

Ensuring climate data quality and homogeneity for operational climate prediction

By Manola Brunet

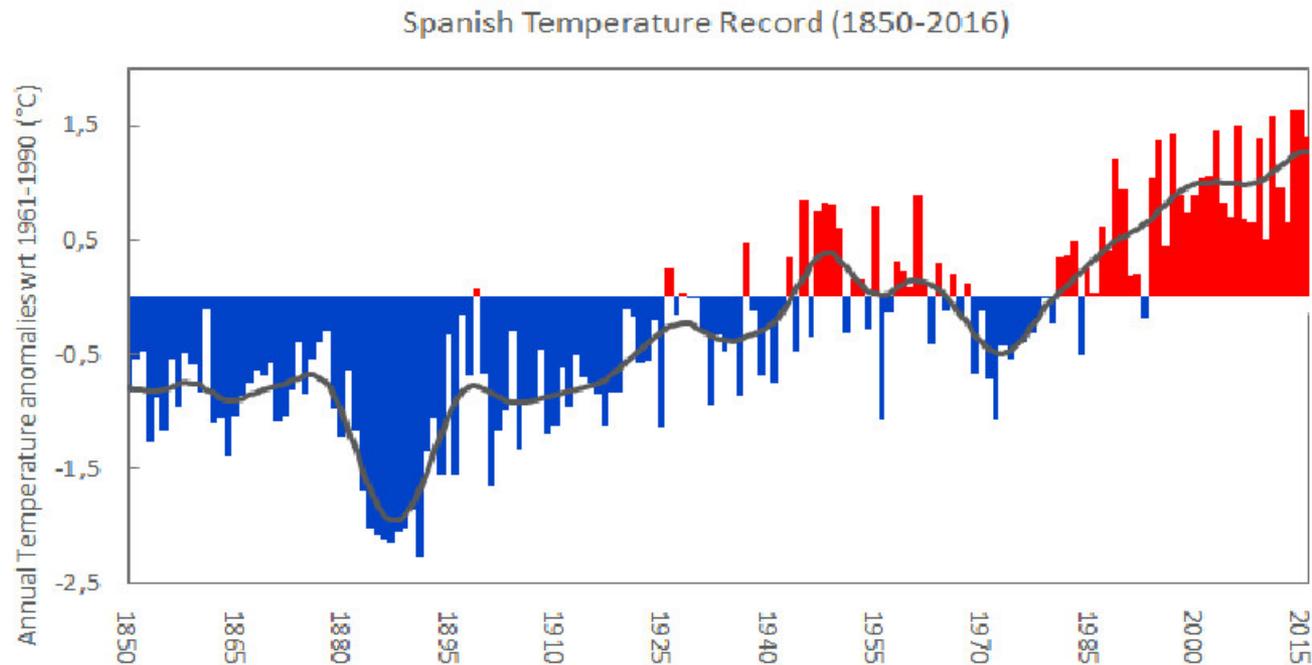
President of the WMO/Commission
for Climatology-17th

Outline

- Need for ensuring and preserving quality and homogeneity of climate data series to develop reliable climate datasets
- CCI data-related activities supporting operational climate prediction

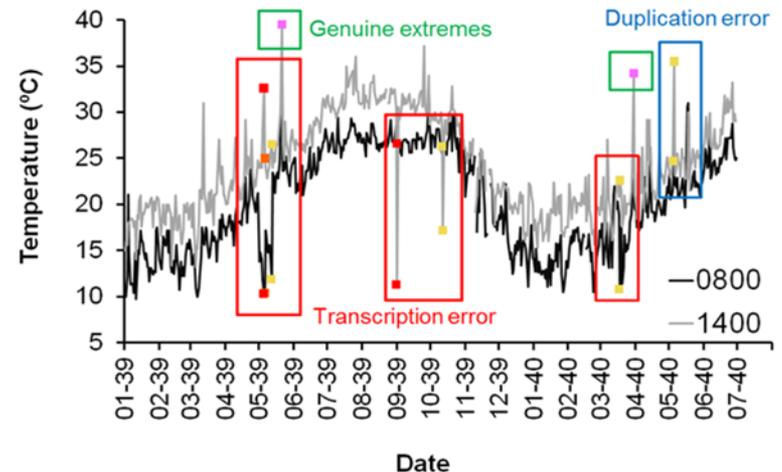
Need for ensuring and preserving quality and homogeneity of climate data series

- **Reliable** climate data series, and the derived **datasets**, are those composed of true meteorological observations and whose time variations and trends are only modulated by weather and climate factors
- So, those time-series reasonably free of both non-systematic (through **QC assurance**) and systematic biases (through **homogenisation adjustment**)



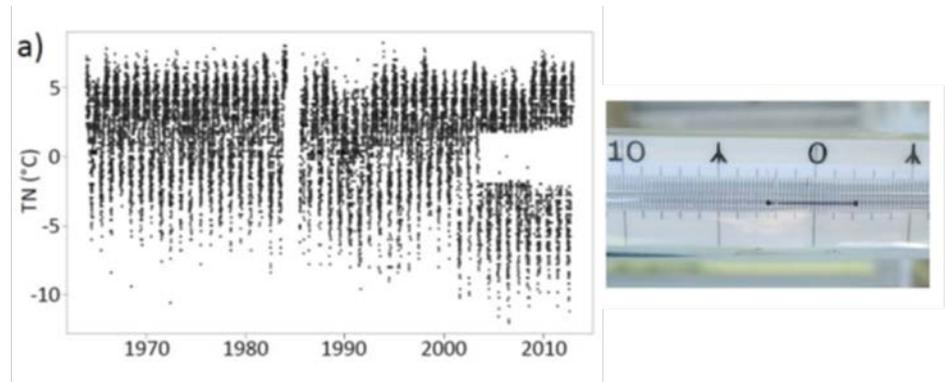
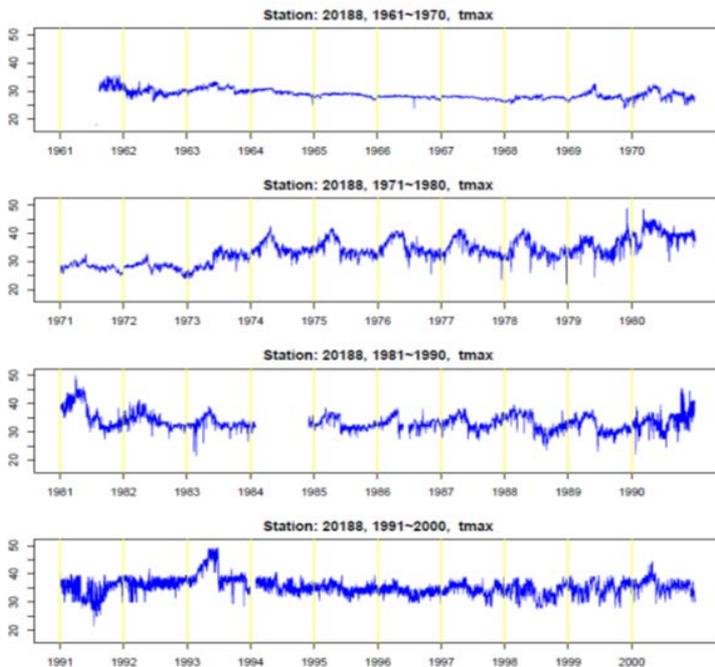
Ensuring climate data series quality

- Many individual observations (and chains of) could be not **real measurements**, but the result of a number of **errors** introduced in the process of **observation, transcription and transmission** to databanks, both in the data and metadata
- **Real-time** and near-real time **QC** ensure current observed data are **free of non-systematic errors**, but don't ensure historical climate data are free of them
- **Identifying** and fixing data **QC issues** (flagging): a battery of QCs tailored for different needs. From simply plotting data series to more complex QC exercises



- | | |
|--|---|
| ■ Outlier | ■ Outlier and IV error |
| ■ Intervariable (IV) error | ■ Big jump, IV error and outlier |

Flagging different potential temperature errors in Port Said station (Egypt).
Taken from Ashcroft et al. 2018



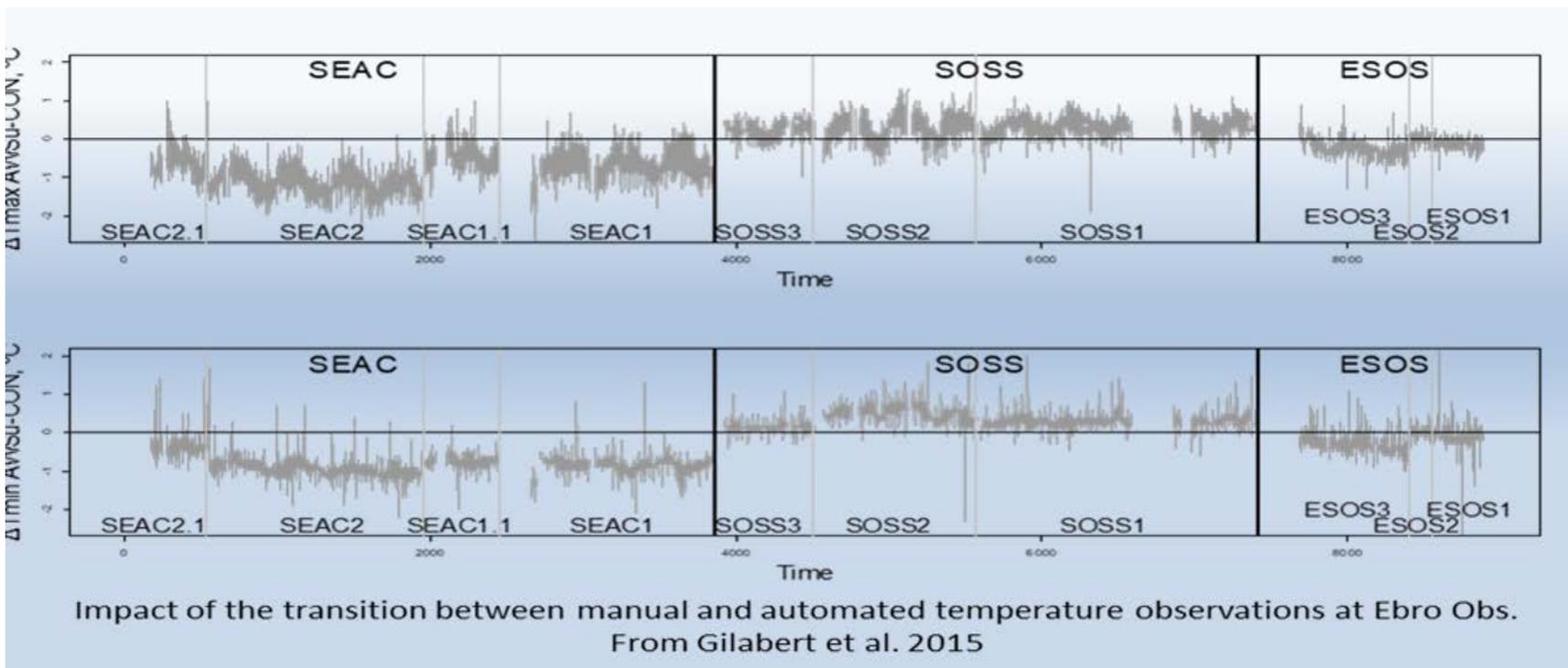
Common & systematic QC issues associated with systematically misreading instruments.
Taken from Hunziker et al. 2017

Common causes breaking time-series homogeneity, their impact and the need for adjustment

Typical **causes breaking homogeneity** in time series:

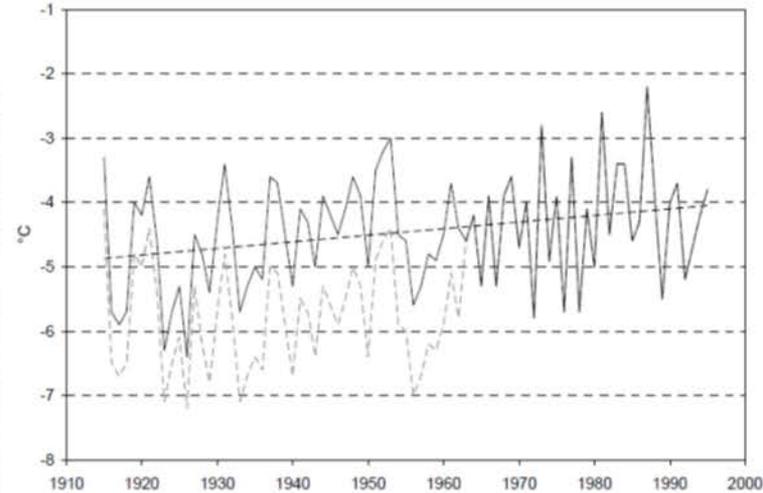
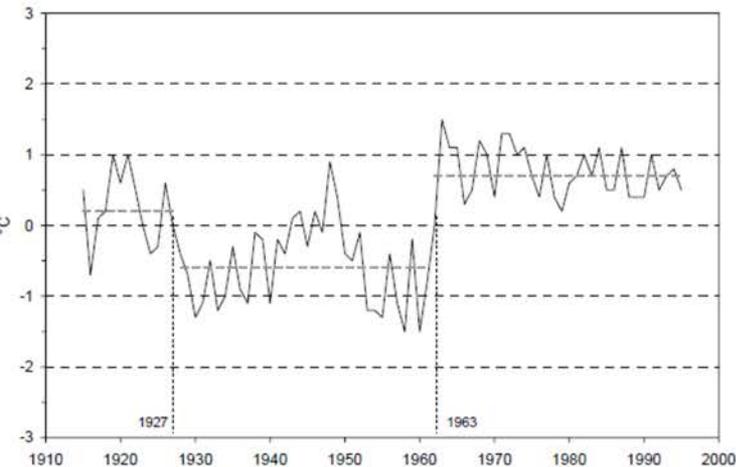
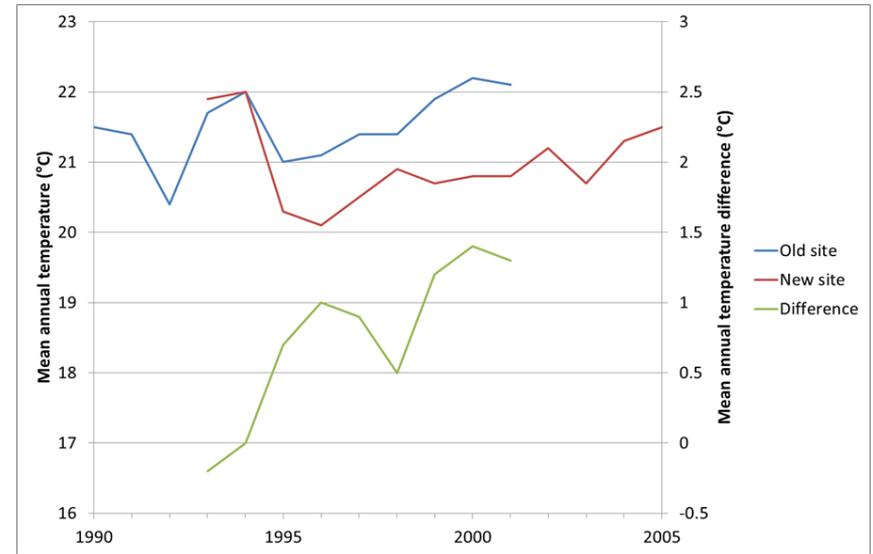
- station relocation
- changes in instrumentation, exposure and sheltering
- changes in observing systems, observers and observing schedules
- changes in observational practices and mean/sums calculation
- changes in stations surroundings (micro- and topo-climatic)

And all these changes can introduce biases even higher than climate signal



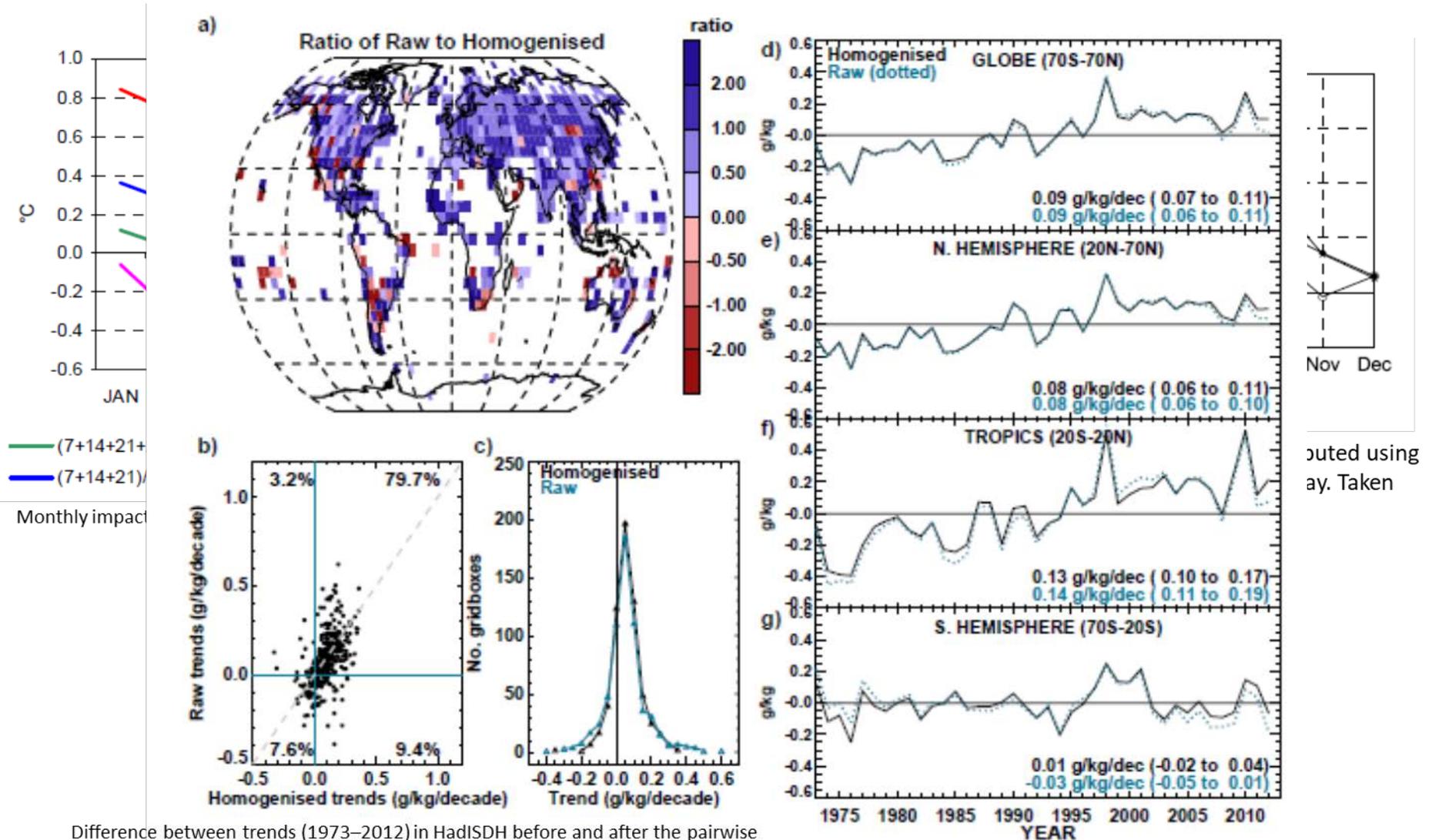
Impact of station relocation and instrumentation exposure

Impact on annual maximum temperatures at Port Lincoln, Australia, around a period of parallel observations between a conventional site in the town centre and at the airport. Taken from WMO-No. 1202 (2017)



Difference series between the candidate (Amos, Canada) and a set of reference stations showing the impact of a relocation (1927) and a change in exposure (1963) and the adjusted series: original (dashed line) and adjusted (full line) data. Taken from Vincent, 1998

Changes when calculating means/sums, in observing times, in topoclimatic conditions, mixed changes & adjusted datasets development: some examples



Difference between trends (1973–2012) in HadISDH before and after the pairwise homogenisation process. Taken from Willett et al. 2013

CCI data-related activities in supporting operational climate prediction: rational

- Most of **CCI activities** are **oriented** to serve the **implementation** of the **CSIS**, the operational core of the GFCS in support of its 5 priority areas, through which information about climate – past, present and future – is routinely archived, analysed, modelled, exchanged and processed – coordinated by the **ICT-CSIS** to compile, produce and distribute a Climate Services Toolkit (**CST**)
- The CST being a **suite of guidance, data, software tools, training resources**, and examples for enabling climate services at global, regional, and national levels. Comprising: a data portal in public domain for access to and analysis of observations;
 - a data management system for quality control and simple management of data;
 - climate monitoring tools for calculation of anomalies, percentiles, return periods;
 - software tools for conducting climate analyses, making predictions, and assessing projections
- Several **CCI Focus Areas** and **many teams** have been working in the past and present intersession periods to support an enhanced availability of and accessibility to **high-quality and high-density data** required for climate monitoring and prediction

Priority areas



Agriculture and food security



Disaster risk reduction



Energy



Health



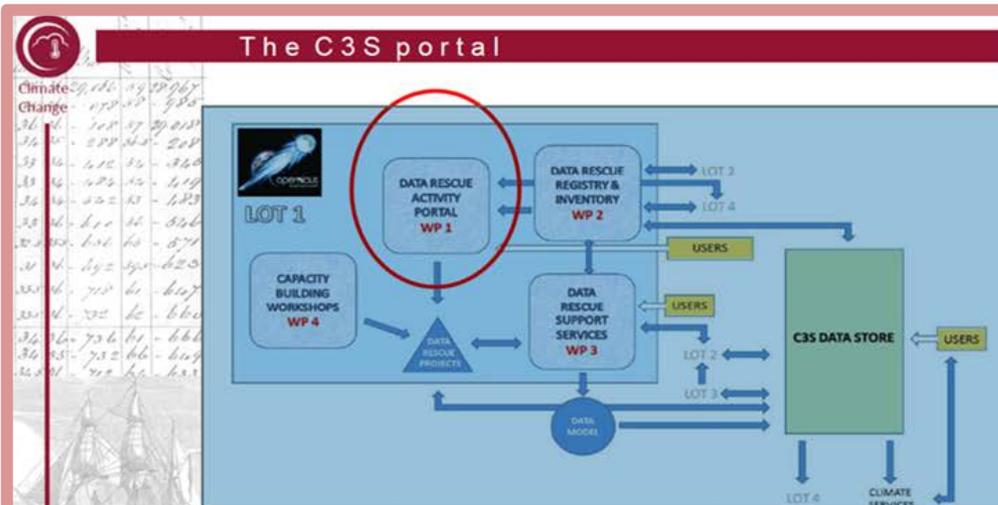
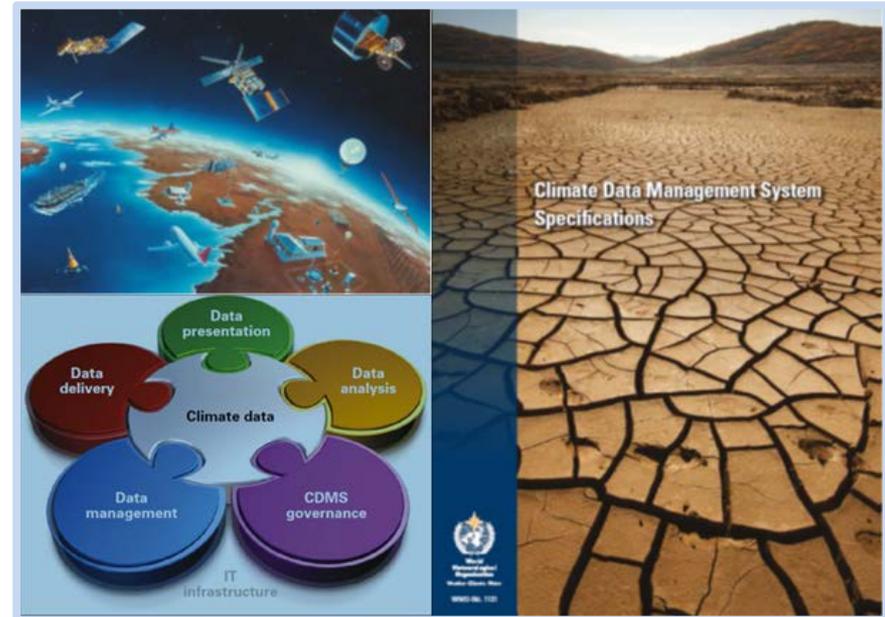
Water



CCI data-related contributions: Climate Data Rescue, Management & Development (1)

Providing guidance, tools & software on :

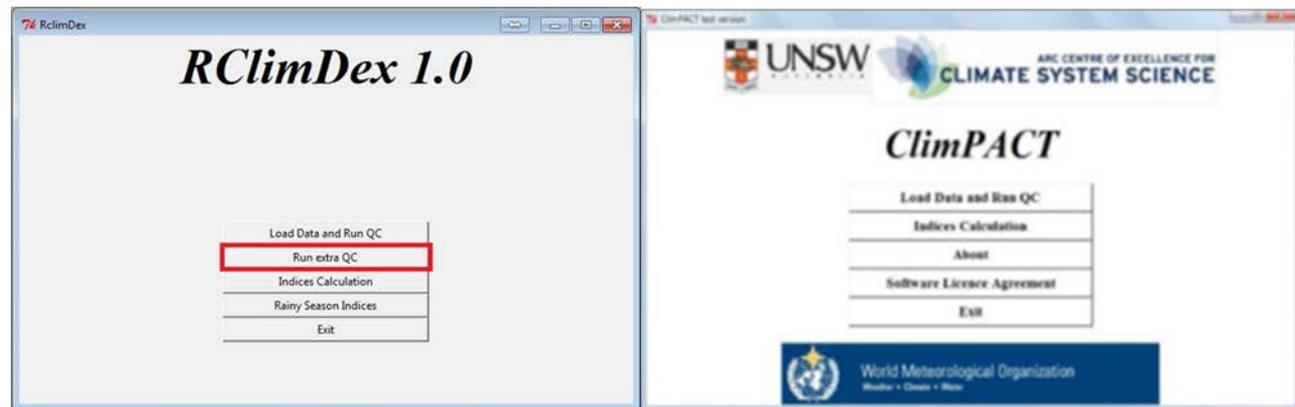
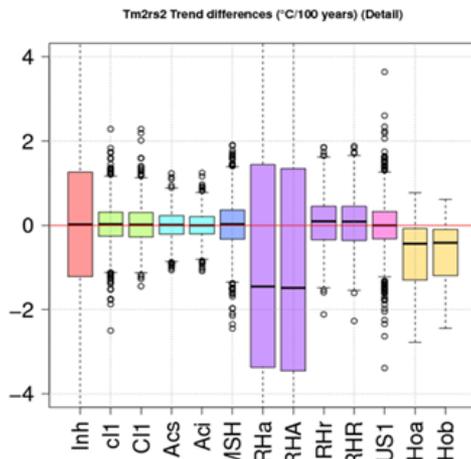
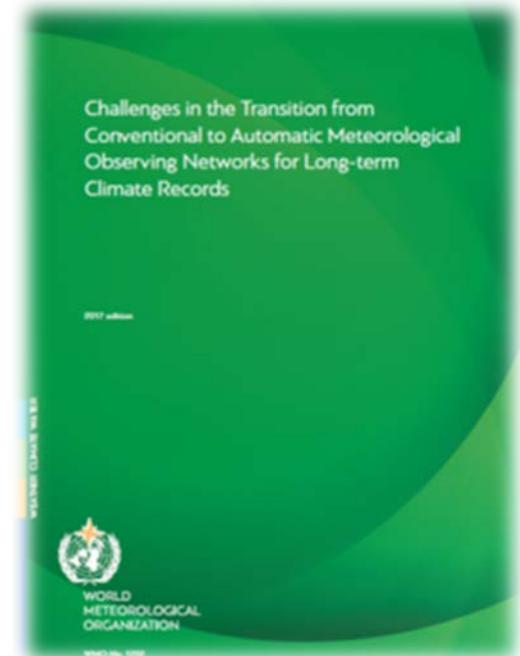
- Climate Data Management Systems (CDMS) specifications
- Supporting Climate Data Modernisation: drafting a High Quality Global Data Management Framework for Climate
- Enhancing Data Rescue (DARE) activities & coordination, recently liaised with the C3S DRS effort for DARE services: I-DARE portal & Guidelines
- Producing NCMPs, extreme indices & unequivocal definitions & characterisation of extreme events
- Inventorying relevant data and products currently available from WMO global and regional centres and other major climate institutions to support CST



CCI data-related contributions: Climate Data Rescue, Management & Development (2)

Providing guidance, tools & software on :

- WMO guidance on Metadata & Homogenisation and an updated WMO Guidelines on Homogenisation drafted
- WMO Guidance Note on challenges in transition periods from conventional to automatic networks for longer-term climate records produced
- A website providing results of homogenisation methods efficiencies to guide their application set up
- Developing QC software, their user manuals & channelling existing homogenisation packages
- Updating, maintaining, developing in-situ climate records to calculate ETCCDI & ETSCI extreme indices & populate HadEXv3 to contribute to IPCC AR6 & CST



Next goals of the new Focus Areas (FA) on Climate Monitoring, Data and Assessment (FA1) to support CSIS Operations (FA2)

- Setting up a strong Focus Area on Climate Monitoring, Data & Assessment, leading to **operationalise** what has been achieved in **data rescue, management & development**
- Providing **guidance** on **quality control, homogenization** & their uncertainties to ensure more complete traceability and **maturity of climate data**, and liaise with other programmes to follow unified schemes for handling data for climate services & contributing to establish a global land surface climate fiducial reference network
- Giving guidance on requirements and criteria for **developing national reference observing networks** for climate monitoring, assessment and services, with a special focus on **climate change aspects**
- **Overseeing** and monitoring **Data Rescue** and **Climate Data Management Systems** activities to give guidance on implementation aspects
- **Encouraging & following up climate data & products exchange** in compliance with Resolution 60 & in benefit of GFCS & the ICT-CSIS by providing advice on the motivation for sharing & contributing to define **technical requirements** for **registering, coding & exchanging** following international standards
- Guiding & advising on the **use** of **remote sensing data** for climate monitoring & prediction in cooperation with WMO Space Program & GCOS
- **Fostering** integrated and **seamless data-processing** and forecasting system



Thanks 4 attention