



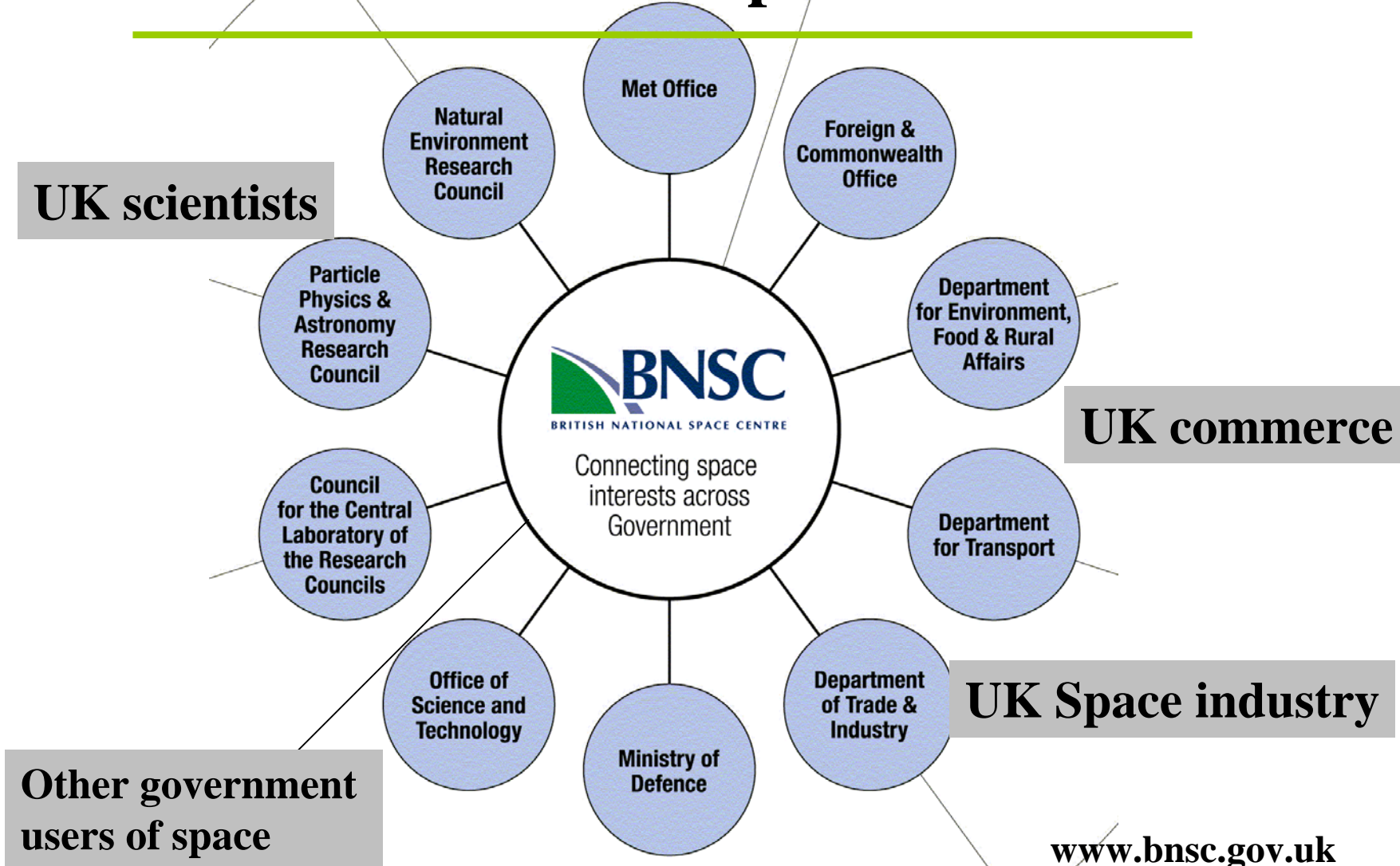
BNSC space programme activities

Contributions to CEOP & Water Cycle Understanding

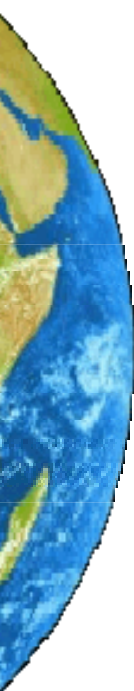
Susanne Mecklenburg
British National Space Centre

28 February 2005

British National Space Centre



Partners with links to CEOP/IGWCO ...



**Natural Environment
Research Council (NERC)**
Climate research and relation
to water cycle
RESEARCH

UK Met Office
Operational weather forecasting,
Monitoring & Observations,
Climate research
OPERATIONS

**Department for Environment
& Food & Rural Affairs (DEFRA)**
Research to underpin policy
development & implementation;
Monitoring
POLICY

UK's mechanisms for contribution to CEOP/IGWCO

- ... through CEOS chairmanship
- ... through contribution to international Space Agencies
(ESA/ Eumetsat)
- ... through international cooperation and projects
(WMO, WCRP, GEWEX, FP6)
- ... through national programmes aimed at contributing to a
global observing system and improving our
understanding of the water cycle

CEOS 2004 – 2005 UK Perspective & Aims

- **Group on Earth Observation (GEO)/Global Earth Observation Systems of Systems (GEOSS)**
- **Disaster Management**
- **Humanitarian Aid**
- **Climate Change**
- **Africa**



UK's contribution to Space Agency

Earth Watch



GMES

EarthCARE

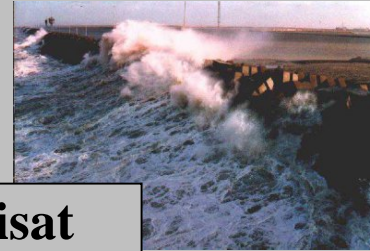


Eumetsat

MetOp

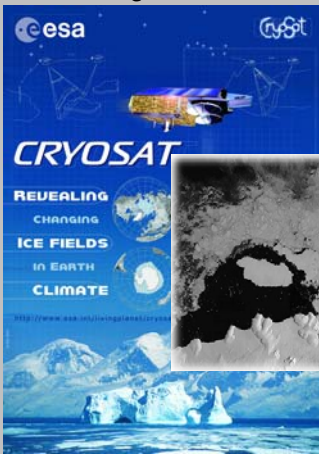


ADM Aeolus



ESA

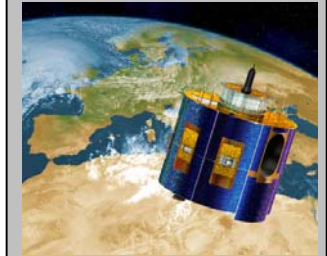
Cryosat



ERS-1/2 & Envisat



MSG

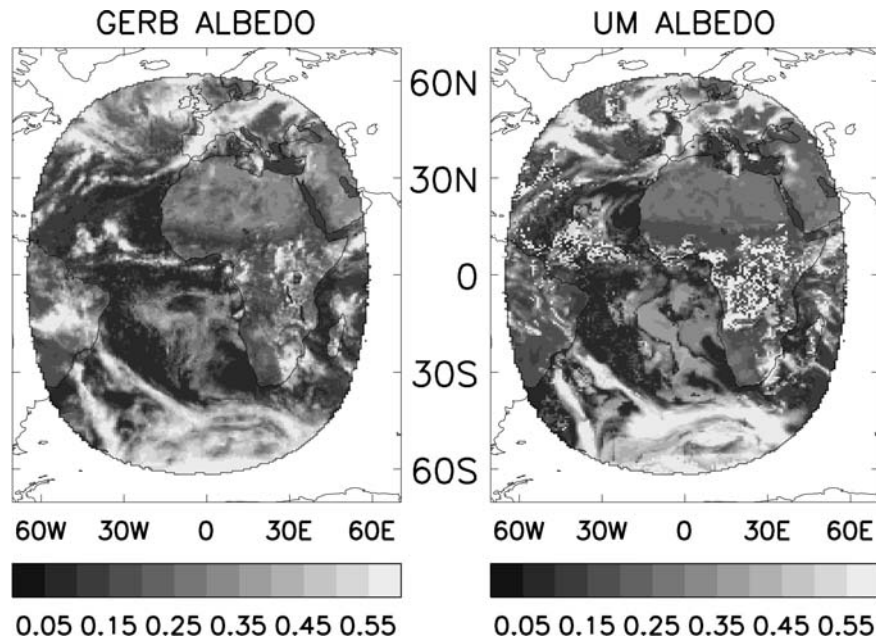


BNSC

space for science, enterprise and environment

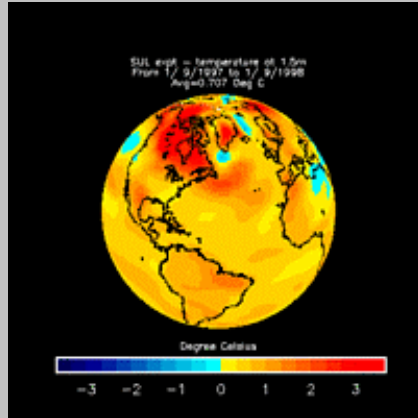
Monitoring climate variability and change

The **Geostationary Earth Radiation Budget (GERB)** instrument on the Meteosat Second Generation (MSG) mission provides an evolving picture of the Earth's radiation budget and investigates issues related to climate change and the effect of clouds, water vapour and oceans.



Hadley Centre for Climate Prediction and Research

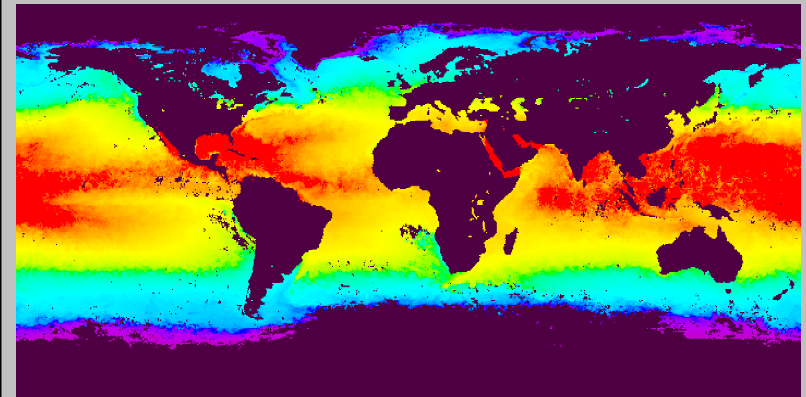
Climate models & change prediction



Surface air temperature change including cooling effect of sulphate aerosols; HadCM2

Observations: AATSR

Long-term climate record of global Sea Surface Temperature



Climate monitoring and climate data sets - Met Office

has been appointed to act as one of two Joint GCOS Upper Air Network (GUAN) Data Analysis Centres

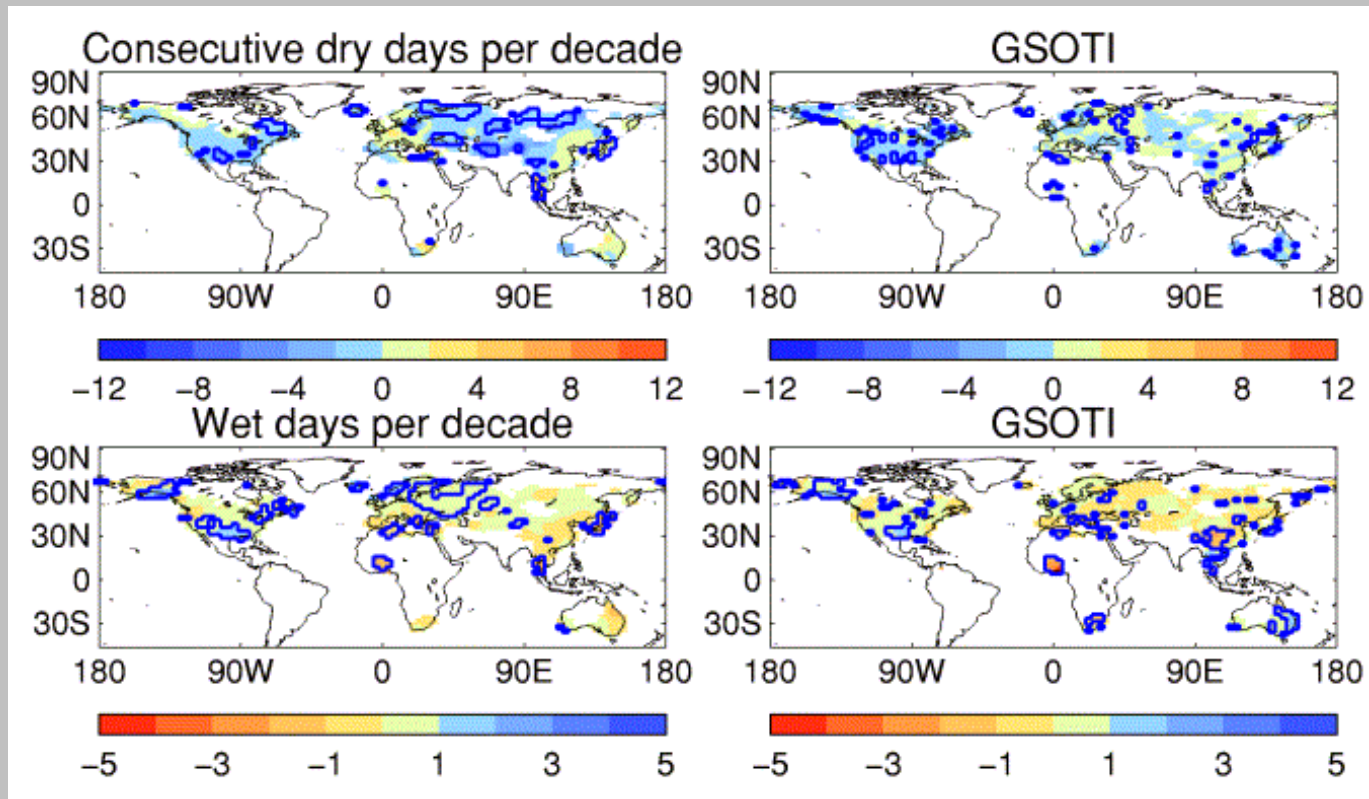
© Hadley Centre, UK Met Office

Monitoring Climate Trends in the Water Cycle

Precipitation extreme event patterns 1950 - 1995

Observations

Model



© Kiktev et al, 2003



GCSS

Global Energy and Water Cycle Experiment

GEWEX

Cloud System Studies

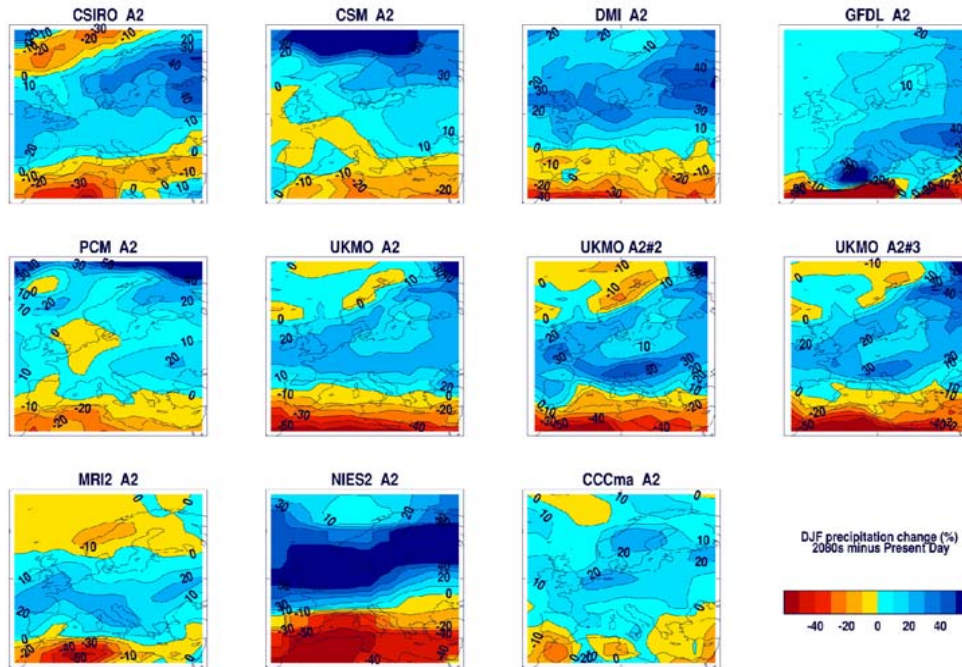


The goal of GCSS Working Group 4 (WG 4) is to improve the parametrization of precipitating convective cloud systems in global climate models and numerical weather prediction models through an improved physical understanding of cloud system processes.

Impacts of Humans on the Water Cycle


EU Framework Programme VI : ENSEMBLES project

Provide policy relevant information on climate change and its interactions with society; Quantify and reduce the uncertainty in representation of physical, chemical, biological and human-related feedbacks in the Earth system.



We can produce a small number of different predictions with no idea of how reliable they might be.

DEFRA – UK Department for Environment & Food & Rural Affairs

- 
- Broad research port-folio, underpinning policy development and implementation, special interest in water cycle and climate change
 - International research: Close links to all approved IGOS themes and in particular the water cycle theme (eg through Hadley Centre)
 - Involvement in EU and global policy making (eg Kyoto protocol, EU Water Framework directive)
 - Lead UK agency for WSSD Implementation



Water Cycle research is conducted in the following policy areas:

- Water Quality
- Water Supply & Regulation (domestic & international)
- Water Framework Directive
- Global Atmosphere Division
- Sustainable Development Unit
- Marine Environment;
- Flood Management
- Diffuse Pollution from Agriculture

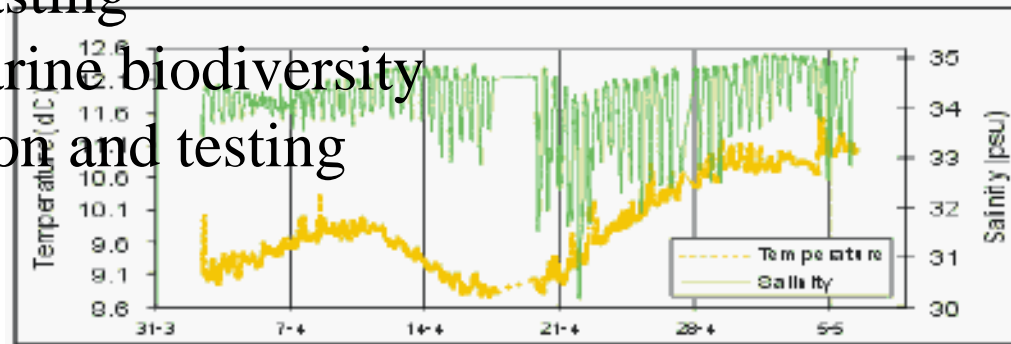


Smart Buoys Project to provide real-time data via satellite link; Monitor eutrophication status; Salinity in relation to Climate Change; Wave height monitoring for flood risk and coastal defence management; Monitor pollutant transport.

Smart Buoys deliver

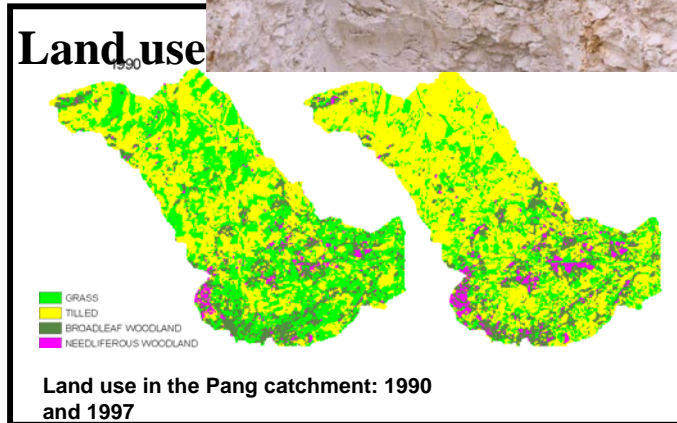
- Improved understanding of environmental variability
- New insights into ecosystem function
- Early warning and forecasting
- Monitoring change in marine biodiversity
- Improved model validation and testing

<http://www.cefas.co.uk/data.htm>



Water cycle research

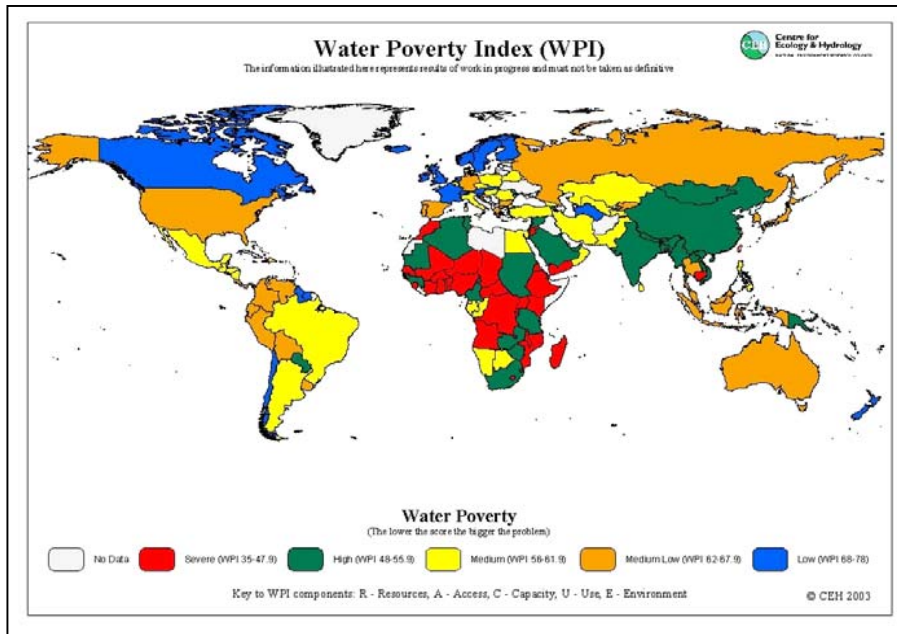
LOCAR: The Lowland Permeable Catchment Research Programme; Understanding the hydrology and ecology of permeable catchments in England



Understanding and monitoring how water, and the material it carries, moves from the vegetation and soil, through the aquifers, to the aquatic ecosystems in the wetlands and rivers

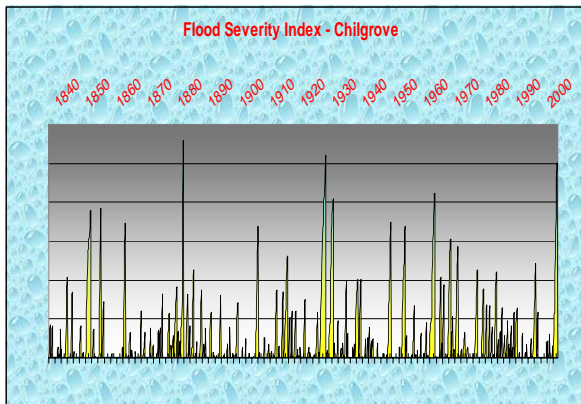
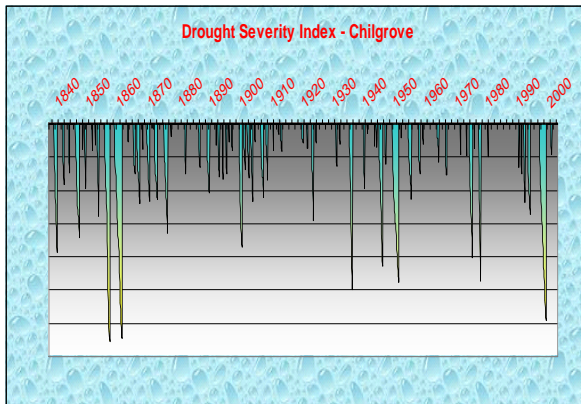
Water management & sustainable development

Water Poverty Index (WPI): holistic water management tool to prioritise water needs; provides link between water availability and community welfare; Planning tool for International Aid organisations



Components of WPI:
 Resource – Access -
 Capacity- Use -
 Environment

Water resource assessment & planning



Images show an index of 'drought' and 'flood' severity in a Chalk aquifer at Chilgrove, Southern UK.

BGS works with CEH looking at long term monitoring of surface and groundwater in the UK. From a network of monitoring sites, operated by different agencies, a database of groundwater levels has been built up

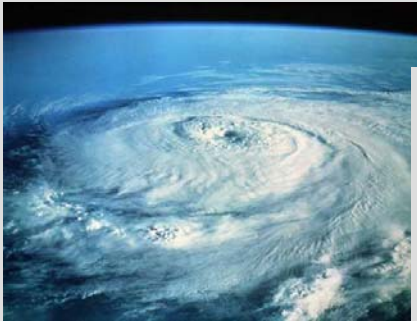
- the longest continuous time series of groundwater levels date back to 1838
- records typically show seasonal fluctuations, overlaying medium term variations resulting from climatic change, groundwater pumping and land use variability
- data can be used to constrain the extent of climate change impacts on groundwater

Towards integration: Data assimilation systems

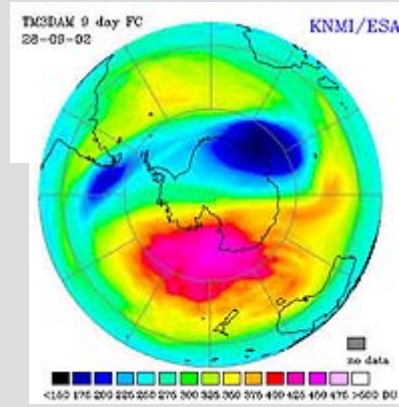
Data Assimilation Research Centre, University of Reading

Combining observations & predictive model

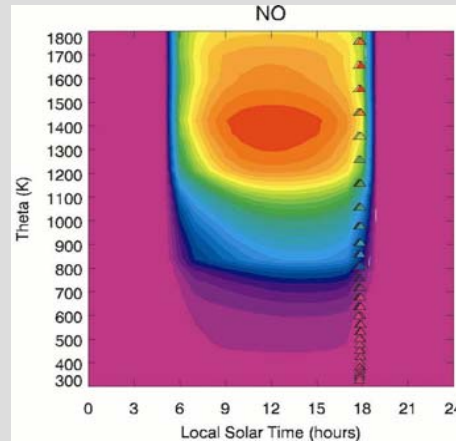
Weather prediction



Ozone Modelling



Pollution Transport Modelling



Water management & sustainable development



BGS has carried out a number of projects looking at variations in groundwater availability in sub-Saharan Africa. These have included

- mapping water availability and demand at a regional level
- identifying drought vulnerability, and drought prone communities, examining the interrelationship between climate, geology and poverty
- looking at long term paleoclimatic signals preserved in groundwater in the Chad basin

The images are of a typical small spring in Oju, Nigeria-. During the dry season there is no flow as the water table has dropped below land surface and is only accessible via shallow hand dug seepage pits. In the wet season recharge has saturated a weathered sandstone, the spring is flowing and water is more easily accessible.