Data available from:</b>	Netherlands Institute for Sea Research (NIOZ)
<b>Data cost:</b>	Free for academic use
<b>Data restrictions:</b>	Use of these data in a scientific publication must acknowledge the data source.
<b>Data via:</b>	Contact Dr. Hendrik M. van Aken E-mail: <a href="mailto:aken@nioz.nl">aken@nioz.nl</a> Also available as graphical plots online at: <a href="http://www.nioz.nl/en/facilities/dmg/marsdiep/hornhelder/marsdiep.htm">http://www.nioz.nl/en/facilities/dmg/marsdiep/hornhelder/marsdiep.htm</a>
<b>Data format:</b>	As requested

### Notes:

Sea Surface Temperature and surface salinity have been measured in the Marsdiep inlet, which connects the western Wadden Sea with the North Sea since 1860. From July 1860 until 1962, daily measurements of temperature and salinity were taken at Den Helder on the southern side of the Marsdiep inlet. Before 1904, samples were taken at high and low water during the day, but from 1904 this was changed to a single sample taken at 0800 hours. In 1947, the State Institute for Fisheries Research started daily measurements of temperature and salinity at 'T Hornje on the northern side of the Marsdiep inlet, which in 1982 were taken over by NIOZ. Thus, there is an overlap of 16 years for both series. From this overlap, the monthly mean systematic differences between 'T Hornje and Den Helder were determined. This systematic difference was used to extend the Den Helder series to present, based on the continuing observations from 't Horntje.

### 13. NATIONAL DATA BUOY CENTRE, UNITED STATES

<b>Variables available:</b>	Varies between each data buoy, but includes: Wind speed Air temperature Sea temperature Air-Sea temperature Sea level pressure Wind gust Significant wave height Average wave period Dominant wave period
<b>Temporal range:</b>	Varies according to station, observations at some sites are available from the 1970s, most data are only available for the mid 1990s onwards.
<b>Temporal resolution:</b>	Usually hourly
<b>Spatial range:</b>	Stations are concentrated around the coastal waters of the United States, Canada, and the United Kingdom
<b>Spatial resolution:</b>	Irregular
<b>Depth range/resolution:</b>	Surface only
<b>Data available from:</b>	National Data Buoy Centre, Stennis Space Center, United States
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at: <a href="http://www.ndbc.noaa.gov">http://www.ndbc.noaa.gov</a>
<b>Data format:</b>	Recent data available on the web site. Historical data are downloadable as either a compressed (*.zip) or uncompressed ASCII file.

**Notes:**

The National Data Buoy Center (NDBC) develops and operates a network of buoy and Coastal-Marine Automated Network (C-MAN) stations. The majority of data available are for North American coastal stations, although some data from United Kingdom Meteorological Office operated buoys are also available via this web site. Both near real-time (previous 24 observations) and historical data are available online, accessed via an interactive map (<http://www.ndbc.noaa.gov/Maps/rmd.shtml>). Historical data are not available for all data buoys, and the user will need to know the World Meteorological Organization (WMO) code for the buoy, which may also be obtained via the interactive map.

## 14. NCEP/NCAR REANALYSIS DATA, PROVIDED BY THE CLIMATIC RESEARCH UNIT, UNITED KINGDOM

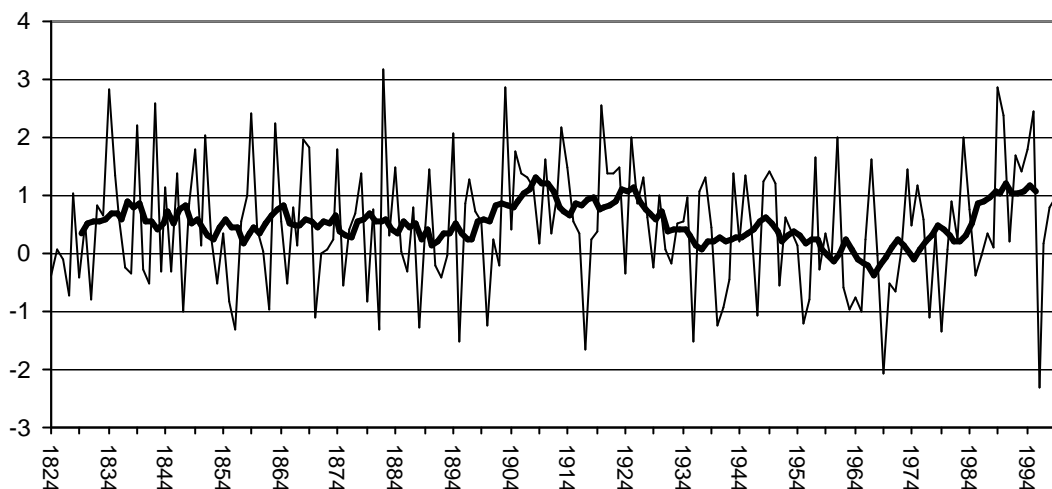
<b>Variables available:</b>	Daily variables: Air temperature at 2 m Max. air temp. at 2 m Min. air temp. at 2 m Precipitation Rate Sea level pressure	6-Hourly variables: Air temperature Geopotential height Precipitation rate Precipitable water Relative humidity Specific humidity Sea level pressure u-wind (0 & 10 m) v-wind (0 & 10 m)
<b>Temporal range:</b>	Mainly 1958–present	
<b>Temporal resolution:</b>	Daily or 6 hourly readings available (see above)	
<b>Spatial range:</b>	Europe and NE Atlantic (80°N–30°N; 60°W–70°E)	
<b>Spatial resolution:</b>	approx. 2.5 degree latitude x longitude grid (see below)	
<b>Depth range/resolution:</b>	N/A	
<b>Data available from:</b>	Climate Research Group, University of East Anglia, United Kingdom	
<b>Data cost:</b>	Free	
<b>Data restrictions:</b>	None	
<b>Data via:</b>	Internet at <a href="http://www.cru.uea.ac.uk/cru/data/ncep/">http://www.cru.uea.ac.uk/cru/data/ncep/</a>	
<b>Data format:</b>	gzipped tabulated ASCII files with a field width of 22 chars. Rows represent latitudes, and columns as longitudes, although as the data is set out on a gaussian grid, (to preserve equal area, these are non-linear). One file is supplied for each year of data.	

### Notes:

The goal of the NCEP/NCAR (National Center for Environmental Prediction / National Center for Atmospheric Research) Reanalysis Project is to produce new atmospheric analyses using historical data. The project involves the recovery and assimilation of land, ship, aircraft, satellite and other meteorological data, from 1957 onwards.

For Europe, the Climate Research Unit at the University of East Anglia provides the NCEP/NCAR reanalysis data. These data have been converted from netCDF into ASCII format. The full data set with a global coverage is available at the NCEP/NCAR reanalysis home page (<http://wesley.web.noaa.gov/reanalysis.html>). However, these data are in netCDF format and may require further processing before they may be fully utilised.

## 15. NORTH ATLANTIC OSCILLATION (NAO)



**Figure 6.** *Interannual variation in the winter North Atlantic Oscillation Index (mean for December to March), with a 10 year centred moving average to emphasise the long term trend*

<b>Variables available:</b>	North Atlantic Oscillation Index (NAO index)
<b>Temporal range:</b>	1823–present
<b>Temporal resolution:</b>	Monthly
<b>Spatial range:</b>	North Atlantic and Europe
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	N/A
<b>Data available from:</b>	Jim Hurrell at the National Center for Atmospheric Research, Boulder, United States, or alternatively from the Climate Research Unit, United Kingdom
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at either <a href="http://www.cgd.ucar.edu/~jhurrell/nao.htm">http://www.cgd.ucar.edu/~jhurrell/nao.htm</a> or <a href="http://www.cru.uea.ac.uk/cru/data/nao.htm">http://www.cru.uea.ac.uk/cru/data/nao.htm</a>
<b>Data format:</b>	Tabulated ASCII format

### Notes:

The NAO index is an ocean basin scale indicator of the pressure and weather patterns present over the North Atlantic area (Hurrell, 1995) constructed from the pressure difference between the sub-tropical high pressures centred on the Azores and the sub-polar low pressures centred on Iceland. This pressure difference affects the speed and direction of surface winds across the North Atlantic (Mann and Lazier, 1991; Taylor and Stephens, 1998) as far as Europe, and winter temperatures on both sides of the Atlantic Ocean (Planque and Taylor, 1998). A high NAO index is associated with stronger wind circulation in the North Atlantic, higher temperatures in western Europe, and lower temperatures on the eastern coast of Canada. In a similar manner to long term fluctuations in the position of the Gulf Stream North Wall, the NAO index has also been associated with changes in the abundance of some zooplankton species in the North Sea (Fromentin and Planque, 1996).



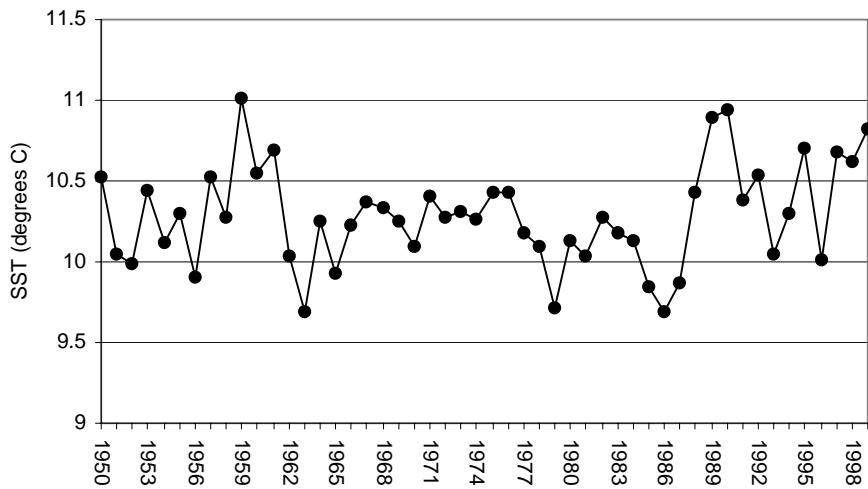
## 16. REAL TIME MARINE DATA – NATIONAL CENTERS FOR ENVIRONMENTAL PREDICTION (NCEP), UNITED STATES

<b>Variables available:</b>	Observed variables: Air temperature SST Sea level pressure u and v-wind Scalar wind Cloudiness Humidity	Derived variables: Latent Heat Parameter Relative Humidity Sensible heat parameter u-wind stress v-wind stress
<b>Temporal range:</b>	June 1991–present, updated monthly	
<b>Temporal resolution:</b>	Monthly means	
<b>Spatial range:</b>	Global ocean coverage	
<b>Spatial resolution:</b>	2 degree latitude x longitude grid	
<b>Depth range/resolution:</b>	Sea level only	
<b>Data available from:</b>	National Oceanographic Data Center, Climatic Diagnostics Center, Boulder, United States	
<b>Data cost:</b>	Free	
<b>Data restrictions:</b>	None	
<b>Data via:</b>	Internet at: <a href="http://www.cdc.noaa.gov/cdc/data.nmc.marine.html">http://www.cdc.noaa.gov/cdc/data.nmc.marine.html</a>	
<b>Data format:</b>	The data are divided by each variable and statistic into separate files. Data is provided for download as netCDF.	

### Notes:

Monthly means of various marine surface meteorological measurements are available from the National Center for Climate Prediction (NCEP) as their 'Real-time Marine Data' data set. The data are gathered from various sources by the NOAA, and are used to construct monthly summaries for 2 degree latitude and 2 degree longitude boxes. These data may be considered to be a continuous update to the Comprehensive Ocean-Atmosphere Data set (COADS). However, the COADS dataset also includes data collected from marine reports which contain the full suite of weather observations, plus a variety of delayed data. Hence, although NCEP real-time marine dataset are considered part of a continuous update to the COADS dataset, the data are not gathered from such a wide range of sources. In addition, it needs to be noted that the COADS dataset are available at a resolution of 1 and 2 degrees, whereas these data are solely available at a 2 degree resolution. These data are presented as monthly means from June 1991 onwards, and are updated regularly about 2 to 5 days following each month.

## 17. RECONSTRUCTED REYNOLDS SEA SURFACE TEMPERATURES



**Figure 7.** Time series of annual means of Sea Surface Temperature for the North Sea (ICES area IV) calculated from the Reconstructed Reynolds dataset

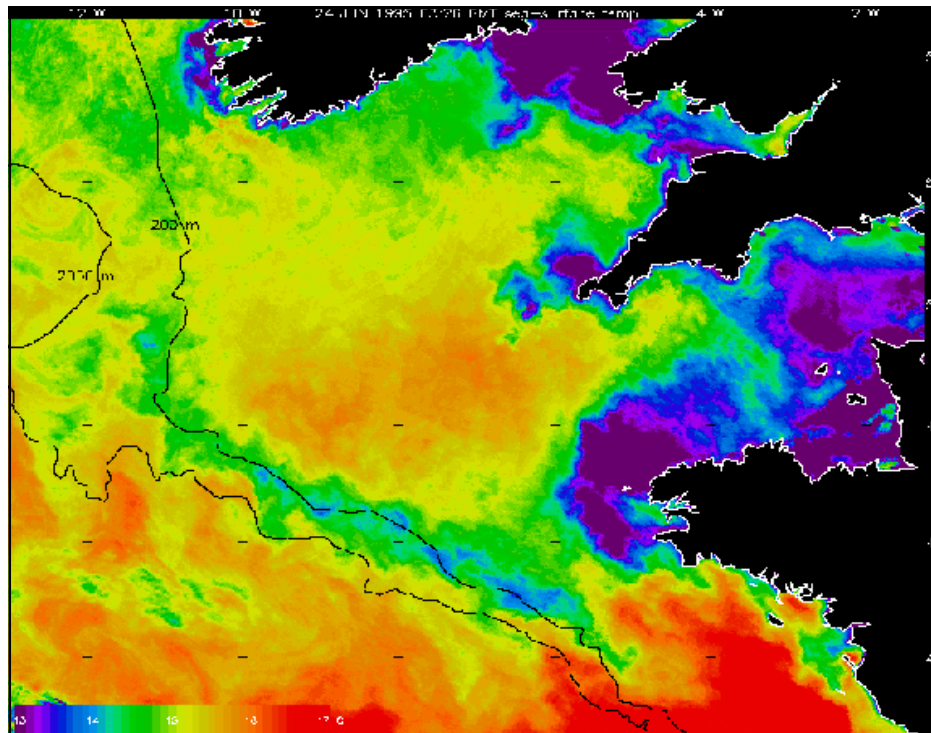
<b>Variables available:</b>	Sea Surface Temperature
<b>Temporal range:</b>	January 1950–December 1999
<b>Temporal resolution:</b>	Monthly means
<b>Spatial range:</b>	Global ocean coverage from 45°S to 69°N
<b>Spatial resolution:</b>	2 degree latitude x longitude grid
<b>Depth range/resolution:</b>	Surface only
<b>Data available from:</b>	National Oceanographic Data Center, Climatic Diagnostics Center, Boulder, United States
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at: <a href="http://www.cdc.noaa.gov/cdc/data.recon_reynolds_sst.html">http://www.cdc.noaa.gov/cdc/data.recon_reynolds_sst.html</a>
<b>Data format:</b>	Data is provided for download as netCDF

### Notes:

The reconstruction of historical Sea Surface Temperatures (Reconstructed Reynolds) is an extension of the Reynolds SST data set (see relevant entry) back to 1950. Reconstruction uses an Empirical Orthogonal Functions interpolation of in-situ observations of SST. The first step was to produce the spatial EOFs from the Optimum Interpolation (OI) analyses of Reynolds and Smith (1994). The dominant EOF modes were then used as basis functions and were fitted to the *in situ* data for the period 1950-92 to determine the time dependence of each mode. A global field of SSTs was then reconstructed from these spatial and temporal modes.

Data may be spatially plotted online for a user selected time range (for an example output see Figure 7), or alternatively the data set may be downloaded for a user-defined spatial and temporal range as a netCDF file.

## 18. REMOTE SENSING DATA ANALYSIS SERVICE (RSDAS) – PLYMOUTH MARINE LABORATORY, PLYMOUTH, UNITED KINGDOM



**Figure 8.** *Thermal infrared image of SW Britain on the 24 June 1995  
(Reproduced with the kind permission of The Remote Sensing Group,  
Plymouth Marine Laboratory)*

<b>Variables available:</b>	Sea Surface Temperatures (restricted to ranging from 5 to 30.5°C)
<b>Temporal range:</b>	SST available from June 1993
<b>Temporal resolution:</b>	Daily
<b>Spatial range:</b>	North Sea and Irish Sea
<b>Spatial resolution:</b>	1.1 km x 1.1 km resolution
<b>Depth range/resolution:</b>	Surface
<b>Data available from:</b>	RSDAS, The Centre for Coastal and Marine Sciences, Plymouth Marine Lab.
<b>Data restrictions:</b>	See below
<b>Data cost:</b>	Free for UK academic use. Commercial and overseas users may be asked to pay costs to RSDAS. Prices vary according to the size of the region, complexity of processing required, quantity, etc.
<b>Data via:</b>	RSDAS website at: <a href="http://www.npm.ac.uk/rsdas/">http://www.npm.ac.uk/rsdas/</a>
<b>Data format:</b>	Data may be supplied either as pre-processed images available for immediate download, or alternatively, a request can be made to RSDAS to convert images into an SST or chlorophyll series for further analysis, although this may incur further costs.

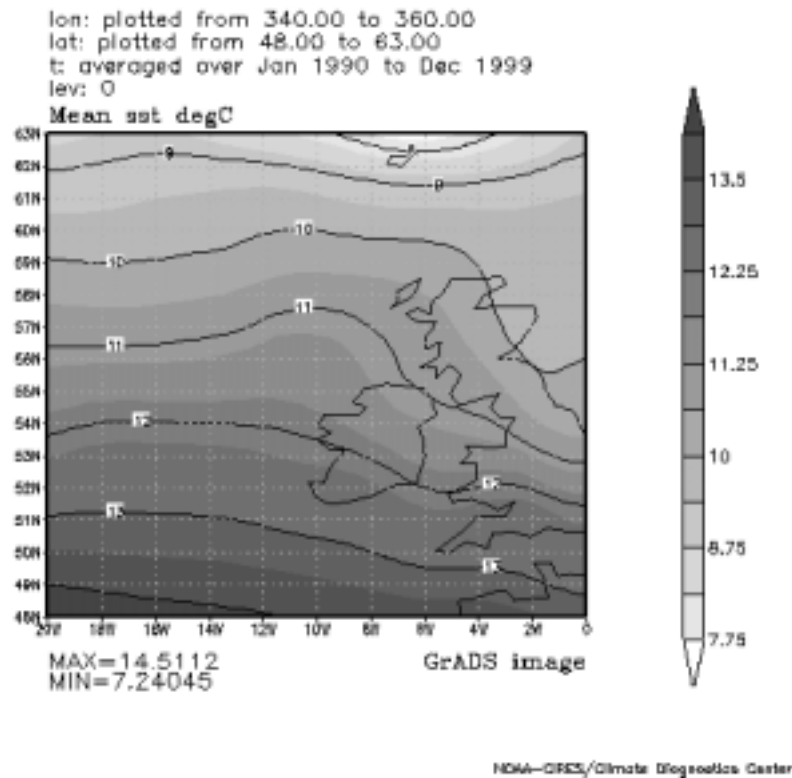
**Notes:**

The remote sensing group at the Centre for Coastal and Marine Sciences, Plymouth, provides pre-processed AVHRR (Advanced Very High Resolution Radiometer) and SeaWiFS satellite data for scientists who are not specialists in remote sensing, or do not have access to image analysis hardware or software. RSDAS use in house algorithms to process the large quantities of raw satellite data, known as Panorama (Processing and Automatic Navigation of Real-time Images).

Following a short online registration, anyone may access up to 30 AVHRR images which are more than 14 days old to evaluate the products available at RSDAS. Further access to images, or images more recently acquired, requires a formal application to RSDAS which needs to be approved via a peer-reviewed process, with the best proposals being given the highest priority, and those less highly graded being accommodated where possible. Following application, access to the pre-processed images are available free of charge to UK academic users, whereas commercial and overseas users may be required to pay the costs of data processing. A unique aspect to the services offered by RSDAS, is the ability to provide processed satellite data within a couple of hours of acquisition, when this is required for the planning and guidance of research cruises.

In addition to colour, pre-processed satellite images, data may be converted to numerical format for further analysis by users, and values may be extracted for specified points, lines, or statistics from regions, although depending upon the amount of data required this may require RSDAS to pass on processing costs to users.

## 19. REYNOLDS SEA SURFACE TEMPERATURES



**Figure 9.** Mean Sea Surface Temperatures over the 1990 to 1999 period to the west of the British Isles

<b>Variables available:</b>	Sea Surface Temperature
<b>Temporal range:</b>	November 1981–present
<b>Temporal resolution:</b>	Weekly and monthly means
<b>Spatial range:</b>	Global ocean coverage
<b>Spatial resolution:</b>	1 degree latitude x longitude grid
<b>Depth range/resolution:</b>	Surface only
<b>Data available from:</b>	National Oceanographic Data Center (NODC), Climatic Diagnostics Center (CDC), Boulder, United States
<b>Data cost:</b>	Free
<b>Data restrictions:</b>	None
<b>Data via:</b>	Internet at: <a href="http://www.cdc.noaa.gov/cdc/data.reynolds_sst.html">http://www.cdc.noaa.gov/cdc/data.reynolds_sst.html</a>
<b>Data format:</b>	Data is provided for download as netCDF

### Notes:

The Reynolds SST dataset covers the period November 1981 to the present day. It is a blend of data from ships and buoys from 1981 to the present, with satellite observations from the 1990s. The data set is available at a one degree latitude and longitude resolution through the use of Optimum Interpolation (OI) analysis. Before the analysis is computed, the satellite data is adjusted for bias using the method of Reynolds (1988) and Reynolds and Marsico (1993). A description of the OI analysis can be found in Reynolds and Smith (1994).

Data may be plotted online for a user selected time range (for an example output see Figure 10), or alternatively the data set may be downloaded as netCDF.

In addition, the CDC provides a weekly update of SST with the optimum interpolation (OI) analysis on a global ocean one degree grid. The weekly file is available on-line over the internet by anonymous ftp at [ftp://ftp.cdc.noaa.gov/ftp/Datasets/reynolds\\_sst](ftp://ftp.cdc.noaa.gov/ftp/Datasets/reynolds_sst).

## 20. SEA SURFACE TEMPERATURE AND SALINITY DATA SET (SHIP ROUTES TO AND FROM THE UK, 1963 TO 1990) – MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, UNITED KINGDOM

<b>Variables available:</b>	Sea Surface Temperature Salinity
<b>Temporal range:</b>	1963–1990, although this varies according to each route
<b>Temporal resolution:</b>	Approximately weekly
<b>Spatial range:</b>	On routes between UK ports and Ocean Weather Stations (OWS) in the North Atlantic
<b>Spatial resolution:</b>	Varies between 10–50 miles along routes
<b>Depth range/resolution:</b>	Surface samples
<b>Data available from:</b>	British Oceanographic Data Centre, Birkenhead, United Kingdom.
<b>Data restrictions:</b>	Restricted to academic research. Contact BODC for further details.
<b>Data cost:</b>	Contact BODC for details of data supply
<b>Data via:</b>	BODC on floppy disk, CD-ROM or pre-arranged ftp (data not available directly online).

### **Notes:**

Sea Surface temperature and salinity data have been collected by ships regularly plying routes between ports in the British Isles and the continent, and on routes to the Ocean Weather Stations (OWS) in the North Atlantic. Approximately weekly measurements being taken at intervals ranging from 10 to 50 miles depending on the route. These observations provide useful information on the seasonal and short-term variability of temperature and salinity offshore and may contribute to an identification of extreme values.

## 21. SEA SURFACE TEMPERATURES FOR THE NORTH SEA – BUNDESAMT FÜR SEESCHIFFAHRT UND HYDROGRAPHIE (BSH), GERMANY

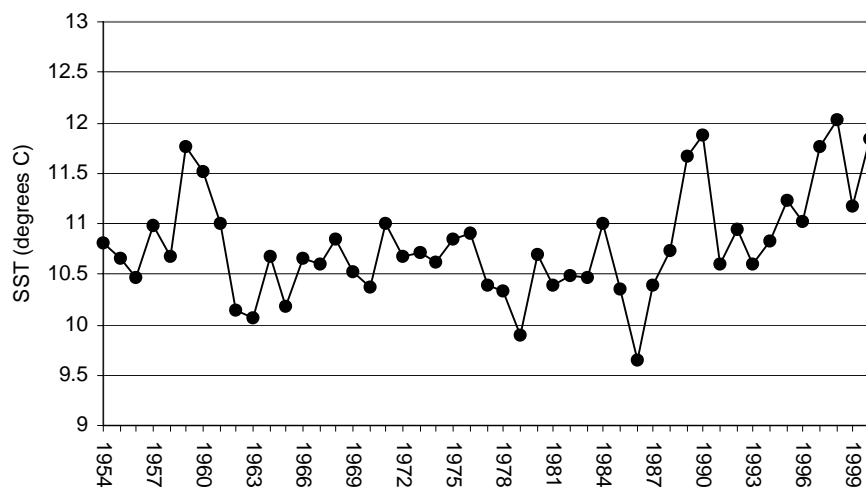
<b>Variables available:</b>	Sea Surface Temperature
<b>Temporal range:</b>	1968–present
<b>Temporal resolution:</b>	Weekly data interpolated from discontinuous data
<b>Spatial range:</b>	North Sea
<b>Spatial resolution:</b>	20km by 20km latitude x longitude grid.
<b>Depth range/resolution:</b>	Surface only
<b>Data available from:</b>	Bundesamt für Seeschifffahrt und Hydrographie (BSH), Hamburg, Germany
<b>Data restrictions:</b>	None
<b>Data cost:</b>	Free
<b>Data via:</b>	Data may be requested by email ( <a href="mailto:dod@bsh.d400.de">dod@bsh.d400.de</a> ), specifying the spatial and temporal coverage and resolution required.
<b>Data format:</b>	Data can be supplied as an ASCII CSV format

### Notes:

This centre is a higher federal authority in Germany with responsibility for maritime matters, and provides weekly North Sea Surface Temperature data. These data are a blend of in-situ observations and AVHRR (Advanced Very High Resolution Radiometer) satellite data. Original data are discontinuous in time, and the weekly data are composites rather than weekly means. These data are updated every Wednesday, and are therefore available in near-real time.



## 22. SEA TEMPERATURE, SALINITY AND NUTRIENT DATA SET 'CYPRIS STATION' – PORT ERIN, ISLE OF MAN, UNITED KINGDOM



**Figure 10. Interannual variation in Sea Surface Temperature recorded at the Cypris station n over the 1954 to 1999 period**

<b>Variables available:</b>	Temperature Salinity Oxygen Nutrients
<b>Temporal range:</b>	1954–present
<b>Temporal resolution:</b>	Minimum sampling frequency of one month
<b>Spatial range:</b>	Single sampling station (54° 05' 30" N, 4° 50' 00" W).
<b>Spatial resolution:</b>	N/A
<b>Depth range/resolution:</b>	Samples collected at depths of 0, 5, 10, 20 and 37 metres
<b>Data available from:</b>	Contact T. Shammon at the Port Erin Marine Laboratory, Isle of Man, United Kingdom
<b>Data cost:</b>	Free, although access to this data set is dependent on the agreement of the data collectors
<b>Data restrictions:</b>	Contact the Port Erin Marine Laboratory, Isle of Man for details
<b>Data via:</b>	Port Erin Marine Laboratory on floppy disk, CD-ROM or ftp
<b>Data format:</b>	ASCII or Microsoft Excel file

### Notes:

The Port Erin Marine Laboratory has collected data at a site in the Irish Sea 5 km off the south-west of the Isle of Man (54°5.5'N, 4°50'W) since 1954. Samples from the bay were collected with a Nansen-Peterson insulated water bottle and temperature recorded to the nearest 0.1°C. Salinity measurements were determined by titration against silver nitrate until 1985, and with an Autolab salinometer afterwards. Nutrients were estimated colourimetrically and dissolved oxygen was determined by the Winkler technique.

## 23. WORLD OCEAN DATABASE – NATIONAL OCEANOGRAPHIC DATA CENTER (NODC), UNITED STATES

<b>Variables available:</b>	Numerous variables including: CTD profiles Temperature Salinity Oxygen pH Pressure Note that the availability of these variables varies depending upon sampling time and location
<b>Temporal range:</b>	Variable according to parameter (e.g. bottle data available from 1934, CTD available from 1967).
<b>Temporal resolution:</b>	Variable.
<b>Spatial range:</b>	Global ocean coverage
<b>Spatial resolution:</b>	1 degree and 5 degree latitude x longitude grids available
<b>Depth range/resolution:</b>	Variable according to parameter
<b>Data available from:</b>	National Oceanographic Data Center (NODC), Boulder, United States
<b>Data cost:</b>	See website for details of current prices.
<b>Data restrictions:</b>	None
<b>Data via:</b>	On CD-ROM via the NODC website: <a href="http://www.nodc.noaa.gov/General/NODC-cdrom.html">http://www.nodc.noaa.gov/General/NODC-cdrom.html</a>
<b>Data format:</b>	Programs to read and convert the data in manageable formats are included on the CD-ROM. Some of these are also available online at the NODC website or linked from it.

### Notes:

The World Ocean Database 1998 (WOD98) is available on a set of 5 CD-ROMs, containing observed and standard level profile data, are an extension of the earlier World Ocean Atlas 1994 (WOA94). The set of CD-ROMS present data from 5,285,106 stations sampled over the world's oceans using a variety of instruments and methods (e.g. low and high resolution CTD data, bottle data, plankton data, bathythermograph, etc.). However, the exact data available varies according to sampling time and location. Some of these data are available 'time-sorted' online at the NODC website (<http://www.nodc.noaa.gov/OC5/wod98v2.html>), as are updates to the CD-ROM editions.

## 24. UNITED KINGDOM LAND SURFACE OBSERVATIONS STATION DATA – METEOROLOGICAL OFFICE, UNITED KINGDOM

<b>Variables available:</b>	Numerous meteorological variables including: Minimum daily air temperature Maximum daily air temperature Sunshine amount Precipitation etc.
<b>Temporal range:</b>	Varies according to station. Earliest data begins in 1853, although many stations only have data from the 1960s onwards
<b>Temporal resolution:</b>	Daily
<b>Spatial range:</b>	Data available for stations in 110 UK counties
<b>Spatial resolution:</b>	Irregular
<b>Depth range/resolution:</b>	Surface
<b>Data available from:</b>	British Atmospheric Data Centre, Birkenhead, United Kingdom
<b>Data cost:</b>	Free (registration required)
<b>Data restrictions:</b>	None for academic users
<b>Data via:</b>	Internet from: <a href="http://www.badc.rl.ac.uk/data/surface/">http://www.badc.rl.ac.uk/data/surface/</a>
<b>Data format:</b>	Three separate tabulated ASCII files (see below). Each daily weather record occupies one row, and variables as columns. Variable headings are on the first row of the data file. Further file format information is present on the BADC website.

### Notes:

This data set forms a long term record of daily meteorological observations. Numerous variables are available, although the exact parameters measured vary from station to station, as does the temporal range available at each station. A full list of the stations available, including their years of operation is available at [http://www.badc.rl.ac.uk/data/surface/station\\_lists/ukstation.dwx.html](http://www.badc.rl.ac.uk/data/surface/station_lists/ukstation.dwx.html).

The data for each station are available as three separate files. The daily weather observation file (.dwx) includes information on parameters such as sunshine duration and the presence of snow on the ground. The temperature observations file (.temp) includes maximum and minimum temperatures, whilst the daily rainfall series are available as a .drain file.

## 25. UNITED KINGDOM NATIONAL DATABANK OF CTD/STD PROFILES (1975 - PRESENT)

<b>Variables available:</b>	Conductivity/Salinity – Temperature – Depth
<b>Temporal range:</b>	1975–present
<b>Temporal resolution:</b>	Variable (depends upon cruises)
<b>Spatial range:</b>	Mainly North-east Atlantic and UK continental shelf
<b>Spatial resolution:</b>	Irregular
<b>Depth range/resolution:</b>	Depth resolution is between 0.5-1.5 m
<b>Data available from:</b>	British Oceanographic Data Centre (BODC), Birkenhead, United Kingdom
<b>Data cost:</b>	Marginal costs may be made for making data available
<b>Data restrictions:</b>	None
<b>Data via:</b>	Data can be made available via ftp, cd-rom or floppy disk
<b>Data format:</b>	Data can be supplied in ASCII format

### Notes:

This data set comprises approximately 10,000 profiles of CTD data, collected by UK laboratories from 1975 onwards, on about 200 research cruises. Data from about 75 cruises have been collected in the shelf seas around the British Isles (i.e. North Sea, Irish Sea), most of the remaining cruises have been in the North East Atlantic and in the deep ocean. Various depth intervals have been used, although these are mostly between 0.5 - 1.5 m. Deep ocean profiles may obtain data down to 5,000m.

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## APPENDIX 1. MAFF Coastal Sea Temperature Stations

Further information on the following stations may be found in Jones and Jeffs (1991)

Station	Date range	Latitude and Longitude
Longstone Lighthouse	1924-1989	55°38'N 01°36'W
Blyth PS	1978-1989	55°08'N 01°32'W
Redcar	1966-1980, 1985-1989	54°38'N 01°05'W
Whitby	1966-1979	54°30'N 00°37'W
Scarborough	1970-1989	54°17'N 00°22'W
Bridlington	1966-1977	54°05'N 00°11'W
Humber LV	1880-1940, 1948-1988	53°37'N 00°21'E
Spurn Point	1966-1989	53°35'N 00°07'E
Dowsing LV	1880-1915, 1950-1988	53°35'N 00°50'E
Leman and Ower LV	1905-1912	53°11'N 01°56'E
Skegness	1966-1979	53°09'N 00°21'E
Lynn Well LV	1963-1973	53°01'N 00°26'E
Brancaster	1966-1989	52°58'N 00°38'E
Blakeney	1966-1989	52°58'N 01°00'E
Cromer	1966-1989	52°56'N 01°18'E
Newarp LV	1880-1937, 1948-1986	52°48'N 01°55'E
Smiths Knoll LV	1910-1914, 1920-1939, 1947-1988	52°43'N 02°18'E
Cross Sand LV	1913-1931	52°38'N 01°57'E
Great Yarmouth PS	1964-1985	52°35'N 01°44'E
Lowestoft	1966-1989	52°27'N 01°45'E
Southwold	1966-1989	52°19'N 01°41'E
Sizewell PS	1967-1989	52°13'N 01°38'E
Shipwash LV	1880-1940, 1948-1981	52°02'N 01°42'E
Ipswich PS	1964-1985	52°02'N 01°10'E
Harwich	1966-1978	51°57'N 01°17'E
Galloper LV	1949-1977	51°44'N 01°58'E
Bradwell PS	1964-1989	51°45'N 00°54'E
Mid Barrow LV	1964-1971	51°35'N 01°10'E
Edinburgh LV	1921-1937	51°31'N 01°20'E
Tongue LV	1975-1985	51°31'N 01°23'E
Leigh on Sea	1966-1989	51°32'N 00°39'E
Barking PS	1964-1979	51°31'N 00°07'E
Belvedere PS	1964-1986	51°30'N 00°10'E
Littlebrook PS	1964-1989	51°28'N 00°15'E
West Thurrock	1964-1989	51°28'N 00°18'E
Northfleet PS	1964-1986	51°27'N 00°21'E
Tilbury PS	1964-1989	51°27'N 00°24'E
Kingsnorth PS	1971-1989	51°25'N 00°36'E
Grain PS	1979-1989	51°26'N 00°43'E
Whitstable	1936-1963	51°22'N 01°00'E
Falls LV	1972-1986	51°18'N 01°48'E
East Goodwin LV	1880-1886, 1892-1914, 1920-1939, 1948-1985	51°13'N 01°36'E
Dover	1926-1941, 1947-1989	51°07'N 01°21'E
Varne LV	1905-1939, 1949-1985	51°01'N 01°24'E
Dungeness PS	1968-1989	50°55'N 00°58'E
Royal Sovereign LV	1880-1901, 1912-1939, 1948-1988	50°43'N 00°27'E
Eastbourne	1892-1941, 1947-1989	50°46'N 00°18'E
Brighton	1948-1981	50°49'N 00°08'W
Shoreham by Sea	1966-1989	50°50'N 00°15'W
Owers LV	1905-1919	50°37'N 00°41'W
Langstone Harbour	1977-1989	50°48'N 01°02'W
Calshot	1962-1982	50°49'N 01°18'W
Bournemouth	1970-1989	50°44'N 01°52'W
Poole	1950-1983	50°42'N 01°59'W
Swanage	1966-1989	50°37'N 01°57'W
Shambles LV	1881-1901, 1912-1939, 1952-1976	50°31'N 02°20'W
Weymouth	1966-1989	50°37'N 02°27'W
Channel LV	1979-1988	49°54'N 02°54'W
Plymouth	1957-1989	50°22'N 04°10'W
MBA Station E1	1960-1985	50°02'N 04°22'W
Fowey	1966-1978	50°20'N 04°38'W
Newlyn	1920-1989	50°06'N 05°32'W
Mouschole	1966-1989	50°05'N 05°32'W
Seven stones LV	1877-1940, 1947-1986	50°04'N 06°04'W
Minehead	1972-1978, 1988-1989	51°13'N 03°28'W
Hinkley Point PS	1976-1989	51°13'N 03°07'W
English and Welsh Grounds LV	1912-1916, 1921-1950	51°27'N 03°00'W
Barry	1978-1989	51°24'N 03°15'W

Station	Date range	Latitude and Longitude
Porthcawl	1972-1979	51°28'N 03°42'W
Swansea	1976-1989	51°36'N 03°56'W
Carmarthen Bay PS	1974-1983	51°41'N 04°14'W
St. Gowan LV	1952-1987	51°30'N 05°00'W
Pembroke Dock	1978-1989	51°42'N 04°58'W
Skomer Island	1985-1989	51°44'N 05°17'W
Daunt Rock LV	1905-1938	51°43'N 08°16'W
Coningbeg LV	1905-1919	52°02'N 06°40'W
Barrels LV	1905-1938	52°10'N 06°36'W
Blackwater LV	1905-1938	52°26'N 06°05'W
South Arklow LV	1906-1919	52°39'N 05°58'W
North Arklow LV	1905-1919	52°52'N 05°58'W
Kish LV	1905-1962	53°19'N 05°55'W
Bardsey	1934-1987	52°45'N 04°48'W
Caernarvon LV	1905-1925	53°08'N 04°25'W
Wylfa PS	1967-1989	53°25'N 04°29'W
Amlwch	1964-1989	53°25'N 04°20'W
Moelfre	1965-1989	52°21'N 04°14'W
Menai Bridge	1954-1970, 1977-1982	53°14'N 04°09'W
North West LV	1905-1914, 1920-1927	53°31'N 03°32'W
Liverpool Bar LV	1928-1972	53°32'N 03°19'W
Morecambe Bay LV	1934-1973	53°55'N 03°29'W
Heysham	1955-1982	54°02'N 02°50'W
Selker LV	1921-1929	54°16'N 03°33'W
Chicken Rock Lighthouse	1934-1960	54°02'N 04°50'W
Port Erin	1902-1931, 1950-1989	54°05'N 04°46'W
Solway LV	1905-1917	54°31'N 03°38'W
Whitehaven	1965-1976	54°39'N 03°35'W
South Rock LV	1905-1911	54°24'N 05°24'W
Skulmartin LV	1905-1967	54°32'N 05°26'W
North Channel	1935-1966, 1971-1984	54°55'N 05°28'W



## APPENDIX 2. Address list

Addresses of those organisations referred to in this directory:

### **British Atmospheric Data Centre (BADC)**

Space Science and Technology Department  
Rutherford Appleton Laboratory  
Chilton  
Didcot  
Oxfordshire  
OX11 1QX  
UK

Tel: +44 1235 821900  
Fax: +44 1235 445848  
<http://www.badc.rl.ac.uk>

### **Bundesamt für Seeschifffahrt und Hydrographie (BSH)**

Bernhard-Nocht Strasse 78  
20359 Hamburg  
Germany

Tel: +49 40 31903542  
Fax: +49 40 31905000  
<http://www.bsh.de/3172.htm>

### **Climatic Research Unit (CRU)**

School of Environmental Sciences  
University of East Anglia (UEA)  
Norwich  
NR4 7TJ  
UK

Tel: +44 1603 592089  
Fax: +44 1603 507784  
<http://www.cru.uea.ac.uk>

### **International Council for the Exploration of the Sea (ICES)**

Palægade 2-4  
DK-1261  
Copenhagen  
Denmark

Tel: +45 3315 4225  
Fax: +45 3393 4215  
<http://www.ices.dk>

### **National Data Buoy Center \*(NDBC)**

Building 1100  
Stennis Space Center, MS 39529  
United States

<http://www.ndbc.noaa.gov>

### **British Oceanographic Data Centre (BODC)**

Proudman Oceanographic Laboratory  
Bidston Observatory  
Birkenhead  
Merseyside  
L43 7RA  
UK

Tel: +44 1516 538633  
Fax: +44 1516 523950  
<http://www.bodc.ac.uk>

### **The Centre for Environment, Fisheries, & Aquaculture Science Laboratory**

Pakefield Road  
Lowestoft  
Suffolk  
NR33 0HT  
UK

Tel: +44 1502 562244  
Fax: +44 1502 513865  
<http://www.cefas.co.uk>

### **European Centre for Medium Range Weather Forecasts (ECMWF)**

Shinfield Park  
Reading  
RG2 9AX  
UK

Tel: +44 118 9499453  
Fax: +44 118 9869450  
<http://www.ecmwf.int>

### **Institut fuer Meereskunde an der Universitaet Hamburg**

Tropowitzstrasse, 7  
D-22529 Hamburg  
Germany

Tel: +49 40 428382605  
Fax: +49 40 5605926  
<http://www.ifm.uni-hamburg.de>

### **National Oceanographic Data Center (NODC)**

SSMC3, 4<sup>th</sup> Floor  
1315 East-West highway  
Silver Spring  
MD 20910  
USA

Tel: +1 301 713 3270  
Fax: +1 301 713 3300  
<http://www.nodc.noaa.gov>

**Nederlands Instituut voor Onderzoek der Zee  
(NIOZ)**  
PO Box 59  
NL-1790 AB Den Burg  
Texel  
Netherlands

Tel: +31 222 369300  
Fax: +31 222 319674  
<http://www.nioz.nl>

**Port Erin Marine Laboratory.**  
The University of Liverpool,  
Port Erin  
Isle of Man  
IM9 6JA  
UK

Tel: +44 624 831000  
Fax: +44 624 831001  
<http://www.liv.ac.uk/peml>

**United States Naval Oceanographic Office**  
N24 Customer Service Division  
1002 Balch Boulevard  
Stennis Space Center  
MS 39522-5001  
USA

<http://www.navo.navy.mil>

**NOAA-CRES Climate Diagnostic Center (CDC)**  
NOAA/OAR/CDC, Code R/CDC1  
325 Broadway  
Boulder  
CO 80303  
USA

Tel: +1 303 4976747  
Fax: +1 303 4977013  
<http://www.cdc.noaa.gov>

**Remote Sensing Data Analysis Service (RSDAS),  
Plymouth**  
CCMS Plymouth Marine Laboratory  
Prospect Place  
Plymouth  
PL1 3DH  
UK

Tel: +44 1752 633151  
Fax: +44 1752 633101  
[http://www.pml.ac.uk/pml/remote\\_sensing](http://www.pml.ac.uk/pml/remote_sensing)

The following addresses are those of organisations from which further atmospheric and hydrographic data may possibly be obtained, although these are not referred to in this directory:

**Department of Agriculture and Rural Development  
(DANI)**  
Dundonald House  
Upper Newtownards Road  
Belfast  
United Kingdom

Tel +44 28 9052499  
Fax: +44 28 90525003  
<http://www.dani.gov.uk>

**Irish Marine Data Centre**  
The Irish Marine Institute  
80 Harcourt Street  
Dublin 2  
Ireland

Tel: +353 1 476 6500  
Fax: +353 1 478 4988  
<http://www.marine.ie/datacentre>

**Fisheries Research Services (FRS)**  
PO BOX 101  
Victoria Road  
Aberdeen  
AB11 9DB  
United Kingdom

Tel: +44 1224 876544  
Fax: +44 1224 295511  
<http://www.marlab.ac.uk>

**Institut Francais de Recherche pour L'Exploration  
de la Mer (IFREMER)**  
Technopolis 40  
155 rue Jean-Jacques Rousseau  
92138 ISSY-LES-MOLINEAUX  
France

Tel: +33 1 46 48 21 00  
Fax: +33 46 48 22 48  
<http://www.ifremer.fr>

**Southampton Oceanography Centre (SOC)**

University of Southampton

Waterfront Campus

European Way

Southampton

SO14 3ZH

United Kingdom

Tel: +44 23 8059 6666

Fax: +44 23 8059 6667

<http://www.soc.soton.ac.uk>

### APPENDIX 3. Availability of useful data processing utilities

Utility	Download Location	Notes
WinZip	<a href="http://www.winzip.com">http://www.winzip.com</a>	Decompressing and managing *.zip and *.gzip files.
PC GrADS	<a href="http://grads.iges.org/grads">http://grads.iges.org/grads</a>	The Grid Analysis and Display System (GrADS) is an integrated tool for the access, manipulation, and display of earth science data (Doty, 2001). GrADS implements a 4-D data model where the dimensions are usually latitude, longitude, time and data value. Operations may be performed on the data directly at the command line, and displayed using a variety of graphical output types.
ncDump	<a href="ftp://ftp.unidata.ucar.edu/pub/netcdf/contrib/win32/netcdf-3.5-beta5.win32bin.zip">ftp://ftp.unidata.ucar.edu/pub/netcdf/contrib/win32/netcdf-3.5-beta5.win32bin.zip</a>	ncDump is distributed as part of the NetCDF (network Common Data Form) package which is an interface for manipulating netCDF files. The ncdump utility is used to convert netCDF files into an ASCII 'human-readable' format.