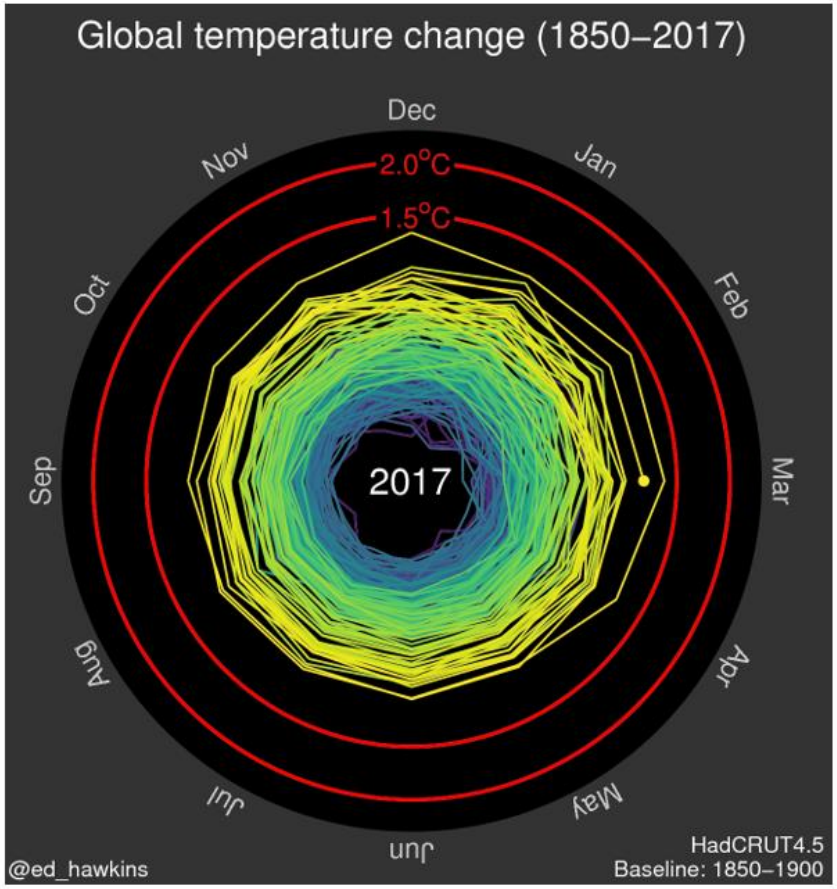
Copernicus Climate Change Service (C3S)

Climate Change Analysis & Modelling: [Some] User Needs & Applications

Rowan Fealy
Maynooth University

Maynooth University
National University of Ireland Maynooth

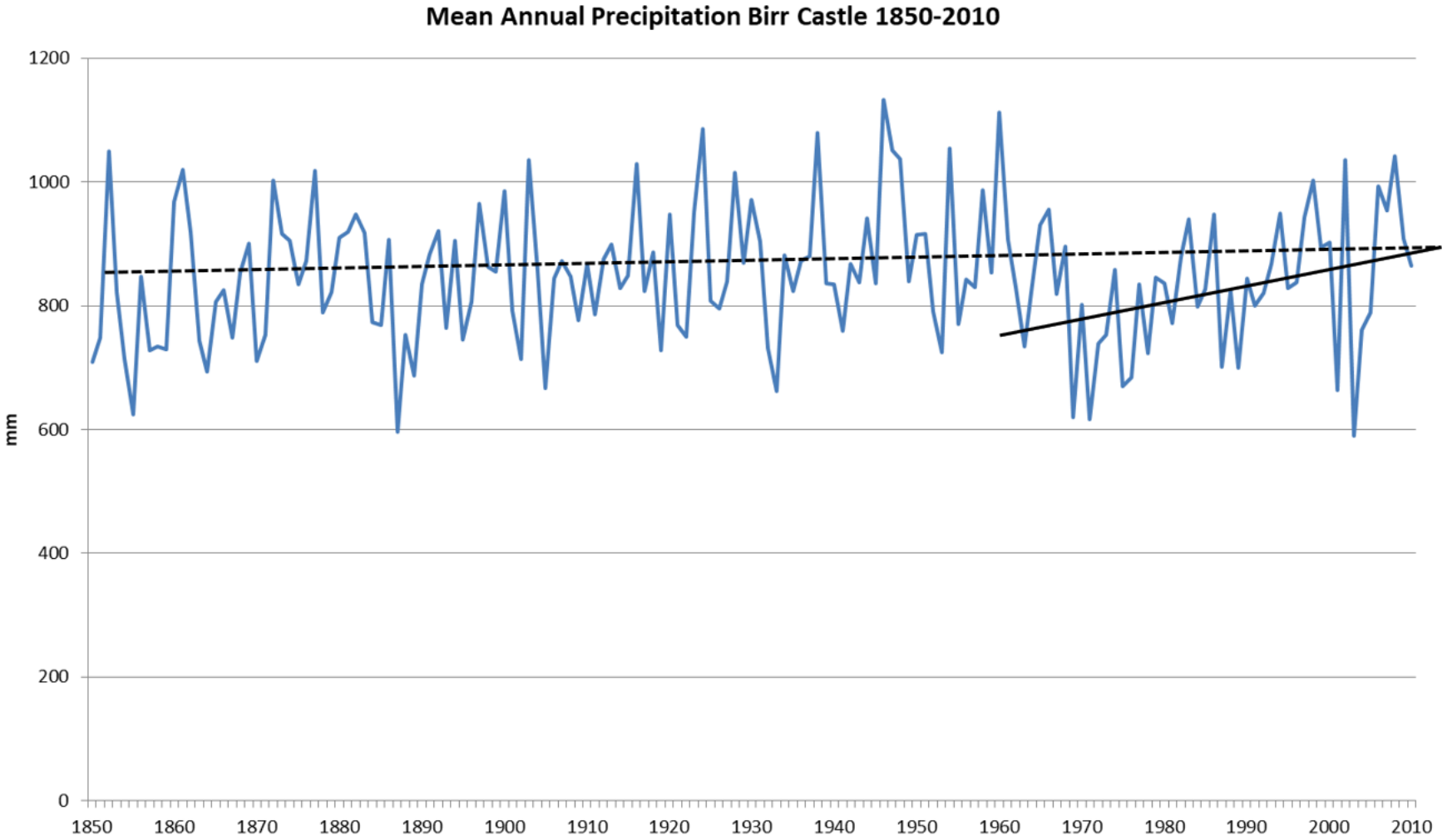
Climate Change



Climate change refers to a “change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity”

Intergovernmental Panel on Climate Change (2007, p 30)

Climate Change Detection and Attribution



(Data Source: Noone et al., 2015)

Long term, high quality, homogenous, time series of climate parameters are an essential requirement in change detection and subsequent attribution studies

Historical Climate Data Rescue

"We can only gather new data about the planet at the rate of one year per year, rescuing old data can add far more data

INDEPENDENT News InFact Politics Voices Indy/Life Business Sport Video Culture Subscribe

News › World › Americas › US politics

Hundreds of activists download and archive climate data to protect it from Donald Trump

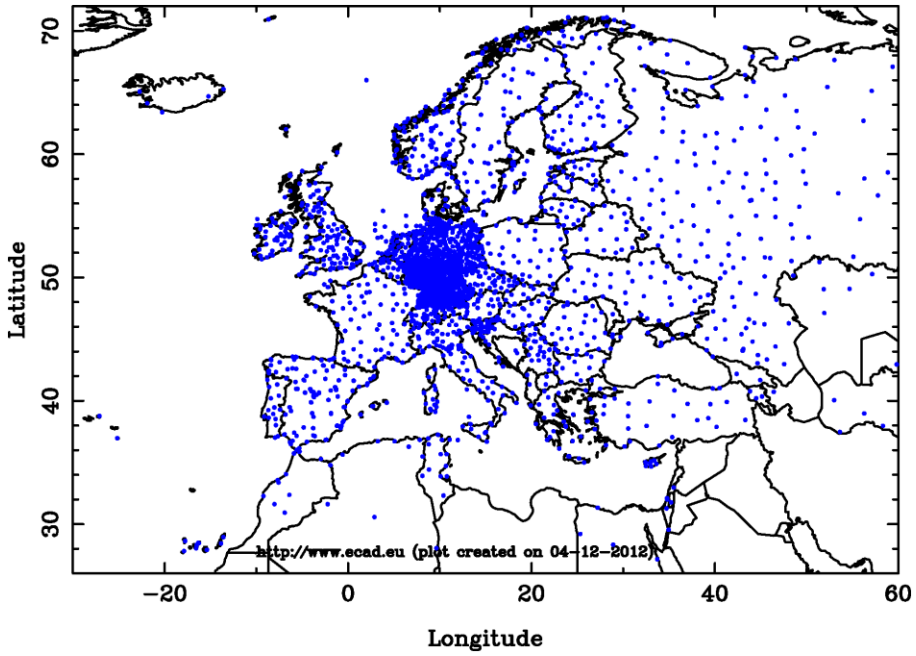
Data rescue meet-ups are scheduled around the US

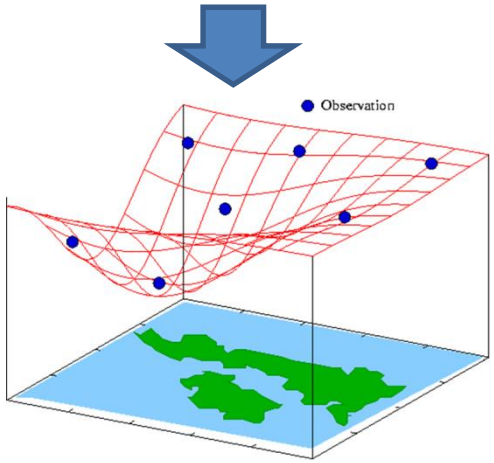
IEDRO

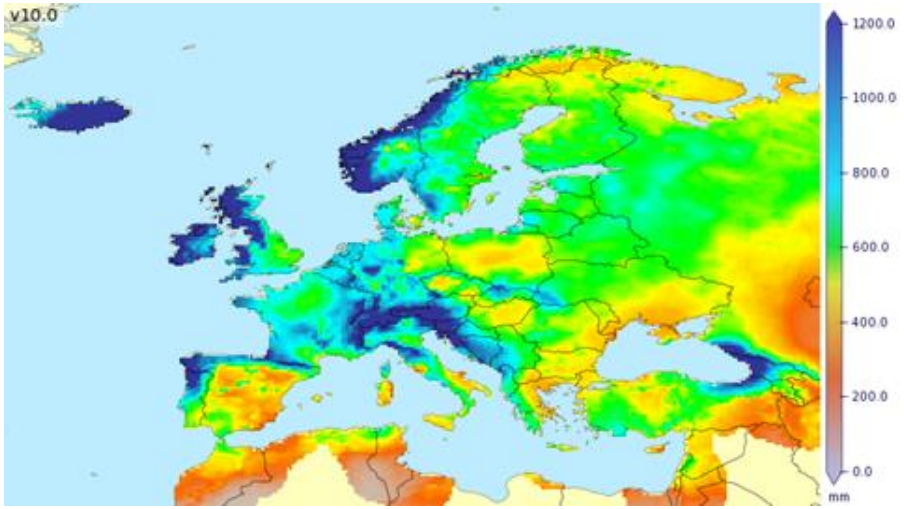
I-DARE INTERNATIONAL DATA RESCUE PORTAL

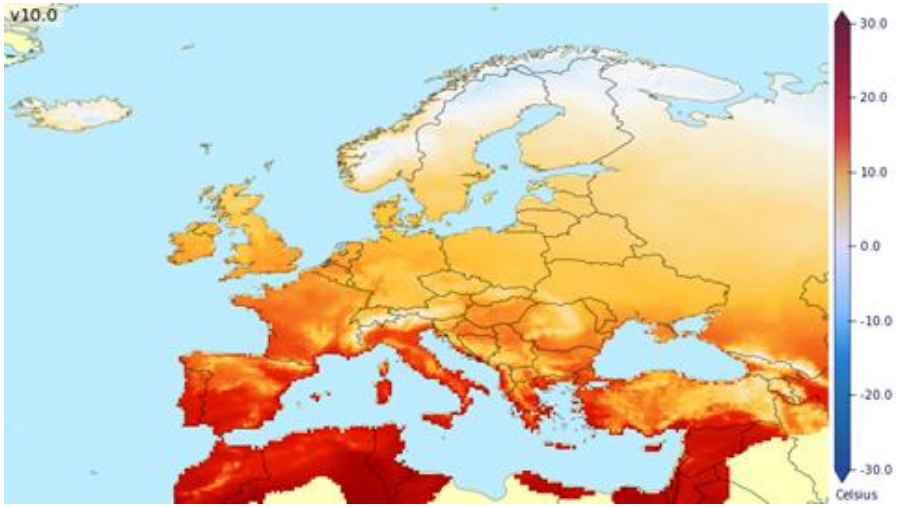
Creating homogeneous, complete data sets from disparate collections is a fundamental challenge facing the climate research community (WMO)

Climate Analysis: Gridded Observations



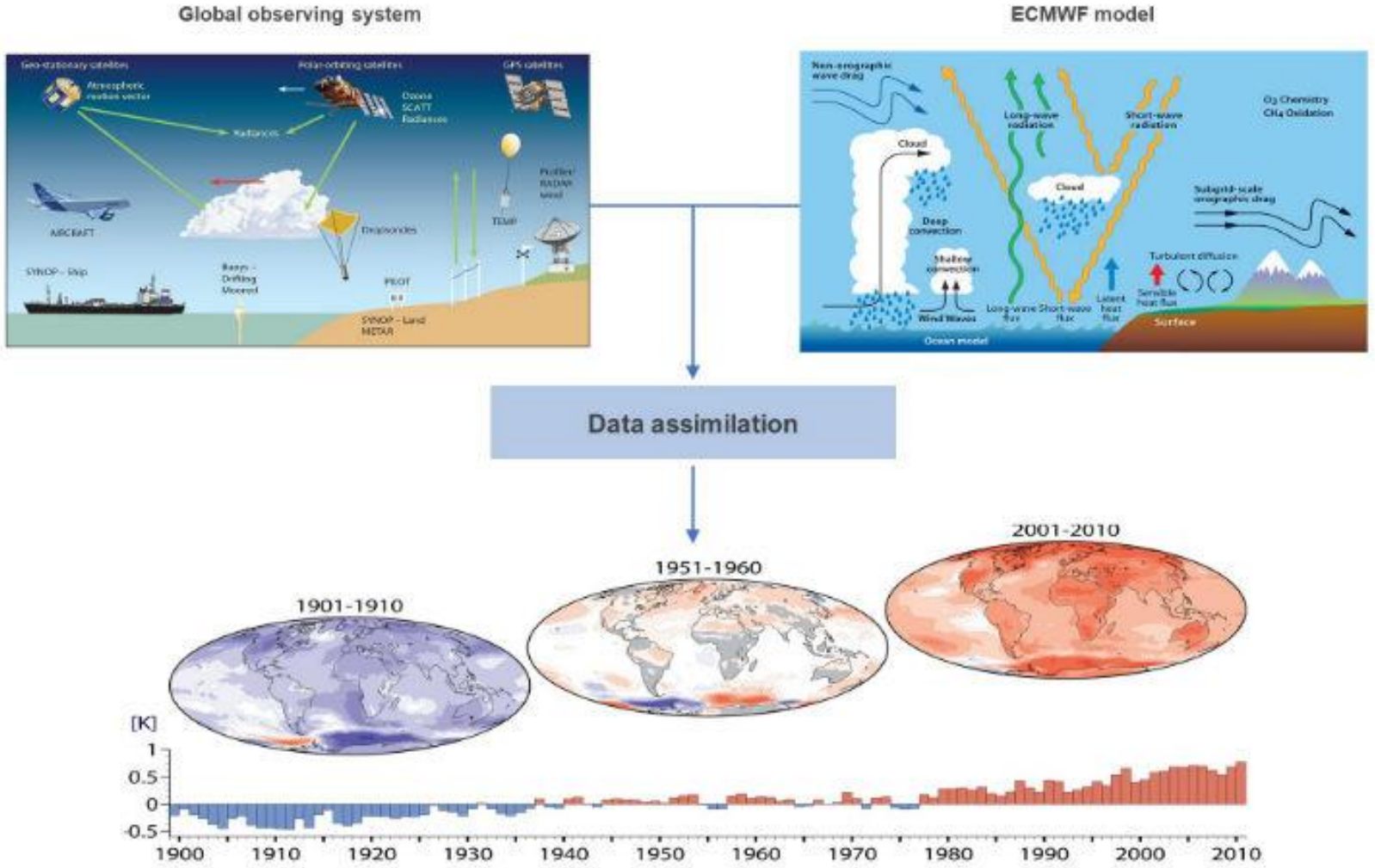






Long term, quality controlled, climate observations are necessary for analysing and understanding spatial changes in the climate system

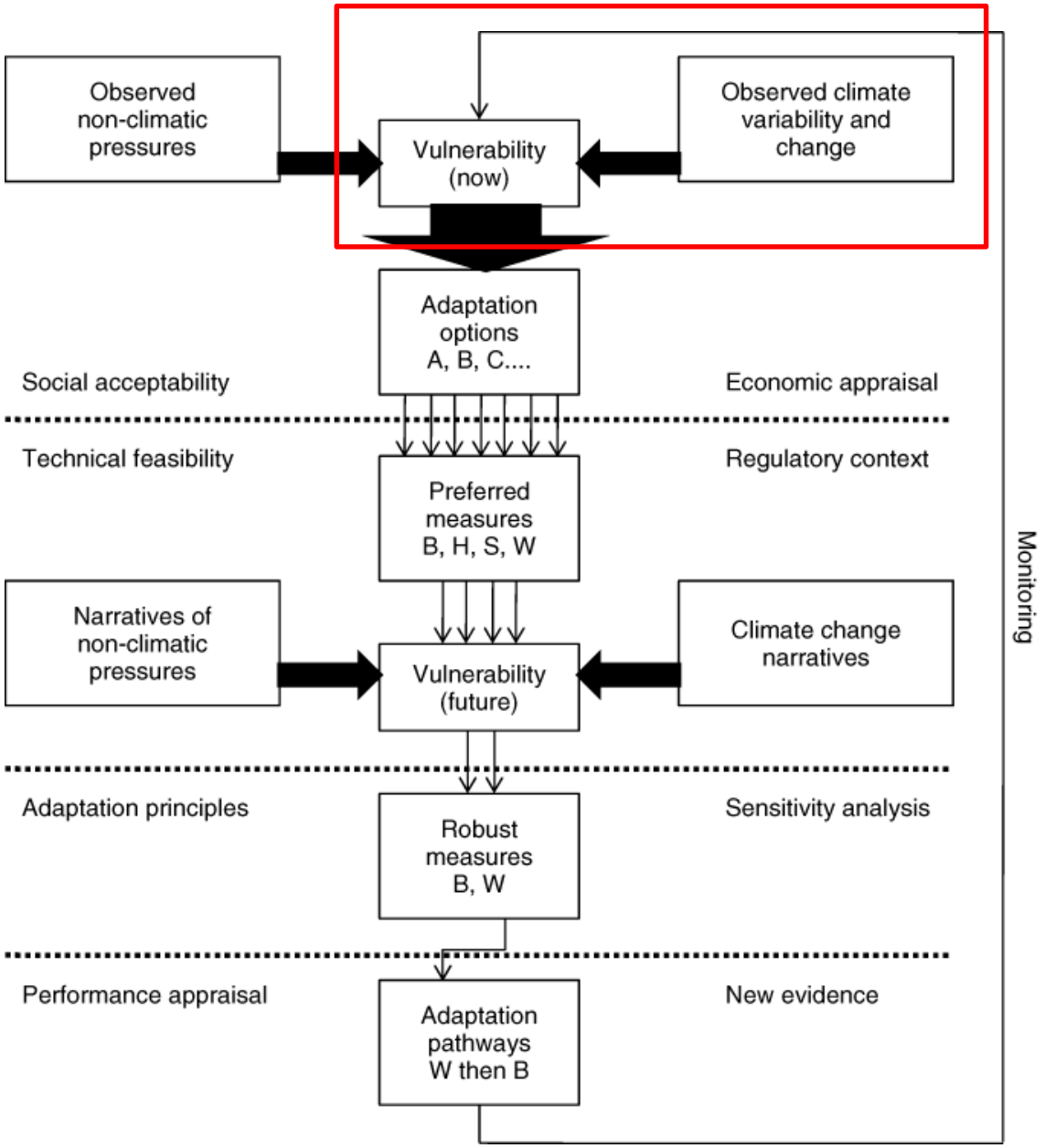
Climate (Re)Analysis



(Image source: ECMWF)

Climate reanalysis or 'historical forecasts' provide a consistent, globally complete and detailed record of the evolution of the atmosphere over past decades, achieved through the assimilation of in-situ and remotely sensed observations with a numerical weather model

Sectoral Climate Change Adaptation

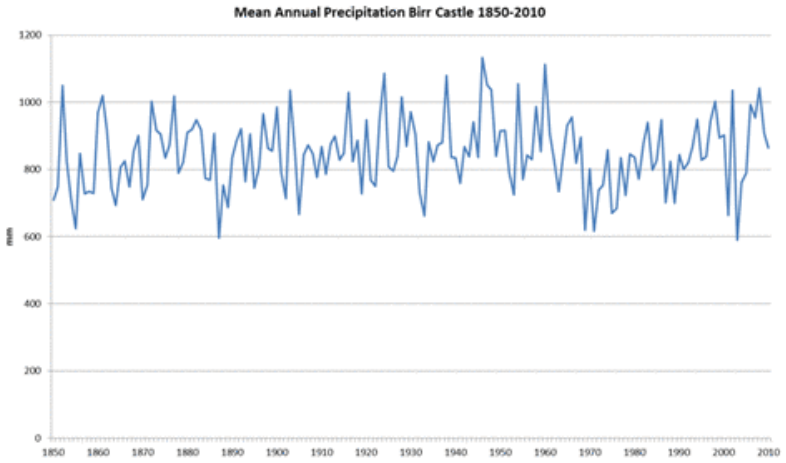


Observed climate information (e.g. in-situ, gridded, reanalysis, remotely sensed) is necessary to reduce vulnerability to the occurrence of present day climate related hazards; developed adaptation options can be tested for robustness against future climate narratives and non-climatic pressures.

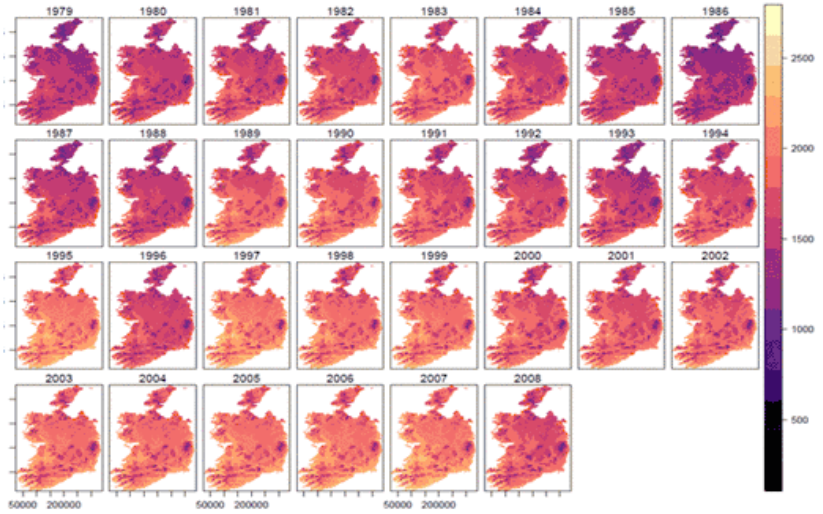
(Source: Wilby and Dessai, 2010)

User Needs

Climate Data Record (CDR)
A time series of measurements of sufficient length, consistency and continuity to determine climate variability and change



Climate Information Product (CIP)
A time series derived from CDRs and related measurements to provide specific information about an environmental phenomena of importance to science and society



Annual growing degree days 1979-2008

CDR - Priority Variables

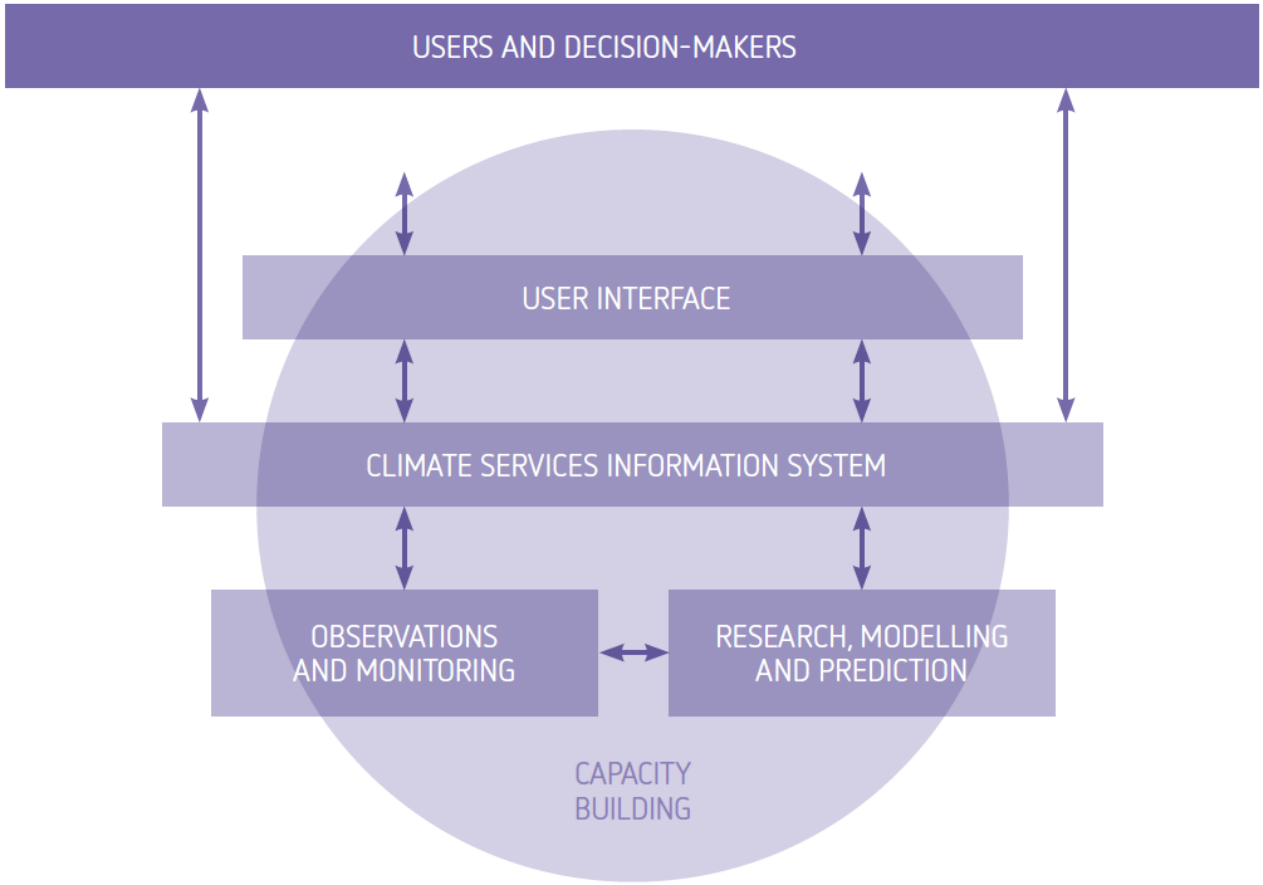
The Essential Climate Variables

Domain	Essential Climate variable	
Atmospheric (land, sea and ice)	Surface	Air temperature, wind speed and direction, water vapour, pressure, **precipitation**, surface radiation budget.
	Upper-air	**Earth radiation budget (including solar irradiance)**, **temperature**, **wind speed and direction**, **water vapour**, **cloud properties**, lightning.
	Composition	**Carbon Dioxide**, methane, other long-lived greenhouse gases (GHGs), **ozone**, aerosols, **aerosol properties**.
Oceanic	Surface	**Sea surface temperature**, sea surface salinity, **sea level**, **sea state**, **sea ice**, currents, **ocean colour (for biological activity)**, carbon dioxide partial pressure), **surface heat flux.**
	Sub-surface	Temperature, **salinity**, currents, nutrients, ocean tracers, ocean colour, phytoplankton, marine habitat properties.
Terrestrial		River discharge, water use, groundwater, **lake levels**, **soil moisture**, **snow cover**, **glaciers and ice caps**, permafrost and seasonally frozen ground, **albedo**, **land cover (including vegetation type)**, **fraction of absorbed photosynthetically active radiation (fAPAR)**, **land surface temperature**, **leaf area index (LAI)**, **below- and above- ground biomass**, **soil carbon**, **fire disturbance**, **ghg fluxes**

Measurements of variables in bold type are largely dependent on satellite observations.

Essential Climate Variables (ECVs) for which global observation is currently feasible and that satisfy the requirements of the UNFCCC (e.g. IPCC) and broader user communities.

Global Framework for Climate Services (GFCS)



"A global response to the need for climate information for decision making"

(Source: EUMETSAT)

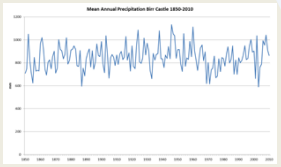
Copernicus (C3S) represents the fundamental European contribution to the Global Framework for Climate Services (GFCS), providing information at global, national, regional and local scales

Copernicus C3S: The Climate Data Store (CDS)

The CDS will provide
Essential Climate Variables (ECVs), climate indicators and other relevant information about the past, present and potential future evolution of the climate system

Observations

Data collection & rescue

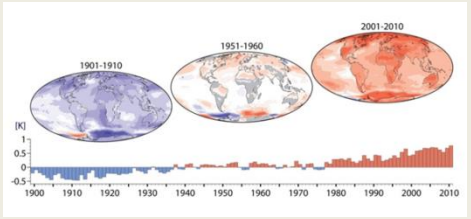


In-situ observations

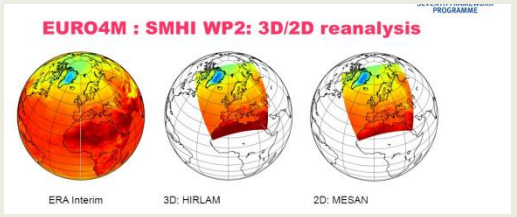
Gridded observations

Earth Observation ECVs

Reanalysis

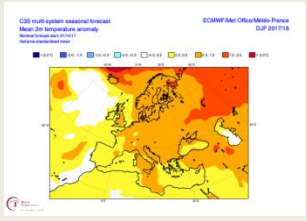


Global/Coupled Reanalysis

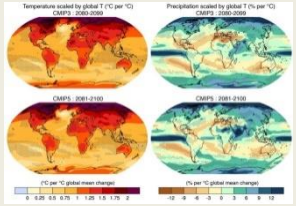


High resolution regional reanalysis

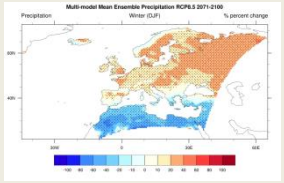
Models



Seasonal Forecasts



CMIP Global Climate Models



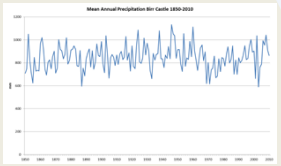
Regional Climate Models

Copernicus C3S: The Climate Data Store (CDS)

The CDS will provide
Essential Climate Variables (ECVs), climate indicators and other relevant information about the past, present and potential future evolution of the climate system

Observations

Data collection



In situ

Gridded

Earth Observation ECVs

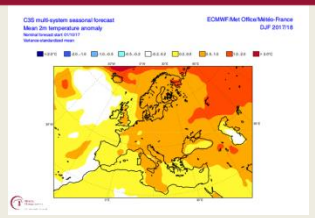
Rean[illegible]

CALCULATION DATA

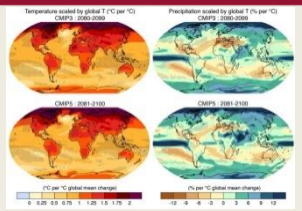
USER

DATA (e.g. CDS)

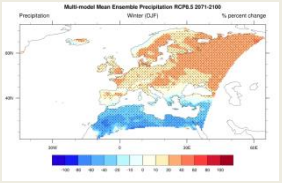
Models



Seasonal Forecasts

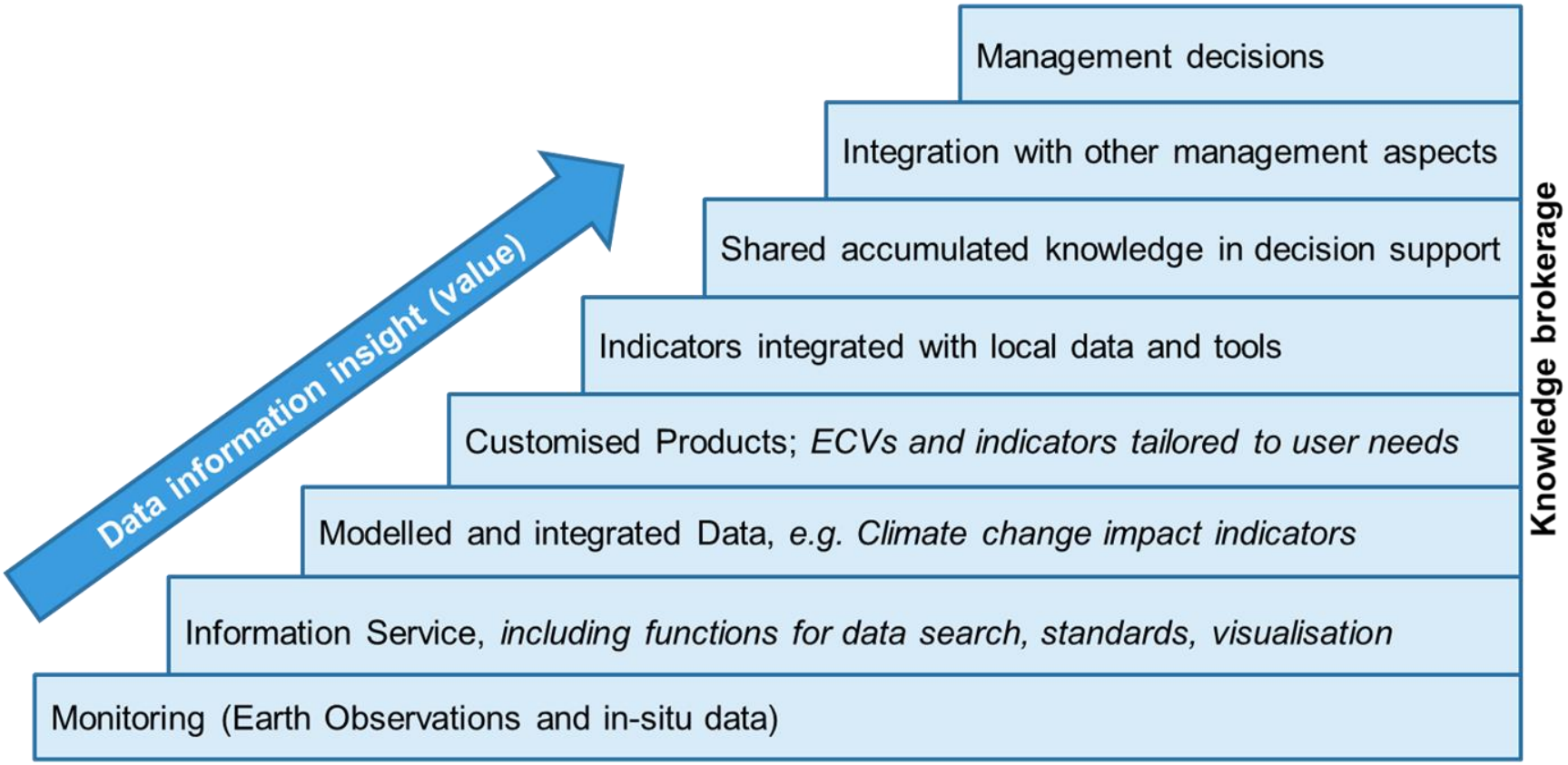


CMIP Global Climate Models



Regional Climate Models

Climate Information Value Chain: Linking Knowledge to Actions



Aim to provide data and tools to support increased knowledge and understanding of the climate system leading to improved climate information for use in adaptation and mitigation decision making at all scales

Copernicus
Europe's eyes on Earth

Climate Change Service

Contact us

Search

Search

ABOUT C3S | NEWS & MEDIA | EVENTS | TENDERS | PRODUCTS | SERVICES | HELP & SUPPORT

IN FOCUS

Meeting the world's science journalists at WCSJ2017

27 Oct 2017

READ MORE

MONTHLY MAPS & CHARTS

Monthly maps and charts of essential climate variables

ARCHIVE

NEWS

27 Oct 2017
Meeting the world's science journalists at WCSJ2017

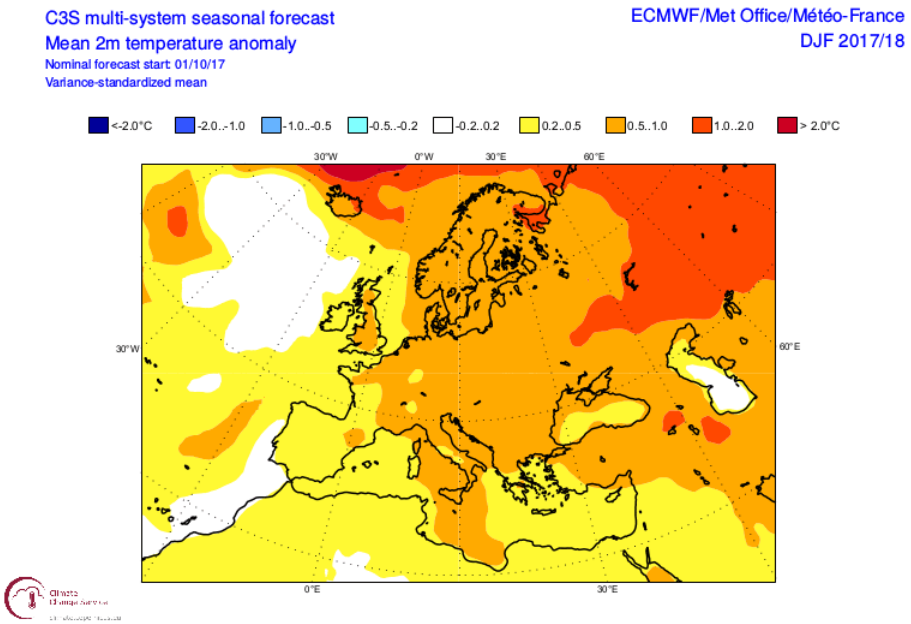
26 Oct 2017
ECMWF Copernicus Services at GEO Week 2017

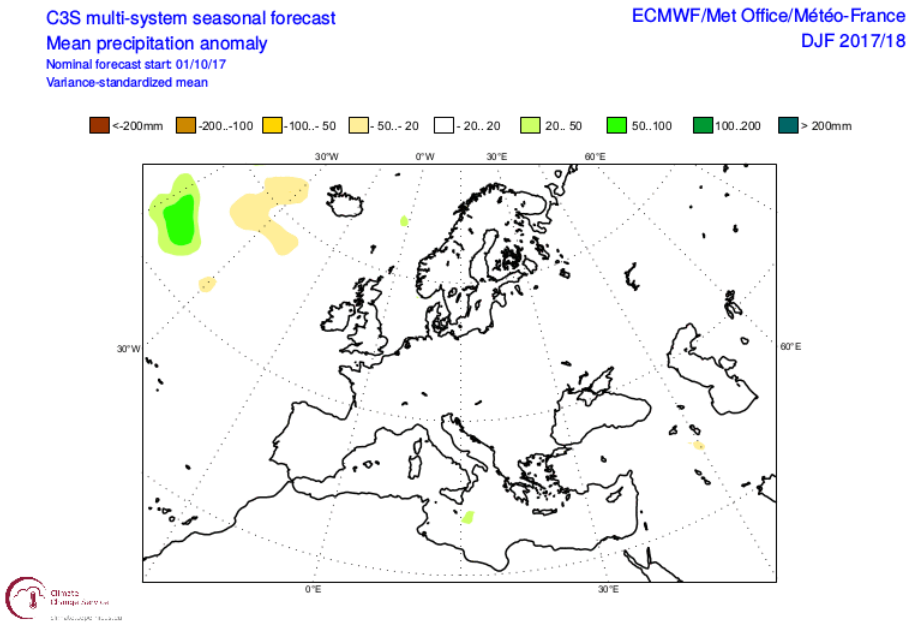
26 Oct 2017
Alpha testing of the Climate Data Store (CDS) Toolbox

ARCHIVE

PROOF OF CONCEPT

C3S Applications: Seasonal Forecasts



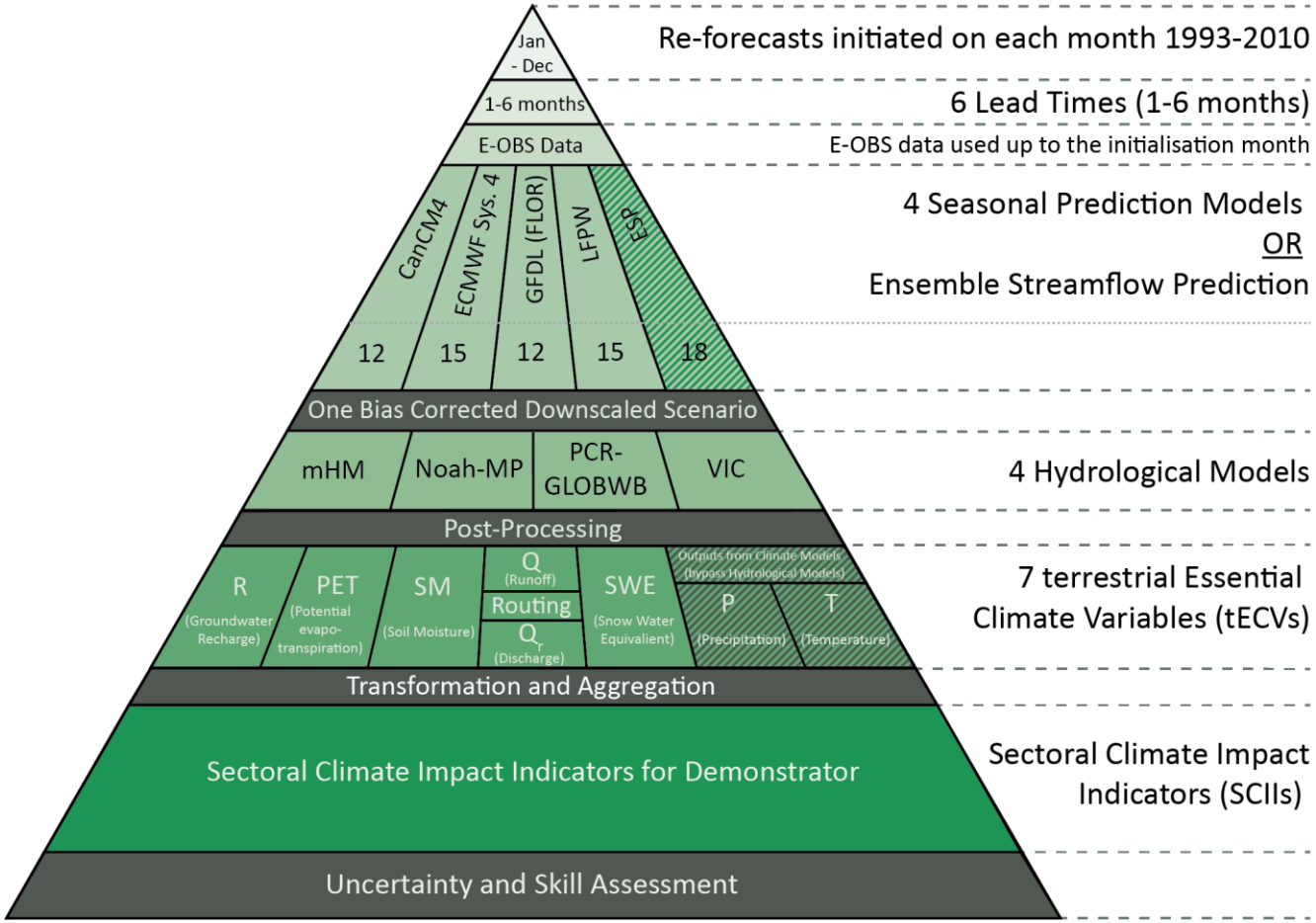


C3S is developing seasonal forecast products, with a target publication date of 15th of each month. These products are based on data from several state-of-the-art seasonal prediction systems.

PROOF OF CONCEPT

C3S Applications: Hydrological Seasonal Forecasts

EDgE Seasonal Forecasting Modelling Chain



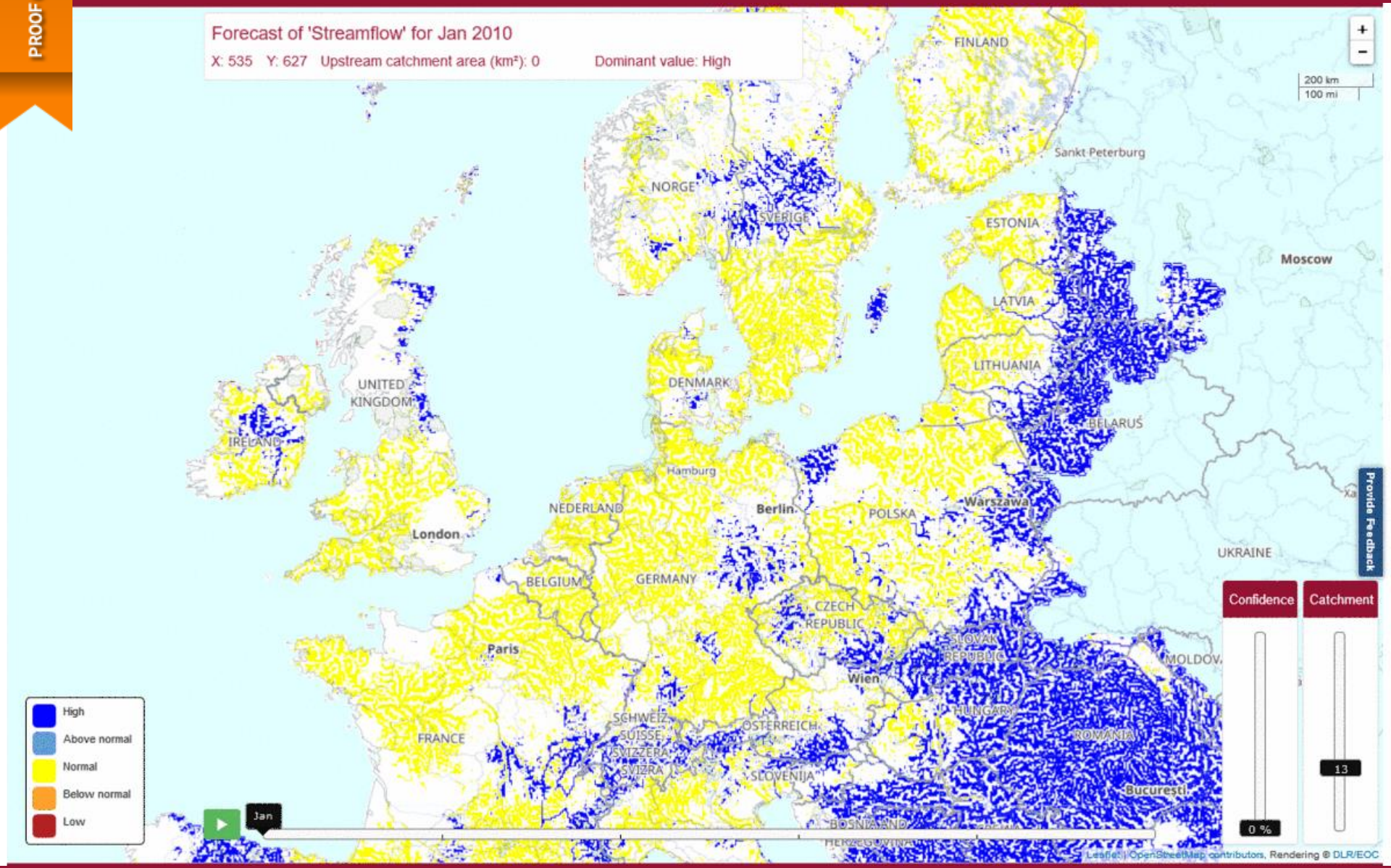
The EDgE (End to end Demonstrator for improved decision-making in the water sector in Europe) project combines climate data and state of the art hydrological modelling to deliver hydrological services for decision makers.

PROOF OF CONCEPT

Copernicus Europe's eyes on Earth

Climate Change Service

C3S HOME | EDGE | MAP VIEWER | USING EDGE | DATA | PUBLICATIONS | HELP



About C3S | Site map | Contact us | Disclaimer / Privacy | Cookies

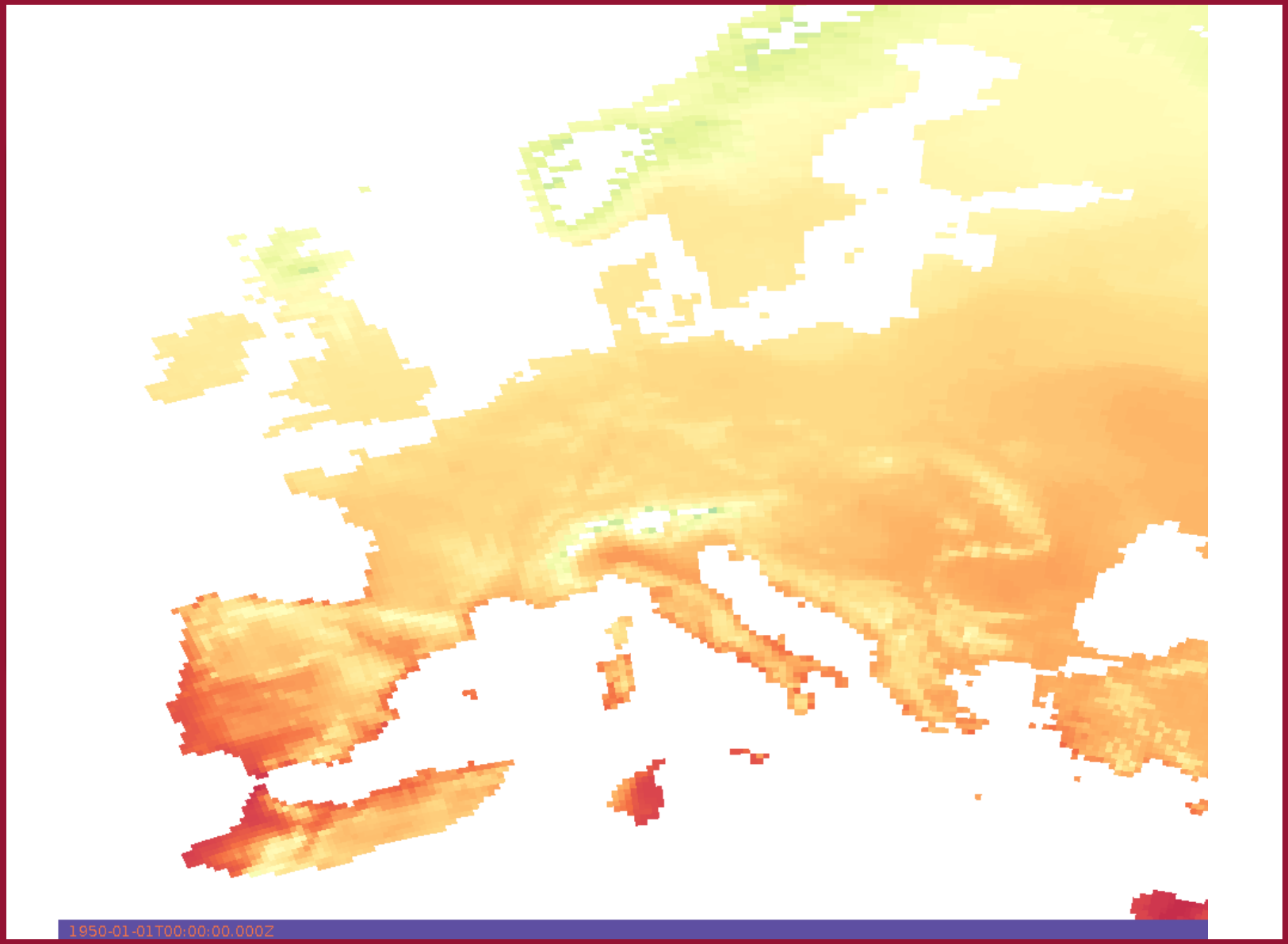
PROOF OF CONCEPT

Copernicus
Europe's eyes on Earth

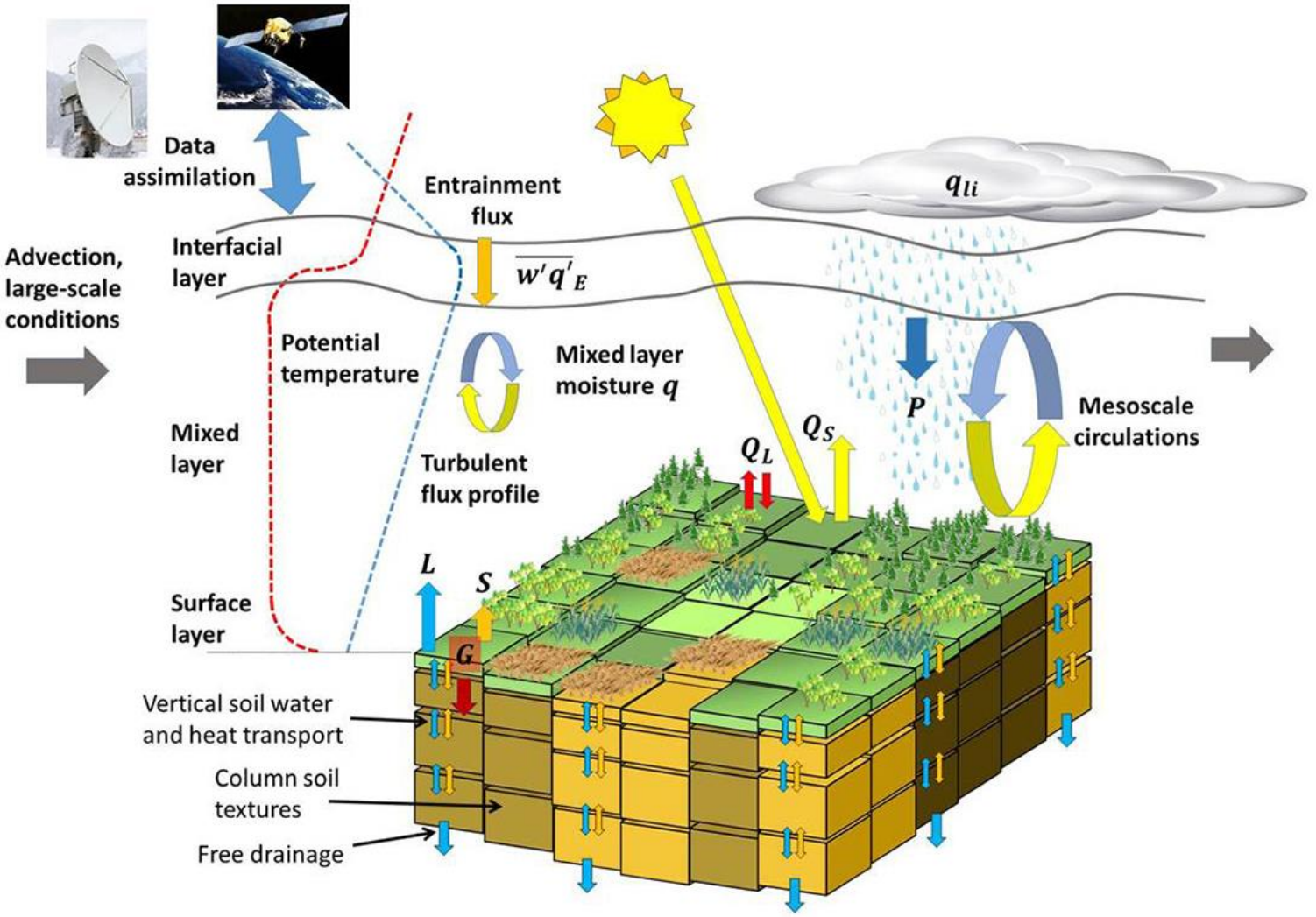
Climate Change Service

Search Search

C3S AGRICLASS SCIENCE PRODUCTS CASE STUDIES SUPPORT



New Research Opportunities



“Big data are no panacea, but if carefully used, they provide an enormous and untapped opportunity to diversify our understanding of adaptation and inform decision-making”

Ford et al. (2016)

Selected References:

Ford et al. (2016) Opinion: Big data has big potential for applications to climate change adaptation. PNAS, 113(39), 10729–10732.

Hegerl, G.C. et al. (2010) Good practice guidance paper on detection and attribution related to anthropogenic climate change. In: Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Detection and Attribution of Anthropogenic Climate Change [T. F. Stocker, et al. (eds.)]. IPCC Working Group I Technical Support Unit, University of Bern, Bern, Switzerland, 8 pp.

Intergovernmental Panel on Climate Change (2012) Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

Knist, S., Goergen, K., Buonomo, E., Christensen, O.B., Colette, A., Cardoso, R. M., Fealy, R., Fernandez, J., Garcia-Diez, M., Jacob, D., Kartsios, S., Katragkou, E., Keuler, K., Mayer, S., van Meijgaard, E., Nikulin, G., Soares, P.M.M., Sobolowski, S., Szepszo, G., Teichmann, C., Vautard, R., Warrach-Sagi, K., Wulfmeyer, V. and Simmer, C. (2017) Land-atmosphere coupling in EURO-CORDEX evaluation experiments. Journal of Geophysical Research-Atmospheres, 122, 79-103.

Noone, S., Murphy, C., Coll, J., Matthews, T., Mullan, D., Wilby, R.L., and Walsh, S. (2015) Homogenization and analysis of an expanded long-term monthly rainfall network for the Island of Ireland (1850–2010). International Journal of Climatology, 36: 2837–2853. doi: 10.1002/joc.4522.

World Bank (2014) Open Data for Resilience Field Guide. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0.

Wilby, R. L. and Dessai, S. (2010), Robust adaptation to climate change. Weather, 65: 180–185. doi:10.1002/wea.543