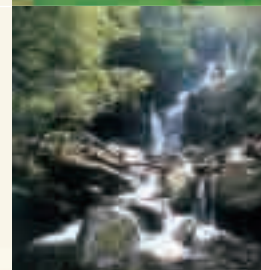
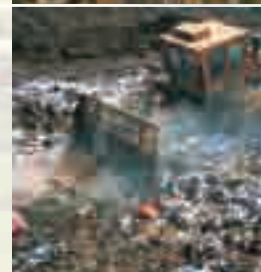


Climate Change- Implementation of the Global Climate Observing System in Ireland



Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Heritage and Local Government.

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The work of the EPA is carried out across four offices:

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- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

Climate Change – Implementation of the Global Climate Observing System in Ireland

Environmental Research Centre Report

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Foreword

In 2003 the Global Climate Observing System (GCOS) Secretariat published its Implementation Plan for global climate observations. Each signatory to the United Nations Framework Convention on Climate Change (UNFCCC) is required to take action to implement those elements of the Plan relevant to them. In 2005 the Environmental Protection Agency (EPA) provided funding for a coordinator to look in detail at the Plan and determine the status of its implementation in Ireland.

In order to oversee the review of the GCOS Implementation Plan a steering committee was set up with representatives from the EPA, Met Éireann and the Marine Institute. This report is the outcome of that process. It has been reviewed by a number of national and international experts in climate observation.

This report addresses only observations that are required as part of the GCOS process. The next phase of the project is to investigate climate monitoring requirements at a national and local level. This is required in order to improve the understanding of climate change and its impacts at a national level.

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Executive Summary

In 1992 Ireland was one of the over 180 signatories of the United Nations Framework Convention on Climate Change (UNFCCC). Systematic, high-quality observations for the atmosphere, ocean and terrestrial environments are required to improve understanding of climate characteristics and assist in understanding the consequences of climate change. To support issues related to systematic observations, the Global Climate Observing System (GCOS) Secretariat was established within the World Meteorological Organisation (WMO) in 1992 to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users.

Given limited progress throughout the 1990s in the establishment of adequate observing systems globally, the UNFCCC charged GCOS to deliver a 10-year Implementation Plan to address the gaps. This Plan became available in October 2004 and presents over 130 separate actions to be taken by the parties to the UNFCCC. It also identified a minimum set of Essential Climate Variables (ECVs) for the atmosphere, ocean and terrestrial environments that require systematic observation.

Within Ireland a number of agencies are responsible for observation of parameters that are included as GCOS ECVs. The major ones include Met Éireann, the National University of Ireland, Galway, the Marine Institute, the Environmental Protection Agency (EPA) and the Office of Public Works (OPW). The climate variables collected are submitted to the relevant international data centres for archiving and dissemination.

The analysis of Ireland's performance with regard to the GCOS Implementation Plan is the subject of this report. The key actions, cross-cutting actions and those in each of the three thematic areas are discussed in turn. Actions of relevance to Ireland are identified and the status of their implementation is presented. This analysis indicates that

the country is fulfilling its climate observation commitments in regard to the UNFCCC. However, there are a number of areas in which additional funding and resources are required to augment existing programmes or to put in place new monitoring initiatives in order to meet the GCOS requirements fully.

This analysis is solely in relation to international requirements for a global monitoring system. It does not reflect adequately the observational needs for smaller countries and local areas. There is a parallel need to determine the requirements at a national level. Researchers have carried out preliminary research on indicators of climate change in Ireland. However, additional analysis of existing data is required and the adequacy of the current observation systems needs to be reviewed and upgraded/modified where necessary. This will be the subject of follow-up work to this report.

Resulting from the analysis of the GCOS Implementation Plan, a number of recommendations can be made as follows:

- Existing systematic observing programmes must be maintained, and sufficient resources and funds allocated for their ongoing upkeep. Any degradation of these systems must be avoided. Appropriate time overlap of observations should be maintained when systems are upgraded or measurement location modified.
- The maintenance and appropriate resourcing of existing long-term climate observatories is essential (e.g. Malin Head sea-surface temperature measurements since 1957).
- For those actions where additional work is needed in order to meet the full implementation requirements, a clear plan including resource requirements and a timetable should be put in place by the relevant organisations.

- Additional resources are required to support observations in a number of areas:
 - Extension of atmospheric ozone-sonde measurements to all year round.
 - Extension of the Voluntary Observing Ship (VOS) observations.
 - Implementation of an in-situ measurement system for oceanographic biogeochemical and ecosystem variables.
 - Establishment of long-term terrestrial ecological monitoring sites, including the expansion of the phenological garden network.
 - Establishment of the Mace Head Atmospheric Research Station as a unique marine cloud observing location.
- Funding for such observations needs to be provided on an ongoing and long-term rather than on a project basis.
- The recommendations of Barrie and Puckett (2006) with regard to the Valentia Observatory and Mace Head Global Atmosphere Watch stations should be implemented.
 - There is a need to develop a comprehensive and clear data policy with regard to climate observations. Currently, the different collecting agencies implement a range of procedures with regard to providing access to data.
 - It is highly desirable that protection of observing sites from adjacent development is incorporated into development planning at a local level.
 - In addition to fulfilling climate observation obligations as part of international agreements, Ireland needs to develop a comprehensive national climate observation plan in order to improve understanding of climate change and its effects locally.

1 Introduction

1.1 The Global Climate Observing System

In 1992 Ireland was one of the over 180 signatories of the United Nations Framework Convention on Climate Change (UNFCCC). The Parties to the UNFCCC agree 'to promote and cooperate in scientific, technological, technical, socioeconomic and other research, systematic observation and development of data archives related to the climate system' (Article 4.1[g]). To support issues related to systematic observations, the Global Climate Observing System (GCOS) Secretariat was established within the World Meteorological Organisation (WMO) in 1992 to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users.

In 1998 the GCOS Secretariat submitted to the UNFCCC a first report on the adequacy of the global observing systems for climate in providing the systematic observations required by the UNFCCC (GCOS, 1998). A subsequent adequacy report was issued in 2003 (GCOS, 2003), identifying where progress had been made and highlighting areas where progress remained to be made. In the light of these reports, the UNFCCC charged GCOS to deliver a 10-year Implementation Plan to address the requirements of the second adequacy report. This became available in October 2004. The Plan (GCOS, 2004) presents over 130 separate actions to be taken by the parties to the UNFCCC.

The Plan identifies a number of Essential Climate Variables (ECVs) and the means of measuring and monitoring these using both in-situ and remote (satellite) observing systems are outlined (Appendix 1). Actions to be taken by the various parties to the UNFCCC are presented under the four headings:

1. overarching/cross-cutting
2. atmospheric domain
3. oceanic domain
4. terrestrial domain.

These are further summarised in 24 key actions that are considered fundamental in order to progress the UNFCCC's implementation.

1.2 The Need for Climate Observations

Systematic, high-quality observations for the atmosphere, ocean and terrestrial environments are required to improve understanding of climate characteristics and assist in understanding the consequences of climate change. The reasons for making climate observations as set out in the GCOS second adequacy report (2003) are to:

- Characterise the state of the global climate system and its variability.
- Monitor the forcing of the climate system, including both natural and anthropogenic contributions.
- Support the attribution of the causes of climate change.
- Support the prediction of global climate change.
- Project global climate change information down to regional and national scales.
- Characterise extreme events important in impact assessment and adaptation, and to assess risk and vulnerability.

Data collected will thus help with the management, adaptation and mitigation of climate change.

Historically, countries have collected climate data primarily for their own national needs. These were often associated with weather forecasting and local climate research. They were not collected with global climate change in mind. Therefore, in certain cases observation systems have not been the most appropriate for such an application.

There is a growing understanding of the global nature of climate change and how climate events in one part of the world have repercussions globally. Satellite sensors have been identified as having a key role to play in providing observations for certain ECVs, due to their ability to view all parts of the earth on a systematic and repeatable basis. Nevertheless, in-situ data collection systems are indispensable and will continue to provide the majority of observations for ongoing climate studies.

In certain locations observations have been made for decades, if not centuries, and provide invaluable historical records. However, these measurements become useful for global climate studies only if they are systematic, continuous, collected in a homogenous way and easily accessible. In some cases such historical data exist only on paper. Consequently, there is the need to transfer them to digital media in order to facilitate wider access.

While the GCOS Implementation Plan identifies climate observation requirements at a global level, there is a parallel need to determine the requirements at a national level. Sweeney et al. (2002) have carried out preliminary research on indicators of climate change in Ireland. They recommend that additional analysis of existing data be carried out but they also advise that the adequacy of the current observation systems be reviewed and upgraded/modified where necessary.

1.3 Implementing the GCOS Plan

In order to respond to the GCOS Implementation Plan, the Environmental Protection Agency (EPA), the Marine Institute and Met Éireann have set up a steering group to oversee the review process and to determine and prioritise those steps necessary for full implementation of the GCOS Plan. Furthermore, this group will coordinate the development of a plan for national climate observation needs, which is required to improve understanding of climate change and its effects locally.



Figure 1: ENVISAT-MERIS image from 3 May 2007 showing an extensive plankton bloom to the south-west of Ireland. (©ESA)

2 Climate Observations in Ireland

2.1 In-Situ Systems

Within Ireland a number of agencies are responsible for the observation of parameters that are included as GCOS ECVs. Met Éireann, the national weather service, is responsible for the key meteorological/climatological-related measurements on both the land surface and in the atmosphere. The National University of Ireland, Galway carries out measurements of atmospheric constituents at the Mace Head Atmospheric Research Station in Co. Galway. The Marine Institute oversees the collection of some offshore meteorological/climatological data and sea state parameters. Terrestrial and hydrological measurements are carried out mainly by the EPA. However, other organisations including the Office of Public Works (OPW) and local authorities also collect hydrology-related parameters. The National Roads Authority has 52 weather stations located across the primary road network. These measure a range of parameters, including air temperature, wind speed and precipitation amounts. A number of measurements of climate-related variables have been or are carried out as part of research programmes and projects by a range of agencies and third-level educational establishments.

Parties to the UNFCCC are obliged to report on their development of systematic observations as part of their national communications. As part of Ireland's second national communication on the UNFCCC in 1997 (Department of the Environment, 1997) the section on systematic observations outlined those made by Met Éireann at its synoptic and climatological stations, as well as its involvement in a number of international projects observing atmospheric constituents. A more comprehensive overview of climate observations was provided in the third national communication in 2003 (Department of the Environment, 2003), while the fourth national communication (Department of the Environment, 2007) reported on the most recent status of observation systems.

2.2 Satellite Systems

GCOS has identified satellite sensing systems as important in the delivery of a number of the ECVs for the atmospheric, oceanic and terrestrial domains. Delivery of these parameters will require effort by space agencies, international bodies and national parties responsible for climate monitoring. In 2006, GCOS published a supplementary document to the 2003 Implementation Plan detailing the satellite-based requirements for climate monitoring (GCOS, 2006).

Ireland is a member of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT): Met Éireann uses its products as regular input to weather forecasting and for climate studies. The Marine Institute works with NASA products for sea-surface temperature and ocean colour applications. For national land-cover mapping, Ireland, via the EPA, participates in the CORINE initiative and has generated maps for 1990 and 2000, while it is currently coordinating generation of the 2006 version. Other bodies and third-level institutions use remote-sensing products on an ad-hoc basis in different projects.

Ireland is also a member of the European Space Agency (ESA) and through Enterprise Ireland actively participates in a number of its programmes. At the December 2005 ESA ministerial meeting Ireland indicated that it would join the Earth Observation Envelope Programme (EOEP) from 2008. Ireland is also active in the European Union's flagship Global Monitoring for Environment and Security (GMES) programme and as a consequence participates in the International Group on Earth Observations (GEO). One of the societal benefit areas identified in the GEO System of Systems (GEOSS) action plan is climate. This enhanced participation of Ireland in these earth observation activities reflects a commitment to the development and exploitation of remote-sensing instruments and their data.

In Ireland the GMES national forum chaired by the EPA and the Geological Survey of Ireland (GSI) provides a coordination and communication mechanism for development of national positions in relation to these initiatives as well as the development of recommendations for the earth observation research programmes.

2.3 GCOS Implementation Plan's Relevance to Ireland

A total of 155 actions, including key actions, are identified in the GCOS Implementation Plan. Not all these require action by Ireland. A number of them are not directly relevant to Ireland for thematic reasons (e.g. sea ice), while others are the responsibility of international organisations including space agencies to which Ireland is affiliated.

This report presents only those actions that are of direct relevance to Ireland. These are grouped under the headings of:

1. key actions
2. cross-cutting actions
3. the three thematic areas:

- (a) atmospheric
- (b) oceanic
- (c) terrestrial.

The ECVs identified in these areas are listed in Table 1. It should be noted that the ECVs are those that are both currently feasible for global implementation and believed to have a high impact in relation to the UNFCCC requirements (GCOS, 2003). These should not be considered exhaustive and do not necessarily reflect more detailed observations that may be needed at national or local levels. However, the guiding principles in relation to data, metadata and sustainability are applicable. A further document on observations that are possible and required at a national level will be produced in addition to this report.

Many of these data are available from WDCs where they are archived. Others are available from the national institutions that collect them. The tables in Appendix 2 show where relevant in-situ variables for Ireland are measured and the centres where the data can be found. These tables are not to be considered exhaustive, as data for the same variable can be dispersed in several locations, depending on who collected it, in what context and using what instrumentation.



Figure 2: Met Éireann maintains a network of climatological stations across Ireland, such as this one in Newport, Co. Mayo. (© D. Perales, CMRC)

Whilst many of the ECVs are collected on a regular, ongoing basis, with national institutional funding, a number of them are collected on an irregular basis, often as part of

short-term projects funded by combinations of national and international funding. Table 2 indicates the source of funding for those ECVs of relevance to Ireland.

Table 1: ECVs as identified by GCOS.

Domain	ECVs	
Atmospheric (over land, sea and ice)	Surface	Air temperature, precipitation, air pressure, surface radiation budget, wind speed and direction, water vapour.
	Upper air	Earth radiation budget (including solar irradiance), upper-air temperature (including MSU radiances), wind speed and direction, water vapour, cloud properties.
	Composition	Carbon dioxide, methane, ozone, other long-lived greenhouse gases, ¹ aerosol properties.
Oceanic	Surface	Sea-surface temperature, sea-surface salinity, sea level, sea state, sea ice, current, ocean colour (for biological activity), carbon dioxide partial pressure.
	Subsurface	Temperature, salinity, current, nutrients, carbon, ocean tracers, phytoplankton.
Terrestrial	River discharge, water use, ground water, lake levels, snow cover, glaciers and ice caps, permafrost and seasonally frozen ground, albedo, land cover (including vegetation type), fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), biomass, fire disturbance.	

Table 2: Funding sources for relevant ECVs.

Domain	ECVs	Funding Source
Atmospheric (over land, sea and ice)	Surface: Air temperature, precipitation, air pressure, surface radiation budget, wind speed and direction, water vapour.	National
	Upper air: Earth radiation budget (including solar irradiance), upper-air temperature (including MSU radiances), wind speed and direction, water vapour, cloud properties.	National funding except for cloud properties. These have been funded with EU money on a project basis.
	Composition: Carbon dioxide, methane, ozone, other long-lived greenhouse gases, aerosol properties.	National: Ozone at Valentia Observatory. Full observation of other gases and aerosols are subject to availability of national and international funding on a project basis.
Oceanic	Surface: Sea-surface temperature, sea-surface salinity, sea level, sea state, current, ocean colour (for biological activity), carbon dioxide partial pressure.	National funding for in-situ measurements (only in the case of sea-surface temperature, sea-surface salinity and sea level).
	Subsurface: Temperature, salinity, current, nutrients, carbon, ocean tracers, phytoplankton.	National: Temperature, salinity and phytoplankton on a project basis. Nutrient observations have been funded with EU money on a project basis.
Terrestrial	River discharge, water use, ground water, lake levels, albedo, land cover (including vegetation type), fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), biomass.	National funding for in-situ measurements.

¹ Including nitrous oxide (N₂O), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF₆) and perfluorocarbons (PFCs).

3 Analysis of Action Plan

3.1 Overview

The GCOS Implementation Plan identifies a total of 110 actions that parties to the UNFCCC should carry out in the thematic areas of atmosphere, oceans and the terrestrial environment. In addition, 21 cross-cutting actions have been identified. These actions consider items that are common to all thematic areas, or coordination activities that are needed for the efficient implementation of the Plan. From this total of 155 actions, 24 key actions were identified as priority and critical in order to fill the gaps in the second adequacy report. It is desired by the GCOS Secretariat that these key actions are implemented before 2010.

For the purpose of this report, each set of actions was analysed in turn. The relevance to Ireland of each action item was determined. Certain actions were deemed not relevant (e.g. observation of sea ice), while others are to be implemented by international bodies (e.g. observation of the earth radiation budget) and are supported by Ireland. For those deemed relevant, information was gathered from the appropriate national data collecting agency as to the status of the action. Based on this information, the action items were either deemed fully implemented or requiring work. Table 3 summarises the status of all the actions identified in the report. The text of the implemented actions and those requiring work are given in Appendix 3. Terrestrial actions are anomalous in that few appear relevant to Ireland. From a global perspective, Ireland's land area and inland hydrological

components are very small; their monitoring is not required from a global climate perspective. Nevertheless, they require monitoring for national needs, and best practice with respect to the international Implementation Plan should be adopted.

In the sections below, a brief outline of the status of implemented actions is given. Actions where further work or consolidation efforts are required are also presented and discussed.

3.2 Key Actions

These are priority and critical actions that have been identified to fill the gaps identified in the second adequacy report and should be implemented in the first five years of the Plan. Of the 24 key actions identified (Appendix 4, Table A4.1), 7 of these are currently fully implemented in Ireland, and 11 are undertaken by international bodies and supported under commitments to these and do not require direct action (Appendix 4, Table A4.2), while 2 actions are not directly relevant for Ireland. The remaining four actions require work to reach full implementation. The status of the fully implemented actions and those requiring additional work are outlined below, while the text of these action items from the GCOS Implementation Plan is also given in Appendix 3. Actions that do not require direct action are listed in Appendix 4, Table A4.2. These are to be addressed by appropriate international bodies. GCOS 'supporting' actions require coordination with other Parties.

Table 3: Summary of implementation status in Ireland of GCOS actions.

	Implemented	Requires work	Support	Not relevant
Key	7	4	11	2
Cross-cutting	5	3	8	5
Atmosphere	12	5	6	9
Oceans	3	4	12	22
Terrestrial	–	1	8	28

3.2.1 Fully Implemented Actions

Key Action 1

Requirement

Parties need, both individually and collectively, to commit to the full implementation of the global observing system for climate, sustained on the basis of a mix of high-quality satellite measurements, ground-based and airborne in-situ and remote-sensing measurements, dedicated analysis infrastructure and targeted capacity-building.

Status

Ireland is committed to the implementation of the observing system and the majority of the elements required by the GCOS Implementation Plan are in place.

Key Action 5

Requirement

Parties are requested to undertake national coordination and planning and to produce national plans on their climate observing, archiving and analysis activities that address this Plan.

Status

A working group with representatives from Met Éireann, the Marine Institute and the EPA has been put in place to address this requirement. Resources have been allocated in order to progress the activity.

Key Action 13

Requirement

Parties are urged to: (a) establish a reference network of precipitation stations on key islands and moored buoys around the globe and at high latitudes; (b) submit national precipitation data (preferably hourly data) to the international data centres; and (c) support the further refinement of satellite precipitation measurement techniques.

Status

(a) There are currently no internationally accepted precipitation gauges for moored buoys, although international research is underway. Ireland is supportive of this activity. (b) National six-hourly precipitation amounts (at 00 06 12 18 UTC) from 15 terrestrial stations are currently submitted to the relevant data centre. (c) Ireland is supportive of this action.

Key Action 15

Requirement

Parties need to: (a) fully establish a baseline network for key greenhouse gases; (b) improve selected satellite observations of atmospheric constituents; and (c) extend existing networks to establish a global baseline network for atmospheric optical depth.

Status

(a) All major and minor greenhouse gases are measured at the Mace Head Atmospheric Research Station in Co. Galway. It should be noted that these measurements are supported by non-national funds but are of considerable interest on a national basis. (b) Via its membership of ESA and EUMETSAT, Ireland supports activities in this domain. (c) There are ongoing optical depth measurements at the Mace Head Atmospheric Research Station.

Key Action 16

Requirement

Parties need to: (a) complete and sustain the initial oceanic observing system for climate; (b) designate and support national Agents for Implementation for implementing this system; (c) establish effective partnerships between their ocean research and operational communities towards implementation; and (d) engage in timely, free and unrestricted data exchange.

Status

(a) The longest measurement record of sea surface temperature (SST) is at Malin Head where observations have been made since 1957. A series of six moored buoys are in place around the Irish coast. There are currently no plans to extend this network. One Argo float has also been deployed on a research basis.² There are currently plans to extend the number of floats deployed to 12 in the period 2008–2009. (b) The Marine Institute together with Met Éireann are the national Agents in charge of implementing the ocean observing system. (c) There is a sound relationship between the ocean research and operational communities within Ireland. (d) Oceanic data needed for climate studies are made available without restriction and in a timely manner. The Marine Institute maintains a web accessible metadata catalogue of its oceanographic holdings. This may be accessed at <http://www.marine.ie/home/publicationsdata/data/WebMapServices/>. Some data may be downloaded directly, while other data may be ordered offline. This is generally provided free of charge or at the cost of reproduction if large data volumes are involved.

Key Action 19

Requirement

Parties need to provide global coverage of the subsurface network by implementing and sustaining: (a) the Argo profiling float array; (b) the systematic sampling of the global ocean full-depth water column; (c) the Ship-of-Opportunity Expendable Bathythermograph (XBT) trans-oceanic sections; and (d) the Tropical Moored Buoy and reference mooring networks, as well as the satellite altimetry system.

Status

(a) One Argo float is currently deployed and maintained by the National University of Ireland, Galway on a research basis. This will be supplemented by the deployment of 12 new floats in 2008–2009. (b) Annual oceanographic surveys to full-depth water column are carried out by the Marine Institute to the west of Ireland. (c) The Marine Institute intends to implement an XBT system on a merchant vessel

between Ireland and Iceland with a view to maintaining this into the medium term. (d) Ireland does not contribute to the Tropical Moored Buoy Network. Via its membership of ESA, it supports use of satellite altimetry data.

Key Action 21

Requirement

Parties are urged to develop a global network of at least 30 reference sites (collocated with atmospheric sites if possible) to monitor key biomes and to provide the observations required in the calibration and validation of satellite data.

Status

Ireland maintains four phenological gardens. These are at the National Botanic Gardens, Dublin; Johnstown Castle, Co Wexford; J.F. Kennedy Arboretum, Co. Wexford; and Valentia Island, Co. Kerry – and are located near Met Éireann synoptic weather stations. However, the location of these gardens is not optimal as all except the Valentia garden are located in the south-east. It is desirable to further the development of phenological observations and to improve the geographical and compositional dimensions of these resources. The establishment of gardens in the north and west of the country is recommended. The siting of these should be subject to consultation with competent authorities and research groups.

3.2.2 Actions Requiring Work

Key Action 6

Requirement

Parties are requested to submit information on their activities with respect to systematic observation of all ECVs as part of their national communications to the UNFCCC, utilising an updated supplementary reporting format.

Status

The supplementary reporting format has not yet been utilised. Its use is foreseen for future national communications.

² The sustainability and long-term utilisation of data from this initiative is not clear. Further consideration of national utilisation of and support for Argo floats is required.



Figure 3: The National Botanic Gardens in Glasnevin, Co. Dublin is one of Ireland's four phenological gardens.

Key Action 7

Requirement

Parties are requested to address the needs of least-developed countries, small-island developing states and some countries with economies in transition for taking systematic climate observations by encouraging multilateral and bilateral technical cooperation programmes to support global observing systems for climate and by participating in the GCOS Cooperation Mechanism.

Status

Ireland's development assistance is focused on the least-developed countries, particularly those in sub-Saharan Africa. Ireland has bilateral development programmes with Lesotho, Ethiopia, Mozambique, Tanzania, Uganda, Zambia, Vietnam, Timor Leste and Malawi. Irish Aid also has programmes in South Africa, Liberia and Sierra Leone and operates throughout the world via the NGO partners and the UN. Ireland's assistance programme supports a wide range of activities, programmes and sectors that have benefits for countries addressing climate change. Many activities related to agriculture, health, infrastructure, water-resource management and disaster prevention have

positive impacts in terms of adaptation to climate change. Ireland also supports climate change activities through multilateral programmes and funds (including the Least Developed Countries Fund and the Special Climate Change Fund) and through support to international organisations and agencies (e.g. the UN Institute for Training and Research, the World Conservation Union, the International Institute for Environment and Development).

Irish Aid has programmed support for climate observing systems in Africa for 2007 and 2008. The GCOS Climate Information for Development in Africa Programme (ClimDev Africa) is an African programme aiming to integrate climate risk management (CRM) into pertinent policy and decision processes throughout the continent. It will be implemented under the direction of the Joint Secretariat (African Union, African Development Bank and the UN Economic Commission for Africa). ClimDev Africa aims to enhance progress towards the Millennium Development Goals through mitigating the vagaries of climate variability and climate change in a livelihoods-based approach, and to ensure that achievements already gained are climate resilient in the longer term (Irish Aid, 2006).

As soon as the programme documents are finalised and a trust fund established, Irish Aid will be one of several donors supporting this initiative.

Key Action 10

Requirement

Parties need to ensure that their climate-observing activities that contribute to GCOS adhere to the GCOS Climate Monitoring Principles (GCMPs) (Appendix 5).

Status

The Marine Institute and Met Éireann climate-observing activities do conform to the GCMP. However, data homogeneity checks are not carried out all the time on all meteorological variables. Such checks will be carried out in future, subject to the availability of the necessary resources.

Key Action 12

Requirement

Parties need to: (a) ensure the implementation and full operation of the following baseline networks and systems:

- GCOS Surface Network (GSN).
- The atmospheric component of the composite surface ocean observation system, including sea-level pressure.
- GCOS Upper Air Network (GUAN).
- Global Atmosphere Watch (GAW) Global CO₂ Network.
- MSU-like radiance satellite observations.
- Total solar irradiance and earth radiation budget satellite observations.

These need to be in accordance with the GCMPs, in order to specifically resolve reported problems, to ensure the exchange of these data with the international community, and to recover and exchange historical records; (b) establish a high-quality reference network of about 30 precision radiosonde stations and other collocated observations; and (c) exploit emerging new technology including the use of radio-occultation techniques and ground-based Global Positioning System (GPS) sensing of the total water column.

Status

(a) The GSN, GUAN and GAW Network are largely in place. However, not all the GCMPs are being implemented on all variables all the time. Data from the GSN and GUAN networks are exchanged on the Global Telecommunication System (GTS) that interconnects meteorological telecommunication centres. Historical observations, as digitised hourly values, are available from the Valentia Observatory and Malin Head GSN stations from October 1939 and May 1955 respectively. (b) The radiosonde network is in place and is in full compliance with coding conventions. (c) New technologies will be adopted if and when they become operational.

3.3 Overarching/Cross-Cutting Actions

Of the 21 cross-cutting actions identified, 5 of these are currently fully implemented in Ireland, 8 are undertaken by international bodies and supported under commitments to these and do not require direct action, while 5 actions are not directly relevant to Ireland. The remaining 3 actions require work to reach full implementation (Appendix 4, Table A4.3). Below, the status of the fully implemented actions and those actions requiring work are outlined, while the text of these action items from the GCOS Implementation Plan is also given in Appendix 3.

3.3.1 Fully Implemented Actions

Action C2

Requirement

Undertake national coordination and produce national plans for contributions to the global observing system for climate in the context of this Plan.

Status

A working group with representatives from Met Éireann, the Marine Institute and the Environmental Protection Agency has been put in place to address this requirement. Resources have also been allocated in order to progress this activity.

Action C11

Requirement

Prepare the data sets and metadata, including historic data records, for climate analyses and reanalyses.

Status

All relevant data sets and metadata are submitted to the appropriate international data centres. Climate data can also be requested from Met Éireann and the Marine Institute.

Action C14

Requirement

Collect, digitise and analyse the historical atmospheric, oceanic and terrestrial data records from the beginning of instrumental observations in a region and submit to international data centres.

Status

Historical records are being digitised as resources allow. Paper records of ship reports are being entered in a digital database. An inventory of digital data exists, while that for paper records is more dispersed. Information on historical climate conditions also exists in other documents such as annals, newspapers, estate records, etc. Little work is being done on the collation of this information at present.

Action C19

Requirement

Ensure timely, efficient and quality-controlled flow of all ECV data to international data centres.

Status

All relevant data sets are being submitted to the appropriate international data centres.

Action C20

Requirement

Ensure that data policies facilitate the exchange and archiving of all ECV data.

Status

ECVs are prepared and submitted to international data centres and are therefore available for archiving and exchange.

3.3.2 Actions Requiring Work

Action C4

Requirement

Report to the UNFCCC on systematic climate observations using an updated supplementary reporting format and guidelines.

Status

The supplementary reporting format has not yet been utilised. Its use is foreseen for future national communications.

Action C8

Requirement

Ensure that all climate observing activities adhere to the GCOS Climate Monitoring Principles (GCMPs) (Appendix 5).

Status

Climate-observing activities do conform to the GCMP. However, data homogeneity checks are not carried out all the time on all variables. Such checks will be carried out in future, subject to the availability of the necessary resources.

Action C21

Requirement

Develop modern distributed data services that can handle the increasing volumes of data and that can allow feedback to observing network management.

Status

The Irish Spatial Data Exchange (ISDE) (<http://www.isde.ie>) is a pilot project implemented in early 2006 to facilitate metadata and data sharing across networks between a number of key environmental data collection organisations within Ireland. The ISDE adheres to the ISO 19115 metadata standard. It is expected that this exchange will be enhanced, subject to resources being made available.

A working group under the auspices of the Department of the Environment is looking at the requirements for setting up an Irish Spatial Data Infrastructure (ISDI), The EU INSPIRE Directive which entered into force in May 2007 will also strongly influence data services. Currently there is no national policy regarding data exchange; hence, agencies have taken different approaches in this area.

3.4 Atmospheric Domain Actions

Of the 32 atmospheric domain actions identified, 12 of these are currently fully implemented in Ireland, 6 are undertaken by international bodies and supported under commitments to these and do not require direct action, while 9 actions are not directly relevant to Ireland. The remaining 5 actions require work to reach full implementation (Appendix 4, Table A4.4). Below, the status of the fully implemented actions and those actions requiring work are outlined, while the text of these action items from the GCOS Implementation Plan is also given in Appendix 3.

3.3.1 Fully Implemented Actions

Action A1

Requirement

Detailed analysis of causes of GSN faults, followed by full implementation of the GSN.

Status

Ireland has two nodes contributing to the GSN. Data are systematically routed to the appropriate international data centre. There are no known problems or faults in terms of observations and exchange of the required Irish GSN data.

Action A2

Requirement

Obtain major progress in implementation and systematic operation of the full World Weather Watch/Global Observing System (WWW/GOS) Regional Basic Synoptic Network (RBSN) in compliance with the Global Climate Monitoring Principles (GCMPs).

Status

Those synoptic stations which supply data for climate monitoring purposes are in compliance with the GCMPs.

Action A6

Requirement

Submit precipitation data from national networks to the international data centres.

Status

Six-hourly precipitation amounts (at 00 06 12 18 UTC) from 15 terrestrial stations are being supplied to the relevant international data centre.

Action A10

Requirement

Ensure availability of three-hourly mean sea-level pressure and wind speed and direction data from GSN stations.

Status

Pressure and wind data are supplied to the relevant international data centre.

Action A12

Requirement

Submit water vapour data from national networks to the international data centres.

Status

Water vapour data are supplied to the relevant international data centre.

Action A13

Requirement

Submit sunshine data from national networks to international data centres.

Status

Sunshine data are supplied from synoptic weather stations to the relevant international data centre.

Action A15

Requirement

Complete implementation of the GCOS Upper Air Network (GUAN), including infrastructure and data management.

Status

Infrastructure is in place at the Valentia Observatory in Cahirciveen and data are being supplied every six hours to the relevant international data centre.

Action A17

Requirement

Improve implementation of the WWW/GOS radiosonde network, compatible with the GCMPs and in full compliance with coding conventions.

Status

Radiosondes are deployed four times daily from the Valentia Observatory. Measurements are in full compliance with coding conventions. Almost all GCMPs are implemented.

Action A18

Requirement

Submit metadata records and inter-comparisons for radiosonde observations to international data centres.

Status

Metadata records are being submitted to appropriate international data centres.

Action A25

Requirement

Establish a plan for and implement a consistent surface- and satellite-based global observing system for the atmospheric composition ECVs, based on common standards and procedures, and encourage data submission to WDCs.

Status

The atmospheric composition ECVs (CO₂, CH₄, O₃, aerosols) are observed at one or other of the GAW stations located at Mace Head and the Valentia Observatory, and the data are submitted to the relevant international data centre. Ireland supports the ongoing work with satellite-based observing systems.

Action A27

Requirement

Establish the GCOS/GAW baseline network for CO₂ and CH₄, and fill the gaps in the network.

Status

The atmospheric concentrations of both CO₂ and CH₄ are measured at the Mace Head GAW station. Data are supplied to the relevant international data centre from where they are readily available.

Action A31

Requirement

Develop and implement a coordinated strategy to monitor and analyse the distribution of aerosols and aerosol properties.

Status

GAW recommends that at least five core aerosol parameters are measured routinely at GAW stations. Three of these are measured at the Mace Head Atmospheric Research Station. The GAW review (Barrie and Puckett, 2006) recommended that routine mass and aerosol chemistry in two size ranges are added to the surface measurement programme at Mace Head.



Figure 4: Met Éireann maintains a network of synoptic stations across Ireland.

3.3.2 Actions Requiring Work

Action A3

Requirement

Apply the GCOS Climate Monitoring Principles (GCMPs) to all surface climate networks.

Status

The GCMPs are being applied. However, data homogeneity checks are not carried out all the time on all variables. Such checks will be carried out in future, subject to the availability of the necessary resources.

Action A14

Requirement

Expand the Baseline Surface Radiation Network (BSRN) to obtain global coverage and establish a formal analysis infrastructure.

Status

Valentia Observatory is responsible within Met Éireann for the national online surface radiation (SR) network, which has 7 long-running stations and 13 recent stations. Broadly, it follows the BSRN quality assurance procedures. There are state-of-the-art SR calibration facilities at the Valentia Observatory, with standards traceable to the international standard. However, as the chief scientist at the observatory does not participate in research and development activities, the station does not meet the stringent conditions for BSRN membership.

Action A23

Requirement

Research to improve cloud property observations in three dimensions.

Status

Plans are in place at the National University of Ireland, Galway to extend the research started as part of the Framework 5-funded CloudNET project, subject to funding availability. The main objectives of the CloudNET project were 'to optimise the use of existing data sets to develop and validate cloud remote sensing synergy algorithms and to demonstrate the importance of an operational network of cloud remote-sensing stations to provide data for the improvement of the representation of clouds in climate and weather forecast models and for the use of GCOS' (University of Reading, 2007).

Action A26

Requirement

Develop and implement a comprehensive plan to observe the vertical profiles of greenhouse gases, ozone and aerosols, utilising commercial and research aircraft, pilotless aircraft, balloon systems, kites, ground-based LIDARs and satellites.

Status

The National University of Ireland, Galway has intentions to initiate work in this area, subject to enabling funds being put in place.

Action A30

Requirement

Define and implement the Baseline Ozone Observing Network for balloon vertical profiles and total column ozone and initiate implementation.

Status

Balloon vertical profiles and total column ozone are being observed at Valentia Observatory GAW station during the winter and spring months. The GAW review (Barrie and Puckett, 2006) recommended that ozone-sonde measurements be extended to all year round. Resources are being put in place to enable this on a project basis. The scope to ensure that these are continued on a long-term basis should be explored.



Figure 5: One of the two GAW stations in Ireland is located at Mace Head in Co. Galway.

3.5 Oceanic Domain Actions

Of the 41 oceanic domain actions identified, 3 of these are currently fully implemented, 13 are undertaken by international bodies and supported under commitments to these and do not require direct action, while 22 actions are not directly relevant to Ireland. The remaining 4 actions require work to reach full implementation (Appendix 4, Table A4.5). Below, the status of the fully implemented actions and those actions requiring work are outlined, while the text of these action items from the GCOS Implementation Plan is also given in Appendix 3.

3.4.1 Fully Implemented Actions

Action O6

Requirement

Improve metadata acquisition and management for a selected, expanding subset of Voluntary Observing Ships (VOS–VOSclim), together with improved measurement systems.

Status

Meteorological data and associated metadata are collected on the two national research vessels. Meteorological data is collected using the shipboard automatic weather station system known as BATOS. Metadata are managed within an information system complying with international metadata standards.

Action O11

Requirement

Implement the GCOS subset of the GLOSS Core Network for sea-level observations, with geocentrically located, high-accuracy gauges. Ensure real-time exchange and archiving of data. Ensure historical sea-level records are recovered and exchanged.

Status

Two stations in Ireland (Malin Head and Castletownsend) are part of the GLOSS network. Data are submitted to the relevant international data centre. Thirteen new stations are currently being installed as part of the Irish National Tide Gauge Network (<http://www.marine.ie/home/services/operational/oceanography/TideGauge.htm>) and are compatible with GLOSS standards.

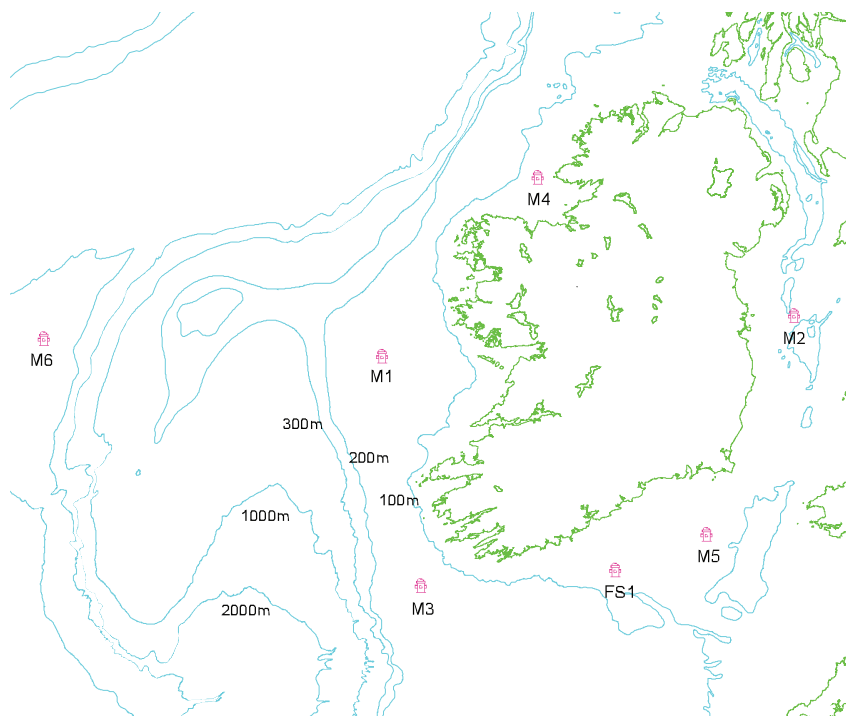


Figure 6: A series of moored boys in Irish waters provide meteorological and oceanographic data on a near real-time basis.

Action O25

Requirement

Perform the systematic global full-depth water column sampling of 30 sections repeated every 10 years.

Status

Annual oceanographic surveys to full water column depth are carried out to the west of Ireland. Data are submitted to the National Oceanographic Data Centre (NODC) and the International Council for the Exploration of the Sea (ICES).

3.4.2 Actions Requiring Work

Action O13

Requirement

Ensure high-frequency, sea-level observations are available for all coastal regions (including historical records) and submitted to the international archive.

Status

It is anticipated that high-frequency sea-level data from eight gauges will be delivered to the European

Sea-Level Service (ESEAS) by early 2008. ESEAS is an element of GLOSS. Information on current tidal heights can be accessed via the recently established Irish National Tide Gauge Network (<http://www.irishtides.ie>) which has 11 reporting nodes as of August 2007. It is anticipated that up to 40 nodes will be operational by 2010.

Action O15

Requirement

Develop a robust programme to observe sea-surface salinity to include VOS ships, research ships, reference moorings and drifting buoys.

Status

VOS activity is very limited. Sea-surface salinity is collected by *The Celtic Voyager* and the *Celtic Explorer* research vessels only (10-second intervals). These vessels spend over 300 and 200 days at sea respectively each year. The collected salinity data are quality controlled, gridded and archived in monthly data files.



Figure 7: The *Celtic Explorer* is one of two national research vessels operated by the Marine Institute. During its cruises it measures a number of climate relevant oceanographic variables. (© É.Ó Tuama, CMRC)

A scoping study has also been carried out regarding the possibility of installing a salinometer on a vessel that sails from Foynes, Co. Limerick to Reykjavik, Iceland. Installation of such a device is subject to funding being made available. There is some scope to acquire oceanographic information using a recently procured underwater Glider vehicle. This will be tested during 2008.

Action O31

Requirement

Develop and deploy in a reference network robust autonomous in-situ instrumentation for biogeochemical and ecosystem variables.

Status

Instrumentation has been installed on the North Bank Lighthouse in Dublin Bay as part of the Marine Institute's involvement in the MATSIS project funded by INTEREG IIIA. This project focuses on measuring the trophic status of the Irish Sea. The variables measured include temperature, salinity, dissolved oxygen, fluorescence and turbidity.

The European Marine Ecosystem Coastal Observatory (EMECO) is an initiative led by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) in the United Kingdom to put in place a long-term in-situ observing system for a range of biogeochemical and ecosystem variables. The Marine Institute is following this development with interest. However, resources are required in order for Ireland to maintain existing instrumentation (e.g. MATSIS) and establish a long-term monitoring system. Deployment of a number of coastal buoy platforms is planned to measure biogeochemical and physical variables off the west coast of Ireland.

Action O37

Requirement

Support data rescue projects.

Status

Paper records of ship reports are being digitised, quality controlled and inserted into an electronic database by Met Éireann. Data up to 1998 had been completed by the end of 2006 and the work is expected to be completed by early 2008. The database has 2.5 million records, spanning just over 150 years and covers a broad area around Ireland. These data can be accessed on request to Met Éireann.

3.6 Terrestrial Domain Actions

Of the 37 terrestrial domain actions identified, eight are undertaken by international bodies and supported under commitments to these and do not require direct action, while 28 actions are not directly relevant to Ireland. The one remaining action requires work to reach full implementation (Appendix 4, Table A4.6). Below, the status of this action is outlined. Terrestrial actions also include those relating to freshwater hydrological bodies: however, for GCOS requirements, all Irish water bodies are below the size required for reporting.

3.5.1 Actions Requiring Work

Action T36

Requirement

Expand the Terrestrial Ecosystem Monitoring Sites (TEMS) to support the metadata collection, collation and publication needs of the terrestrial ECVs and associated data centres.

Status

A total of 24 TEMS sites and projects for Ireland are registered. Details for some of these are missing or out of date. It is not clear if the data collected are compatible with the TEMS requirements.

4 Conclusions and Recommendations

4.1 Conclusions

The GCOS Implementation Plan contains 110 actions that cover the atmospheric, oceanic and terrestrial domains. In addition, there are 45 key and cross-cutting actions to be implemented by signatories to the UNFCCC. Of these 155 actions, specific action on implementation by Ireland is required for a total of 43. To date, 26 (60%) of these are fully implemented. Work is underway or is still required for the remaining 17 actions in order to meet the full implementation requirements.

In general, Ireland is fulfilling its climate observation commitments in regard to the UNFCCC. However, there are a number of areas in which additional funding and resources are required to augment existing programmes or to put in place new monitoring programmes.

This analysis in relation to international requirements provides a global framework for development of national observations in support of analysis of signals of climate change. Such global systems do not reflect adequately the observational needs for smaller countries and local areas. Observation systems are particularly needed for areas and ecosystems that are recognised as being vulnerable to climate impacts or have critical responses to climate impacts.

This report provides the international context within which the requirements for climate monitoring and related data analysis to support national programmes, including climate change adaptation, can be developed. The assessment of these requirements will be the next step in this process.

4.2 Recommendations

Resulting from the analysis of the GCOS Implementation Plan, a number of recommendations can be made:

- Existing systematic observing programmes must be maintained and sufficient resources and funds allocated for their ongoing upkeep. Any degradation of these systems must be avoided. Appropriate time overlap of observations should be maintained when systems are upgraded or measurement location modified.
- The maintenance and appropriate resourcing of existing long-term climate observatories is essential (e.g. Malin Head sea-surface temperature measurements since 1957).
- For those actions where additional work is needed in order to meet the full implementation requirements, a clear plan including resource requirements and a timetable should be put in place by the relevant organisations.
- Additional resources are required to support observations in a number of areas:
 - Extension of atmospheric ozone-sonde measurements to all year round.
 - Extension of the Voluntary Observing Ship (VOS) observations.
 - Implementation of an in-situ measurement system for oceanographic biogeochemical and ecosystem variables.
 - Establishment of long-term terrestrial ecological monitoring sites, including the expansion of the phenological garden network.
 - Establishment of the Mace Head Atmospheric Research Station as a unique marine cloud observing location.

- Funding for such observations needs to be provided on an ongoing and long-term rather than on a project basis.
- The recommendations of Barrie and Puckett (2006) with regard to the Valentia Observatory and Mace Head GAW stations should be implemented.
- There is a need to develop a comprehensive and clear data policy with regard to climate observations. Currently, the different collecting agencies implement a range of procedures with regard to providing access to data.
- It is highly desirable that protection of observing sites from adjacent development is incorporated into development planning at local level.
- In addition to fulfilling climate observation obligations as part of international agreements, Ireland needs to develop a comprehensive national climate observation plan in order to improve understanding of climate change and its effects locally.

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Acronyms

ARGO	global array of profiling floats
BSRN	Baseline Surface Radiation Network
CDIAC	Carbon Dioxide Information Analysis Centre
CFC	chlorofluorocarbon
ClimDev Africa	Climate Information for Development in Africa Programme
CORINE	Coordination of Information on the Environment
CRM	climate risk management
CTD	conductivity, temperature and depth
ECV	Essential Climate Variable
EMECO	European Marine Ecosystem Coastal Observatory
EOEP	Earth Observation Envelope Programme
EPA	Environmental Protection Agency
ESA	European Space Agency
ESEAS	European Sea Level Service
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
fAPAR	fraction of absorbed photosynthetically active radiation
GAW	Global Atmosphere Watch (WMO)
GCMP	GCOS Climate Monitoring Principle
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GLOSS	Global Sea-Level Observing System
GMES	Global Monitoring for Environment and Security
GOS	Global Observing System (WMO)
GOSUD	Global Ocean Surface Underway Data Pilot Project

GPS	Global Positioning System
GRDC	Global Runoff Data Centre
GSI	Geological Survey of Ireland
GSN	GCOS Surface Network
GTN	Global Terrestrial Network
GTS	Global Telecommunications System
GUAN	GCOS Upper Air Network
ICES	International Council for the Exploration of the Sea
IGOS	Integrated Global Observing Strategy
IGRA	Integrated Global Radiosonde Archive
INSPIRE	Infrastructure for Spatial Information in Europe
IOCCG	International Ocean-Colour Coordinating Group
ISDE	Irish Spatial Data Exchange
ISDI	Irish Spatial Data Infrastructure
JRC	Joint Research Centre
LAI	leaf area index
LIDAR	light detection and ranging
MIDA	Marine Irish Digital Atlas
MSU	microwave sounding unit
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Centre (NOAA)
NDSC	Network for Detection of Stratospheric Change
NGO	non-governmental organisation
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Centre
NUI	National University of Ireland
NODC	National Oceanographic Data Centre
OPW	Office of Public Works

PMEL	Pacific Marine Environmental Laboratory (NOAA)
RBSN	Regional Basic Synoptic Network
TEMS	Terrestrial Ecosystem Monitoring Site
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VOS	Voluntary Observing Ship
VOSCLIM	Voluntary Observing Ship Climate Project
WDC	World Data Centre
WDCA	World Data Centre for Aerosols
WDCGG	World Data Centre for Greenhouse Gases
WMO	World Meteorology Office
WOA01	World Ocean Atlas 2001
WOUDC	World Ozone and Ultraviolet Radiation Data Centre
WWW	World Weather Watch
XBT	expendable bathythermograph

Appendix 1: Essential Climate Variables

ECVs that are both currently feasible for global implementation and have a high impact on UNFCCC requirements (GCOS, 2003).

Table A1.1: Essential Climate Variables as identified by GCOS domains.

Domain	ECVs	
Atmospheric (over land, sea and ice)	Surface	Air temperature, precipitation, air pressure, surface radiation budget, wind speed and direction, water vapour.
	Upper air	Earth radiation budget (including solar irradiance), upper-air temperature (including MSU radiances), wind speed and direction, water vapour, cloud properties.
	Composition	Carbon dioxide, methane, ozone, other long-lived greenhouse gases, aerosol properties.
Oceanic	Surface	Sea-surface temperature, sea-surface salinity, sea level, sea state, sea ice, current, ocean colour (for biological activity), carbon dioxide partial pressure.
	Subsurface	Temperature, salinity, current, nutrients, carbon, ocean tracers, phytoplankton.
Terrestrial	River discharge, water use, ground water, lake levels, snow cover, glaciers and ice caps, permafrost and seasonally frozen ground, albedo, land cover (including vegetation type), fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), biomass, fire disturbance.	

Appendix 2: Data Centres for Essential Climate Variables

The GCOS Implementation Plan lists a number of ECVs that parties to UNFCCC should be measuring. The tables below show where relevant in-situ variables for Ireland are measured and the centres where the data can be found. These tables are not to be considered exhaustive, as data for the same variable can be dispersed in several locations, depending on who collected it, in what context and using what instrumentation.

A2.1 Atmospheric domain – surface.

Table A2.1: Essential Climate Variables as identified by GCOS domains.

Variable name	Measurement location	Data centre	URL
Temperature	Synoptic stations	NCDC	http://cdo.ncdc.noaa.gov/CDO/cdo
Air pressure	Synoptic stations	NCDC	http://cdo.ncdc.noaa.gov/CDO/cdo
Wind speed/direction	Synoptic stations	NCDC	http://cdo.ncdc.noaa.gov/CDO/cdo
Precipitation	Synoptic stations	NCDC	http://cdo.ncdc.noaa.gov/CDO/cdo

Table A2.2: Atmospheric domain – upper air.

Variable name	Measurement location	Data centre	URL
Temperature	Valentia Observatory	IGRA	http://www.ncdc.noaa.gov/oa/climate/igra/index.php
Wind speed/direction	Valentia Observatory	IGRA	http://www.ncdc.noaa.gov/oa/climate/igra/index.php
Water vapour	Valentia Observatory		
Cloud properties	Satellite		

Table A2.3: Atmospheric domain – composition.

Variable name	Measurement location	Data centre	URL
Carbon dioxide	Mace Head	WDCGG	http://gaw.kishou.go.jp/wdchg.html
Methane and other greenhouse gases	Mace Head	WDCGG	http://gaw.kishou.go.jp/wdchg.html
Ozone	Mace Head	WOUDC	http://www.woudc.org/data_e.html
Aerosol properties	Mace Head	WDCA	http://wdca.jrc.it/

Table A2.4: Oceanic domain – surface.

Variable name	Measurement location	Data centre	URL
Temperature	Fixed data buoys	Marine Institute	http://www.marine.ie/home/publicationsdata/data/buoys/
Salinity	Research vessels	Marine Institute	http://www.marine.ie/home/publicationsdata/data/MarineDataOnline.htm
	Research vessels (global)	GOSUD	http://www.gosud.org/
Sea level	Malin Head, Castletownsend	GLOSS	http://www.gloss-sealevel.org/
	Tide Gauge Network	Marine Institute	http://www.marine.ie/home/services/operational/oceanography/TideGauge.htm
CO ₂ partial pressure	Global	CDIAC	http://cdiac.esd.ornl.gov/oceans/global_pco2.html
Ocean colour	Research vessels	Marine Institute	http://www.marine.ie/home/publicationsdata/data/MarineDataOnline.htm
	Satellite and in-situ	IOCCG	http://www.ioccg.org/
Sea state (wave height, direction, length, period)	Fixed data buoys	Marine Institute	http://www.marine.ie/home/publicationsdata/data/buoys/
Surface current	No information available		
Sea ice	Not relevant		

Table A2.5: Oceanic domain – subsurface.

Variable name	Measurement location	Data centre	URL
Temperature	Argo floats	Coriolis	http://www.coriolis.eu.org/
	Research vessels (CTD)	Marine Institute	http://www.marine.ie/home/publicationsdata/data/MarineDataOnline.htm
Salinity	Argo floats	Coriolis	http://www.coriolis.eu.org/
	Research vessels (CTD)	Marine Institute	http://www.marine.ie/home/publicationsdata/data/MarineDataOnline.htm
Currents	Argo floats	Coriolis	http://www.coriolis.eu.org/
Nutrients (oxygen, phosphorus, nitrates, silicates)	World Ocean Atlas	WOA01	http://iridl.ldeo.columbia.edu/SOURCES/NOAA/NOODC/WOA01/dataset_documentation.html
	Research vessels (CTD)	Marine Institute	http://www.marine.ie/home/publicationsdata/data/MarineDataOnline.htm
Carbon	Cruise tracks	NOAA/PMEL	http://www.pmel.noaa.gov/co2/hydro/
Ocean tracers	No information available		
Phytoplankton	Ships of Opportunity	SAHFOS	http://192.171.163.165/data.htm

Table A2.6: Terrestrial

Variable name	Measurement location	Data centre	URL
River discharge	Hydrometric stations	GRDC	http://grdc.bafg.de/servlet/is/987/
	Hydrometric stations	OPW	http://www.opw.ie/hydro/home.asp
	Hydrometric stations	EPA	http://www.epa.ie/downloads/pubs/water/flows/
Lake level	Hydrometric stations	OPW	http://www.opw.ie/hydro/home.asp
	Hydrometric stations	EPA	http://www.epa.ie/downloads/pubs/water/flows/
Ground waters (levels and use)	Groundwater monitoring network	EPA	http://www.epa.ie/environment/water/ground/
Water use (areas of irrigated land)	Not relevant		
Snow	Not relevant		
Glaciers	Not relevant		
Permafrost	Not relevant		
Albedo	Satellite	NASA	http://modis-atmos.gsfc.nasa.gov/ALBEDO/
Landcover	Satellite	EPA	http://www.epa.ie/OurEnvironment/Land/CorineLandCover/
	Satellite	MIDA	http://mida.ucc.ie/
fAPAR/LAI	Satellite	JRC	http://fapar.jrc.it/
Biomass	Satellite		
Fire disturbance	Not relevant		

Appendix 3: Text of all Fully Implemented and Requiring Work Action Items from the GCOS Implementation Plan

Key Actions

Key Action 1 (fully implemented)

Parties need, both individually and collectively, to commit to the full implementation of the global observing system for climate, sustained on the basis of a mix of high-quality satellite measurements, ground-based and airborne in-situ and remote-sensing measurements, dedicated analysis infrastructure and targeted capacity building.

Key Action 5 (fully implemented)

Parties are requested to undertake national coordination and planning, and produce national plans on their climate observing, archiving and analysis activities that address this Plan.

Key Action 6 (requiring work)

Parties are requested to submit information on their activities with respect to systematic observation of all ECVs as part of their national communications to the UNFCCC utilising an updated supplementary reporting format.

Key Action 7 (requiring work)

Parties are requested to address the needs of least-developed countries, small-island developing states and some countries with economies in transition for taking systematic climate observations by encouraging multilateral and bilateral technical cooperation programmes to support global observing systems for climate and by participating in the GCOS Cooperation Mechanism.

Key Action 10 (requiring work)

Parties need to ensure that their climate-observing activities that contribute to GCOS adhere to the GCOS Climate Monitoring Principles (GCMPs) (Appendix 5).

Key Action 12 (requiring work)

Parties need to: (a) ensure the implementation and full operation of the following baseline networks and systems.

- GCOS Surface Network (GSN).
- The atmospheric component of the composite surface ocean observation system including sea-level pressure.
- GCOS Upper Air Network (GUAN).
- Global Atmosphere Watch (GAW) Global CO₂ Network.
- MSU-like radiance satellite observations.
- Total solar irradiance and earth radiation budget satellite observations.

Key Action 13 (fully implemented)

Parties are urged to: (a) establish a reference network of precipitation stations on key islands and moored buoys around the globe and at high latitudes; (b) submit national precipitation data (preferably hourly data) to the international data centres; and (c) support the further refinement of satellite precipitation measurement techniques.

Key Action 15 (fully implemented)

Parties need to: (a) fully establish a baseline network for key greenhouse gases; (b) improve selected satellite observations of atmospheric constituents; and (c) extend existing networks to establish a global baseline network for atmospheric optical depth.

Key Action 16 (fully implemented)

Parties need to: (a) complete and sustain the initial oceanic observing system for climate; (b) designate and support national Agents for Implementation for implementing this system; (c) establish effective partnerships between their ocean research and operational communities towards implementation; and (d) engage in timely, free and unrestricted data exchange.

Key Action 19 (fully implemented)

Parties need to provide global coverage of the subsurface network by implementing and sustaining: (a) the Argo profiling float array; (b) the systematic sampling of the global ocean full-depth water column; (c) the Ship-of-Opportunity Expendable Bathythermograph (XBT) trans-oceanic sections; and (d) the Tropical Moored Buoy and reference mooring networks, as well as the satellite altimetry system.

Key Action 21 (fully implemented)

Parties are urged to develop a global network of at least 30 reference sites (collocated with atmospheric sites if possible) to monitor key biomes and to provide the observations required in the calibration and validation of satellite data.

Cross-Cutting Actions

Action C2 (fully implemented)

Undertake national coordination and produce national plans for contributions to the global observing system for climate in the context of this Plan.

Action C4 (requiring work)

Report to the UNFCCC on systematic climate observations using an updated supplementary reporting format and guidelines.

Action C8 (requiring work)

Ensure that all climate observing activities adhere to the GCOS Climate Monitoring Principles (GCMPs) (Appendix 5).

Action C11 (fully implemented)

Prepare the data sets and metadata, including historic data records, for climate analyses and reanalyses.

Action C14 (fully implemented)

Collect, digitise and analyse the historical atmospheric, oceanic and terrestrial data records from the beginning of instrumental observations in a region and submit to international data centres.

Action C19 (fully implemented)

Ensure timely, efficient and quality-controlled flow of all ECV data to international data centres.

Action C20 (fully implemented)

Ensure that data policies facilitate the exchange and archiving of all ECV data.

Action C21 (requiring work)

Develop modern distributed data services that can handle the increasing volumes of data and that can allow feedback to observing network management.

Atmospheric Actions

Action A1 (fully implemented)

Detailed analysis of causes of GSN faults, followed by full implementation of the GSN.

Action A2 (fully implemented)

Obtain major progress in implementation and systematic operation of the full WWW/GOS Regional Basic Synoptic Network (RBSN) in compliance with the Global Climate Monitoring Principles (GCMPs).

Action A3 (requiring work)

Apply the GCOS Climate Monitoring Principles (GCMPs) to all surface climate networks.

Action A6 (fully implemented)

Submit precipitation data from national networks to the international data centres.

Action A10 (fully implemented)

Ensure availability of three-hourly mean sea-level pressure and wind speed and direction data from GSN stations.

Action A12 (fully implemented)

Submit water vapour data from national networks to the international data centres.

Action A13 (fully implemented)

Submit sunshine data from national networks to international data centres.

Action A14 (requiring work)

Expand the Baseline Surface Radiation Network (BSRN) to obtain global coverage and establish a formal analysis infrastructure.

Action A15 (fully implemented)

Complete implementation of the GCOS Upper Air Network (GUAN), including infrastructure and data management.

Action A17 (fully implemented)

Improve implementation of the World Weather Watch/Global Observing System (WWW/GOS) radiosonde network, compatible with the GCMPs and in full compliance with coding conventions.

Action A18 (fully implemented)

Submit metadata records and inter-comparisons for radiosonde observations to international data centres.

Action A23 (requiring work)

Research to improve cloud property observations in three dimensions.

Action A25 (fully implemented)

Establish a plan for and implement a consistent surface- and satellite-based global observing system for the atmospheric composition ECVs, based on common standards and procedures, and encourage data submission to WDCs.

Action A26 (requiring work)

Develop and implement a comprehensive plan to observe the vertical profiles of greenhouse gases, ozone and aerosols, utilising commercial and research aircraft, pilotless aircraft, balloon systems, kites, ground-based LIDARs and satellites.

Action A27 (fully implemented)

Establish the GCOS/GAW baseline network for CO₂ and CH₄, and fill the gaps in the network.

Action A30 (requiring work)

Define and implement the Baseline Ozone Observing Network for balloon vertical profiles and total column ozone, and initiate implementation.

Action A31 (fully implemented)

Develop and implement a coordinated strategy to monitor and analyse the distribution of aerosols and aerosol properties.

Oceanic Actions

Action O6 (fully implemented)

Improve metadata acquisition and management for a selected, expanding subset of Voluntary Observing Ships (VOS–VOSCLIM) together with improved measurement systems.

Action O11 (fully implemented)

Implement the GCOS subset of the GLOSS Core Network for sea-level observations, with geocentrically located high-accuracy gauges. Ensure real-time exchange and archiving of data. Ensure historical sea-level records are recovered and exchanged.

Action O13 (requiring work)

Ensure high-frequency sea-level observations are available for all coastal regions (including historical records) and submitted to the international archive.

Action O15 (requiring work)

Develop a robust programme to observe sea-surface salinity to include VOS ships, research ships, reference moorings and drifting buoys.

Action O25 (fully implemented)

Perform the systematic global full-depth water column sampling of 30 sections repeated every 10 years.

Action O31 (requiring work)

Develop and deploy in a reference network robust autonomous in-situ instrumentation for biogeochemical and ecosystem variables.

Action O37 (requiring work)

Support data rescue projects.

Terrestrial Actions

Action T36 (requiring work)

Expand the Terrestrial Ecosystem Monitoring Sites (TEMS) to support the metadata collection, collation and publication needs of the terrestrial ECVs and associated data centres.

Appendix 4: Status of all Action Items from the GCOS Implementation Plan

Table A4.1: Relevance to Ireland of key action items from the GCOS report.

Key action	Implemented	Supported	Not relevant	Requires work
1	X			
2		X		
3		X		
4			X	
5	X			
6				X
7				X
8		X		
9			X	
10				X
11		X		
12				X
13	X			
14		X		
15	X			
16	X			
17		X		
18		X		
19	X			
20		X		
21	X			
22		X		
23		X		
24		X		

Table A4.2: Key actions to be supported or undertaken by international bodies.

Key Action 2: Parties need to provide support for an International Project Office to provide overall coordination, to monitor performance, to report regularly on implementation, to initiate corrective actions, and to oversee the GCOS Cooperation Mechanism.
Key Action 3: The international and intergovernmental organisations need to incorporate the relevant actions in this Plan within their own plans and actions.
Key Action 8: Parties need to ensure that international data centres are established and/or strengthened for all ECVs.
Key Action 11: International standards for metadata for all ECVs need to be established and adopted by the Parties in creation and archiving of climate data records.
Key Action 14: Parties need to: (a) ensure the continued operation of satellite measurements of the earth radiation budget and solar irradiance (e.g. the NASA Earth Radiation Budget Experiment); and (b) support research to extend and improve current capabilities for monitoring clouds as a high priority.
Key Action 17: Parties need to ensure climate quality and continuity for essential ocean satellite observations.
Key Action 18: Parties need to provide global coverage of the surface network by implementing and sustaining: (a) the GCOS baseline network of tide gauges; (b) an enhanced drifting buoy array; (c) an enhanced Tropical Moored Buoy Network; (d) an enhanced Voluntary Observing Ships Climatology (VOSCLIM) network; and (e) a globally distributed reference mooring network.
Key Action 20: Parties are urged to support the operational continuation of the satellite-based products.
Key Action 22: Parties are urged to: (a) fill the identified gaps in the global networks for permafrost, glaciers, rivers and lakes; (b) provide support for the designated international data centres; and (c) submit current and historical data to the international data centres.
Key Action 23: Parties are urged to adopt an internationally coordinated approach to the development of integrated global climate products and to make them accessible to all Parties. As far as possible, these products should incorporate past data covering at least the last 30 years in order to serve as a reference for climate variability and change studies.
Key Action 24: Parties are urged to give high priority to establishing a sustained capacity for global climate reanalysis, to develop improved methods for such reanalysis, and to ensure coordination and collaboration among centres conducting reanalyses.

Table A4.3: Status of overarching/cross-cutting actions from the GCOS report.

Action	Implemented	To support	Not relevant	Requires work
C1			X	
C2	X			
C3		X		
C4				X
C5			X	
C6		X		
C7		X		
C8				X
C9		X		
C10		X		
C11	X			
C12		X		
C13		X		
C14	X			
C15			X	
C16			X	
C17			X	
C18		X		
C19	X			
C20	X			
C21				X

Table A4.4: Status of atmospheric domain actions from the GCOS report.

Action	Implemented	Supported	Not relevant	Requires work
A1	X			
A2	X			
A3				X
A4			X	
A5			X	
A6	X			
A7		X		
A8		X		
A9		X		
A10	X			
A11			X	
A12	X			
A13	X			
A14				X
A15	X			
A16		X		
A17	X			
A18	X			
A19			X	
A20			X	
A21		X		
A22			X	
A23				X
A24			X	
A25	X			
A26				X
A27	X			
A28			X	
A29		X		
A30				X
A31	X			
A32			X	

Table A4.5: Status of oceanic domain actions from the GCOS report.

Action	Implemented	Supported	Not relevant	Requires work
O1			X	
O2			X	
O3		X		
O4			X	
O5			X	
O6	X			
O7			X	
O8		X		
O9			X	
O10		X		
O11	X			
O12			X	
O13				X
O14			X	
O15				X
O16			X	
O17			X	
O18		X		
O19		X		
O20			X	
O21			X	
O22			X	
O23			X	
O24			X	
O25	X			
O26		X		
O27			X	
O28			X	
O29		X		
O30		X		
O31				X
O32			X	
O33			X	
O34			X	
O35			X	
O36		X		
O37				X
O38		X		
O39			X	
O40		X		
O41		X		

Table A4.6: Relevance to Ireland of terrestrial items from the GCOS report.

Action	Implemented	To support	Not relevant	Requires work
T1			X	
T2		X		
T3		X		
T4			X	
T5			X	
T6			X	
T7			X	
T8			X	
T9			X	
T10			X	
T11			X	
T12			X	
T13			X	
T14			X	
T15			X	
T16			X	
T17			X	
T18			X	
T19			X	
T20			X	
T21			X	
T22			X	
T23			X	
T24			X	
T25		X		
T26		X		
T27			X	
T28			X	
T29		X		
T30		X		
T31		X		
T32			X	
T33			X	
T34			X	
T35			X	
T36				X
T37		X		

Appendix 5: GCOS Climate Monitoring Principles

1. The impact of new systems or changes to existing systems should be assessed prior to implementation.
2. A suitable period of overlap for new and old observing systems should be required.
3. The results of calibration, validation and data homogeneity assessments, and assessments of algorithm changes should be treated with the same care as data.
4. A capacity to routinely assess the quality and homogeneity of data on extreme events, including high-resolution data and related descriptive information, should be ensured.
5. Consideration of environmental climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.
6. Uninterrupted station operations and observing systems should be maintained.
7. A high priority should be given to additional observations in data-poor regions and regions sensitive to change.
8. Long-term requirements should be specified to network designers, operators and instrument engineers at the outset of new system design and implementation.
9. The carefully planned conversion of research observing systems to long-term operations should be promoted.
10. Data management systems that facilitate access, use and interpretation should be included as essential elements of climate monitoring systems.

Furthermore, satellite systems for monitoring climate need to:

- (a) Take steps to make radiance calibration, calibration-monitoring and satellite-to-satellite cross-calibration of the full operational constellation a part of the operational satellite system.
- (b) Take steps to sample the earth system in such a way that climate-relevant (diurnal, seasonal, and long-term inter-annual) changes can be resolved.

Thus, satellite systems for climate monitoring should adhere to the following specific principles.

11. Constant sampling within the diurnal cycle (minimising the effects of orbital decay and orbit drift) should be maintained.
12. A suitable period of overlap for new and old satellite systems should be ensured for a period adequate to determine inter-satellite biases and maintain the homogeneity and consistency of time-series observations.
13. Continuity of satellite measurements (i.e. elimination of gaps in the long-term record) through appropriate launch and orbital strategies should be ensured.
14. Rigorous pre-launch instrument characterization and calibration, including radiance confirmation against an international radiance scale provided by a national metrology institute, should be ensured.
15. On-board calibration adequate for climate system observations should be ensured and associated instrument characteristics monitored.
16. Operational production of priority climate products should be sustained and peer-reviewed new products should be introduced as appropriate.
17. Data systems needed to facilitate user access to climate products, meta-data and raw data, including key data for delayed-mode analysis, should be established and maintained.
18. Use of functioning baseline instruments that meet the calibration and stability requirements stated above should be maintained for as long as possible, even when these exist on de-commissioned satellites.
19. Complementary in-situ baseline observations for satellite measurements should be maintained through appropriate activities and cooperation.
20. Random errors and time-dependent biases in satellite observations and derived products should be identified.

An Gníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil agus Rialtais Áitiúil a dhéanann urraíocht uirthi.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreal.

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí chomhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOIL

- Monatóireacht ar chaighdeán aer agus caighdeán aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairiscíu neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA hÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdeán aer agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Gníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaímseartha, ar a bhfuil Príomhstíúrthóir agus ceithre Stíúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

The EPA's Environmental Research Centre (ERC) was established as a centre of excellence under the National Development Plan 2000-2006. The ERC allows for a more structured approach to environmental research and provides for stronger environmental support to the NDP. The objectives of the ERC are:

- ◆ to allow for a more structured approach to environmental research,
- ◆ through the development of advanced innovative techniques and systems,
- ◆ and addressing priority environmental issues,
- ◆ thereby supporting environmentally sustainable development.