



**Centre for
Ecology & Hydrology**

NATURAL ENVIRONMENT RESEARCH COUNCIL

INTERNATIONAL HYDROMETEOROLOGICAL SERVICES

Capacity development in hydrometeorological service delivery and research

Main front cover photo - Waikato River, New Zealand, Harry Dixon, CEH.

The Centre for Ecology & Hydrology (CEH) is the UK's Centre of Excellence for integrated research in terrestrial and freshwater ecosystems and their interaction with the atmosphere.

CEH offers expertise in hydrometeorological monitoring and information systems to support capacity development in the fields of:

- Disaster Risk Reduction (DRR), helping to define appropriate responses to hydrological disasters (floods and droughts)
- Integrated Water Resource Management (IWRM), to aid management decisions and water resources allocation in river basins
- Climate Services, to assess and mitigate climate-related risks.

CEH key competencies

CEH can offer a range of solutions including:

- Support for hydrometeorological monitoring
- Advice on national and international data collection programmes
- Assist hydrometeorological data management processes and tools development
- Design, installation and operation of decision support systems for water management
- Delivery of quantitative hydro-meteorological information to support IWRM and DRR policy
- Knowledge transfer, staff training and capacity building.

CEH experience

We integrate national-scale multi-disciplinary scientific capabilities allowing us to provide flexible solutions that address key water management issues. CEH has world-leading expertise in all aspects of hydrometeorological data, from collection in the field to interpretation and dissemination.

CEH has a long history of supporting governments around the world to develop and operate national and regional hydrometric monitoring and data systems. For over 50 years, CEH (and its predecessor the Institute of Hydrology) has been working in scientific and capacity building partnerships, including those under the UNESCO International Hydrological Programme and World Meteorological Organization initiatives (e.g. WMO Hydrology and Water Resources Programme).

As the Centre of Excellence for freshwater science, we act as the focal point for hydrometric data in the UK. CEH's experience in developing and operating highly efficient, long-term observation, data management and decision support systems has resulted in our advanced capability in hydrometeorological services.

CEH project: Low flows and hydrological data management training was delivered by CEH and partners in Thimpu, Bhutan



Mo Chhu River, Bhutan

CEH Areas of Expertise

Design and operation of monitoring sites

CEH has extensive experience of operating multi-scale observation platforms (i.e. at plot, reach, catchment, national and international scales). Our monitoring campaigns range from short-term, project-based installations to long-term multi-decadal observation programmes. CEH is able to offer hydrometric expertise in:

- Instrument requirement specification, procurement and testing
- Monitoring station design and installation
- Data collection and real-time transmission systems
- Review, refurbishment and optimisation of observing systems and networks
- Compliance with international monitoring and equipment standards
- Development of operating protocols, risk assessment and maintenance guidelines of monitoring sites
- Assessment and implementation of new monitoring technologies
- Integration of cross-disciplinary monitoring instruments and sites.

Experimental catchments and research facilities

Our multidisciplinary monitoring and observation systems provide the basis for integrated hydrological science and water management projects. We have expertise in setting up and operating hydrometeorological monitoring facilities, including:

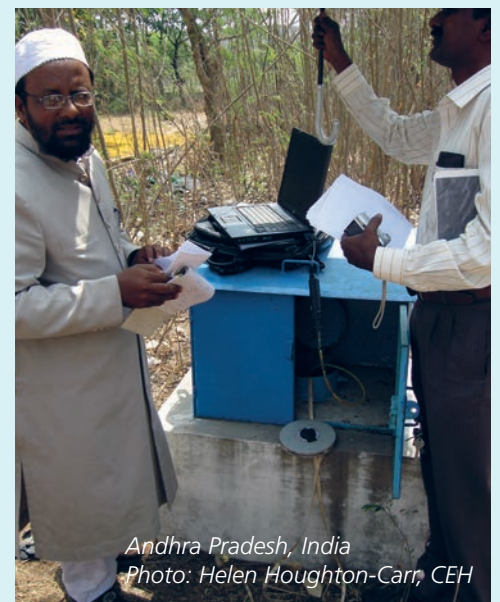
- Catchment-scale monitoring platforms, including: source-to-sea observatories and urban runoff studies
- Integrated, high frequency, hydrological, biogeochemical and ecological monitoring programmes
- Upland paired catchment observatories
- Cross-disciplinary lowland river and wetland observatories
- Experimental flume and aquatic mesocosm facilities
- Climate monitoring networks
- Freshwater manipulation and impact experiments
- High-resolution lake monitoring networks.

Development and review of national and international monitoring networks

In addition to our own monitoring programmes and facilities, CEH has experience in designing, developing and evaluating large-scale observation networks operated by others in the UK and overseas. Through this work, we are able to offer expertise in:

- Stakeholder analysis and needs assessments
- Provision of monitoring advice to governments and environmental regulators
- Network design, implementation and optimisation
- National and international standards development and compliance (including those of ISO and WMO)
- International monitoring requirements and data exchange policy development
- Best practice guidelines development for network operation and data management
- Data compliance protocols and service level agreement development and use
- Monitoring system audits and site reviews.

CEH project: Funded by the World Bank, CEH provided expert advice and support to implementing agencies under the India Hydrology II Project.



Andhra Pradesh, India
Photo: Helen Houghton-Carr, CEH

Data management and dissemination

CEH is experienced in the development and operation of complex data management protocols across multiple organisations. Our expertise in hydrometeorological data management includes:

- National and international data centre establishment and operation
- Data processing, manipulation and visualisation
- Development and operational use of QA/QC procedures
- Real-time data acquisition systems
- Metadata definition, collection and handling
- Data dissemination services, publication and product development
- Spatial and remote sensed data creation, processing and analysis
- Controlled vocabularies, data dictionaries and Linked Open Data applications development
- Data rescue advice and implementation.

Data and information management systems

Our monitoring systems and data management activities are underpinned by expertise in information management systems development, installation and operation. We offer development advice and technical support for a range of hydrometeorological data systems including:

- User-needs assessment and systems and software specification
- Relational database management systems design and development
- Data handling systems development and operation
- Data standards compliance
- Data dissemination, including web portal development and web services
- Spatial data storage and geographical information systems
- High Performance Computing and cloud infrastructures.

Data integration for water-situation assessments

As the UK's focal point for hydrometric data, CEH couples data and information management capabilities with considerable scientific expertise to integrate and present national scale data. Our products inform policy makers, water managers and the general public through:

- Cross-disciplinary data integration and research
- National and regional water situation reporting
- Generation and reporting of national water resources statistics
- Seasonal hydrological outlooks.

Complete hydrometeorological monitoring

CEH offers the above expertise in relation to monitoring of:

- Precipitation (ground-based and radar observation)
- Soil moisture
- Evaporation
- Soil-vegetation-atmosphere fluxes of water vapour
- River flows
- Surface water storages (lakes, reservoirs)
- Groundwater
- Water quality and sediment loads
- Freshwater ecology.

Development of decision support tools

CEH hydrometeorological monitoring and information systems knowledge and skills compliment our wider science portfolio to support capacity development. Our expertise in information analysis, modelling and forecasting allows us to deliver services in:

- Flood risk management, including: real-time flow forecasting, flood monitoring, forecasting and warning services, flood risk estimation, reservoir safety assessments
- Water resources management, including: water resource and hydropower assessments, drought forecasting and impact appraisals, water quality and hydro-ecological modelling, ecotoxicological impact evaluation
- Climate impact assessment, including: analysis, quantification and prediction of current and future water resource states at regional, national and global scales.

Delivery of CEH's support

CEH offers capacity development in hydro-meteorology to suit customer needs, including:

- In-country assessments of stakeholder monitoring needs and current systems
- Development of tailored monitoring processes, guidelines and manuals
- Development, installation and customisation of data management tools and software
- Model development and training
- Tools and warning systems to deliver hydro-meteorological data to end users
- Staff placements and visits
- Field- and classroom-based training
- PhD supervision / university / private sector training partnerships
- Management advice
- Research project design and management.

CEH project: Technical support for the implementation of the SADC-HYCOS project was provided by CEH and partners across 11 countries in the Southern Africa region.



*Kafue River, Zambia
Photo: Matt Fry, CEH*

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