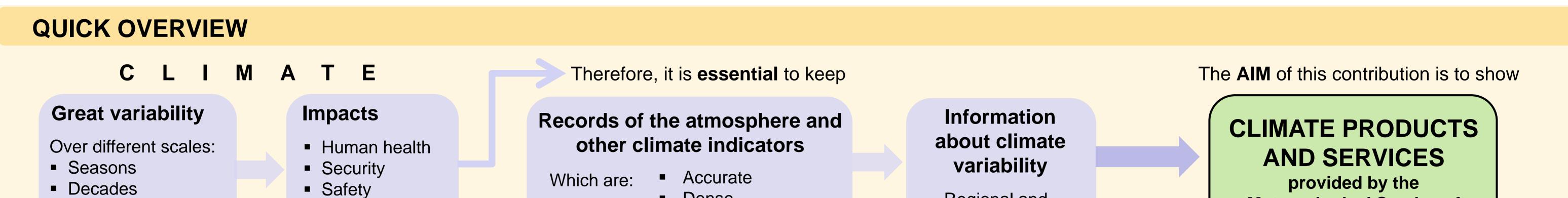# Variability and climate change monitoring tools at the Meteorological Service of Catalonia

Laura Barbería[1], Antoni Barrera-Escoda[1], Montserrat Busto[1], Jordi Cunillera[1], Mònica Herrero[1], Alba Llabrés[1], Anna Miró[1], Juan Carlos Peña[1], Anna Rius[1], Vicent Altava-Ortiz[2] and Marc J. Prohom[1]

(1) Meteorological Service of Catalonia, Area of Climatology, Barcelona, Catalonia, Spain (clima@meteo.cat)
(2) Meteorological Service of Catalonia, Area of Applied Research and Modelling, Barcelona, Catalonia, Spain

QUICK OVERVIEW

C L I M A T E

Great variability
Over different scales:
- Seasons
- Decades
- Thousands of years
- Etc.

Impacts
- Human health
- Security
- Safety
- Etc.

Therefore, it is **essential** to keep

Records of the atmosphere and other climate indicators
Which are:
- Accurate
- Dense
- Long-term

Information about climate variability
Regional and local scale

The **AIM** of this contribution is to show

CLIMATE PRODUCTS AND SERVICES provided by the Meteorological Service of Catalonia (SMC)

The information is provided freely to the final user

CLIMATE PRODUCTS AND SERVICES
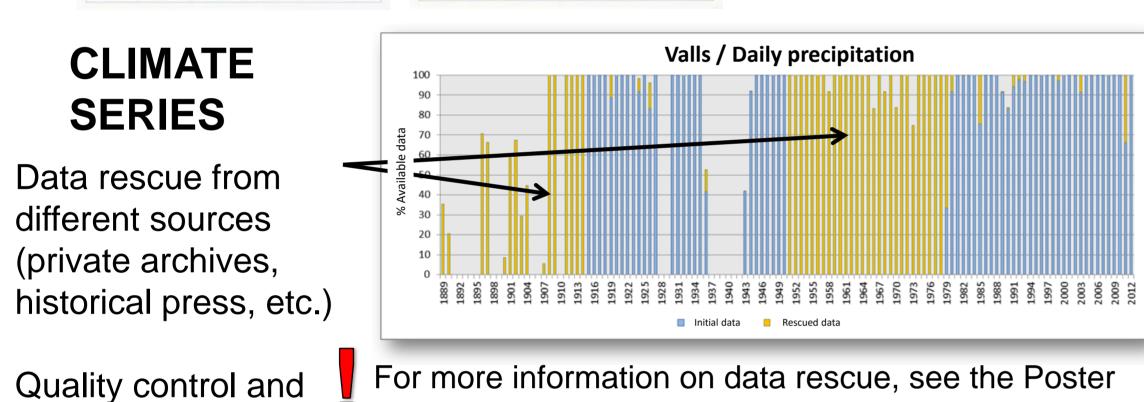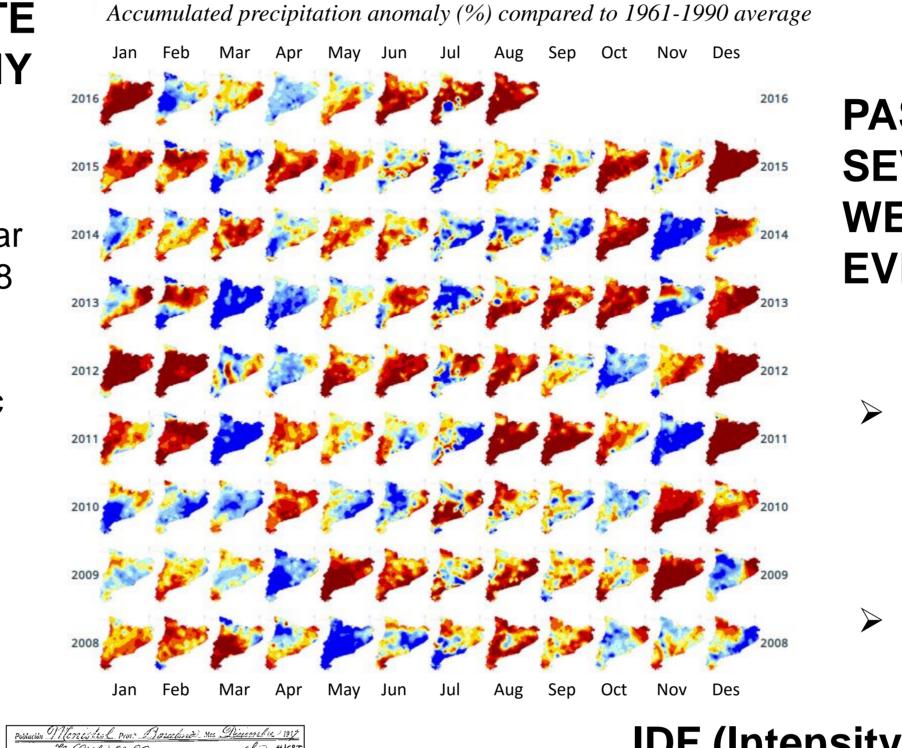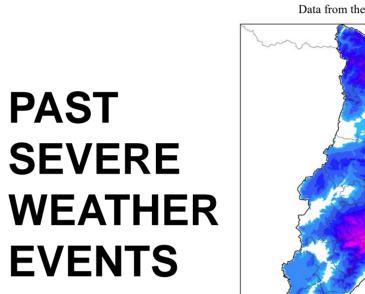
CLIMATE YESTERDAY

CLIMATE ATLAS
- Reference period 1961-1990
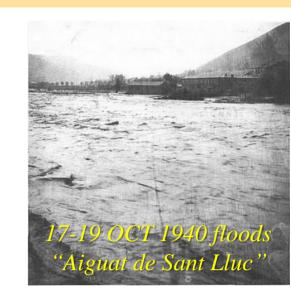- Spatial fields with climatological means (temperature, precipitation) on monthly, seasonal, annual scales

PAST CLIMATE CARTOGRAPHY CALENDARS
- For temperature, precipitation and solar irradiation since 2008
- Monthly, seasonal, yearly & pluviometric year (SEP-AUG)

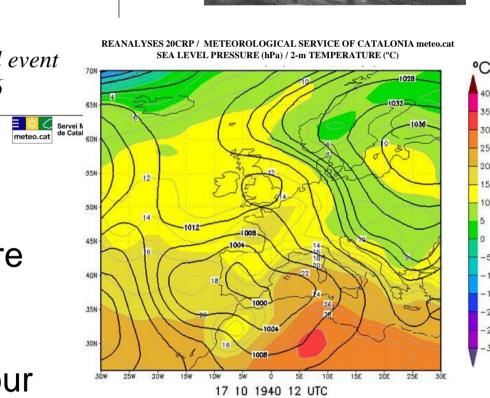Accumulated precipitation anomaly (%) compared to 1961-1990 average

CLIMATE SERIES
- Data rescue from different sources (private archives, historical press, etc.)
- Quality control and homogenisation

Valls / Daily precipitation

! For more information on data rescue, see the Poster *Prohom and Herrero: Ongoing and future climate data rescue activities at the SMC (EMS2016-243)*

PAST SEVERE WEATHER EVENTS

Severe snowfall event JAN 1986

17-19 OCT 1940 floods "Aiguat de Sant Lluc"

- Gathering of images, data, damages, and meteorological reanalyses for historical severe weather events
- Special articles published in our blog

IDF (Intensity-Duration-Frequency) CURVES

CLIMATE TODAY

PERIODICAL BULLETINS
- Monthly
- Seasonal
- Yearly & Pluviometric year (SEP – AUG)

SEA TEMPERATURE & SEA LEVEL
- **L'Estartit** (Costa Brava, NE Catalonia). Thanks to the observer **Josep Pascual**
- **SST** (sfc, –5 m, –20 m, –35 m, –65 m & –80 m) since 1969
- **Sea level** since 1990

SST

L'Estartit – Temporal evolution for the monthly mean sea level (1990-2015)

PHENOLOGY
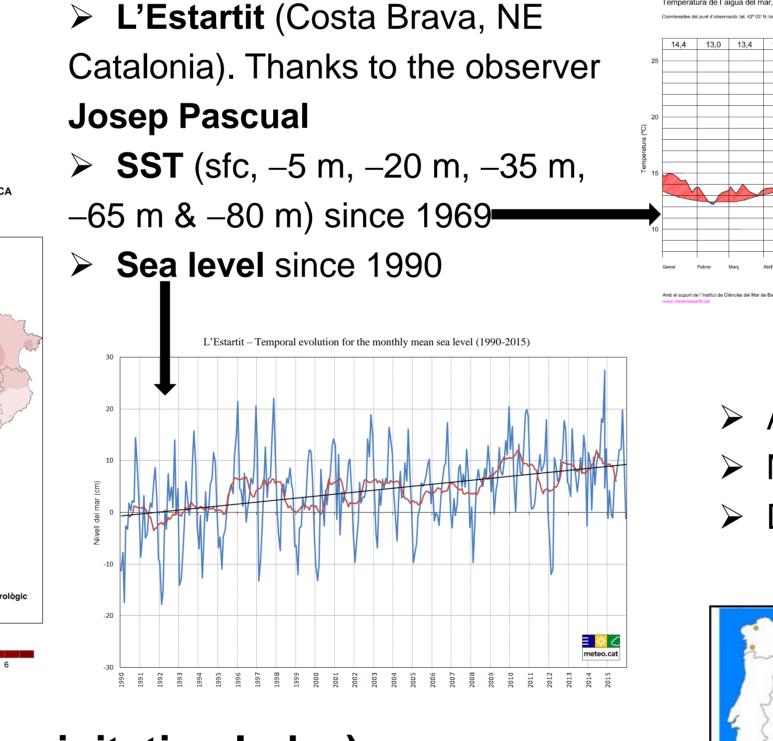- A dense network from 2013
- Member of the PEP725
- Data rescue and trends

Phenological network

SPI (Standardised Precipitation Index)
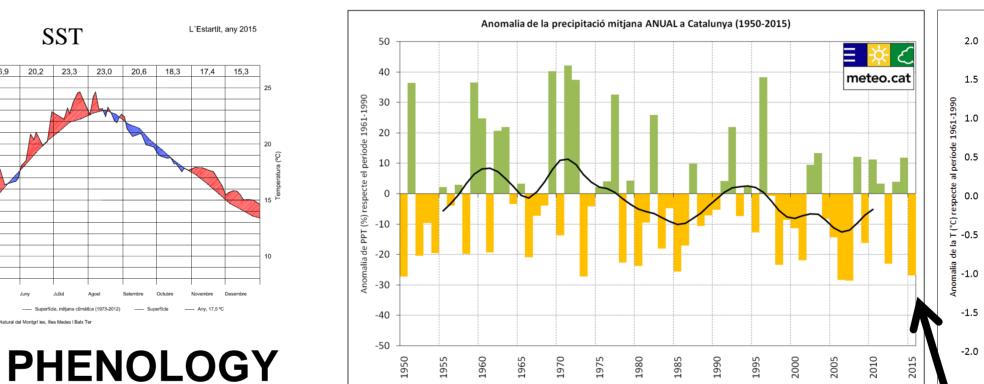- Drought monitoring at different moving temporal scales (3, 6, 9, 12, 24, 36 & 72 months)
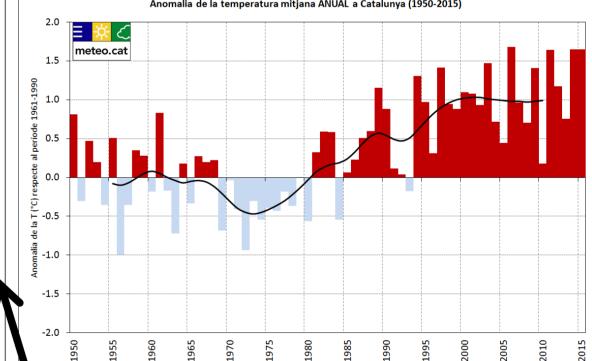
SPI (6 months) MAR 2016 – AUG 2016
SPI (9 months) DEC 2015 – AUG 2016
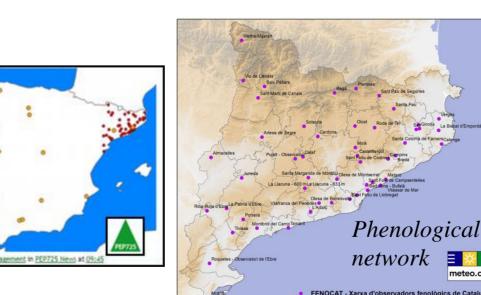SPI (12 months) SEP 2015 – AUG 2016
SPI (36 months) SEP 2013 – AUG 2016

CLIMATE TRENDS & INDICES (1950-2015)

Anomalia de la precipitació mitjana ANUAL a Catalunya (1950-2015)

Anomalia de la temperatura mitjana ANUAL a Catalunya (1950-2015)

- Periodical Annual Bulletin of climate indicators for Catalonia (BAIC)
- Anomalies compared to 1961-1990 mean values
- High-quality & continuous data series: Temperature (24) and precipitation (71)

Apple tree (*Malus domestica*) leaf fall

Barn swallow (*Hirundo rustica*) departure date

Trend (days / decade) for Annual Number of Tropical Nights (Min. temperature > 20 °C)

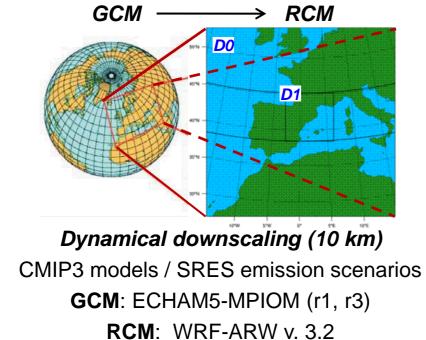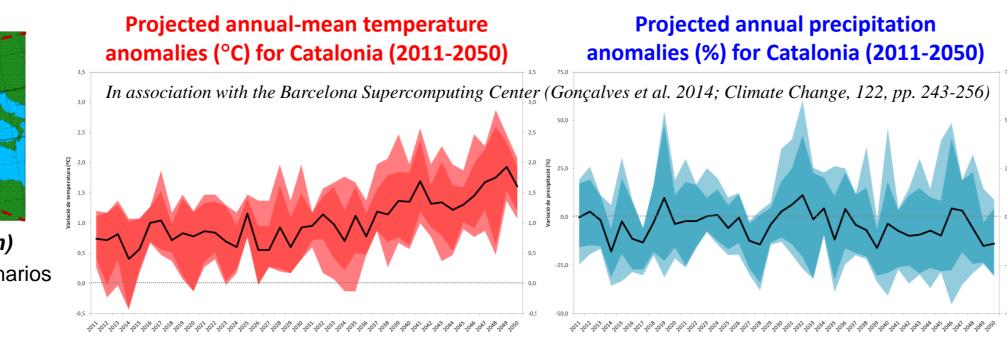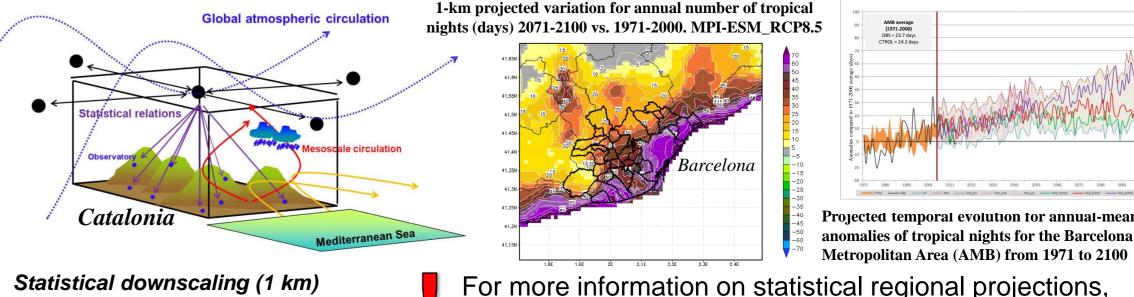*Trend (days / decade) for Warm Spell Duration Index (WSDI)*

CLIMATE TOMORROW

CLIMATE REGIONAL PROJECTIONS
- Dynamical (10-km spatial resolution) and statistical (1-km spatial resolution) downscaling

GCM → RCM

Dynamical downscaling (10 km)
CMIP3 models / SRES emission scenarios
GCM: ECHAM5-MPIOM (r1, r3)
RCM: WRF-ARW v. 3.2

Projected annual-mean temperature anomalies (°C) for Catalonia (2011-2050)
In association with the Barcelona Supercomputing Center (Gonçalves et al. 2014; Climate Change, 122, pp. 243-256)

Projected annual precipitation anomalies (%) for Catalonia (2011-2050)

Global atmospheric circulation

Catalonia
Mediterranean Sea

Statistical downscaling (1 km)
CMIP5 models / RCPs emission scenarios
GCM: MPI-ESM, GFDL-ESM2G & CanESM2 (r1)
RCM: Analog Method

1-km projected variation for annual number of tropical nights (days) 2071-2100 vs. 1971-2000. MPI-ESM_RCP8.5

Projected temporal evolution for annual-mean anomalies of tropical nights for the Barcelona Metropolitan Area (AMB) from 1971 to 2100

! For more information on statistical regional projections, see the Presentation *Altava-Ortiz et al.: High-resolution climate projections for the Barcelona Metropolitan Area (EMS2016-489)*