5th Annual Forum of the EU Strategy for the Danube Region

Workshop 2:

WATER – NON-ALTERNATIVE SOURCE FOR LIFE

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Hydrological drought – curent status and new challenges of the research

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DROUGHT DEFINITION

Drought is a relative term because of:

- **different conditions in different climatic zones**
  - **normal conditions in arid zones,**
  - **extreme conditions in other zones**
- **different need for water in various types of natural ecosystems and sectors of human activities**

drought vs water scarcity

(1) WHAT IS DROUGHT?

Drought is:

- **Part of natural climate cycle**
- **Complex phenomenon manifesting itself in all components of the hydrological cycle, being the most pronounced in the**
  - **atmosphere**
  - **hydrosphere**
  - **soil system**
  - **biosphere**
  - **and consequently in the anthroposphere**

(2) WHAT IS DROUGHT?

Drought is:

- **One of the meteorological and hydrological extremes**
- **One of the meteorological features the most difficult to predict**
- **One of the costliest hazards connected to climate**
- **One of the hazards with the wide range of impacts, mostly in:**
  - **environment**
  - **society**
  - **economy**

Public water supply
Energy production
Water-born transportation
Agriculture and aquaculture
Tourism and recreation
Ecology (water quality deterioration, violation of legal minimum flow requirements)

DROUGHT INDICES

- Lloyd-Hughes (2013) assembled more than 100 numeric drought parameters – drought indices
- High number of drought indices is the result of difficult drought defining in the wide range of sectors affected by drought
- The most often indices used are:
  - standardized precipitation index (SPI), implemented by McKee et al. (1993)
  - standardized precipitation and evapotranspiration index (SPEI), implemented by Vincente-Serrano et al. (2010)
  - standardized runoff index (SRI), standardized discharge index (SFI)
  - standardized baseflow index (SGI/SWI)
  - standardized index of drought severity (SDSI) enabling comparison of drought periods with different duration and deficit volume
  - Water Exploitation Index Plus (WEI+)

NEW ACHIEVEMENTS

Case study: European 2015 drought

Ionita et al., 2016: The European 2015 drought from a climatological perspective [Hydrology and Earth System Sciences, under review]

Van Lanen et al., 2016: Hydrology needed to manage droughts: the 2015 European case [Hydrological Processes, August 2016]

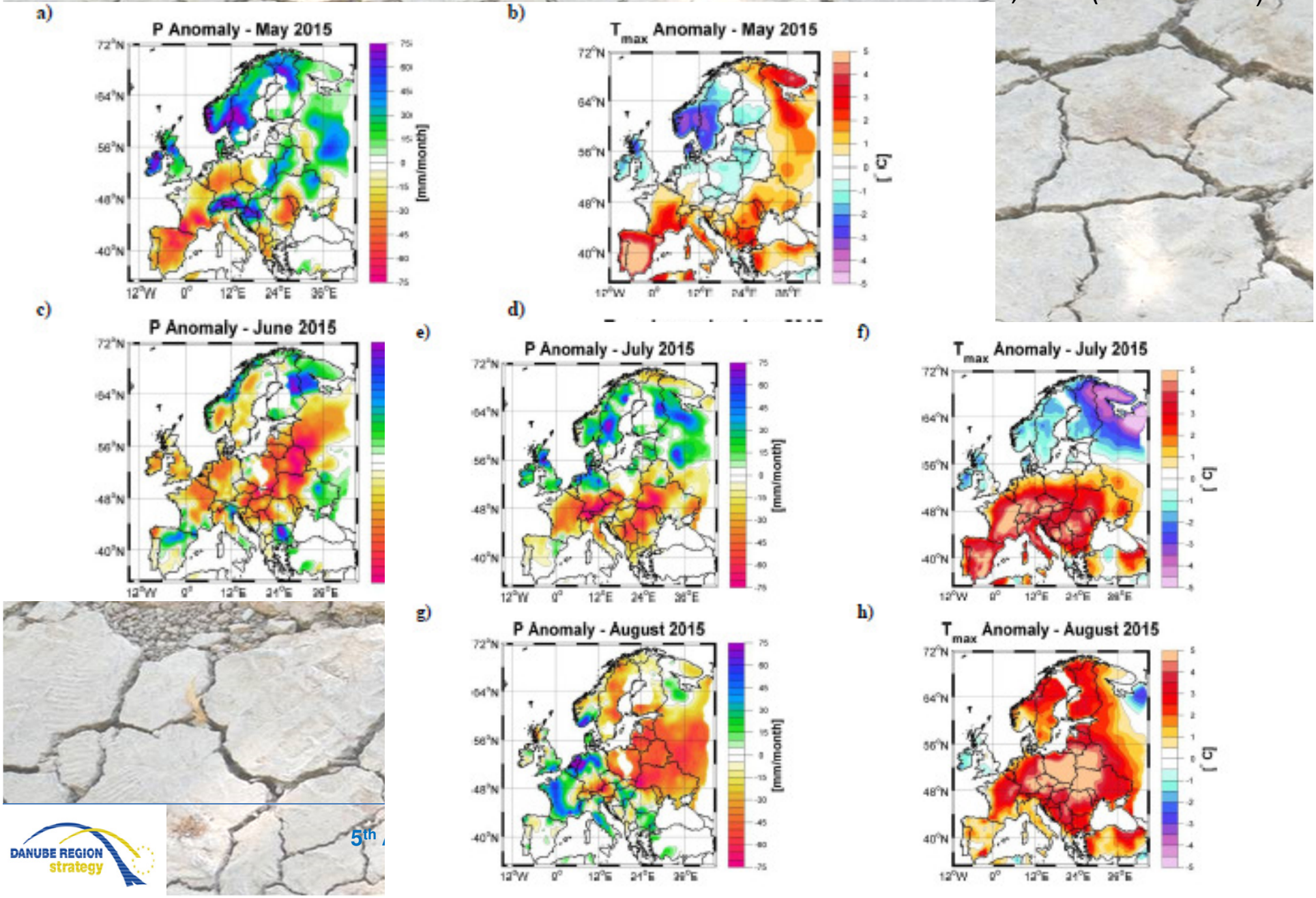
Laaha et al., 2016: The European 2015 drought from a hydrological perspective (Hydrology and Earth System Sciences, under review]

Factors controlling occurrence of meteorological droughts (warm part of the year) over the Europe

- Temperature anomalies (persisting high temperatures, heat waves)
- Precipitation anomalies (low precipitation over longer period)
- Blocking episodes (positive height anomalies flanked by large negative anomalies)
- Sea surface temperatures (negative anomalies in the North Atlantic, positive ones in the Mediterranean basin

Temperature and precipitation anomalies in 2015 (with respect to 1971-2000)

Ionita et al., 2016 (under review)

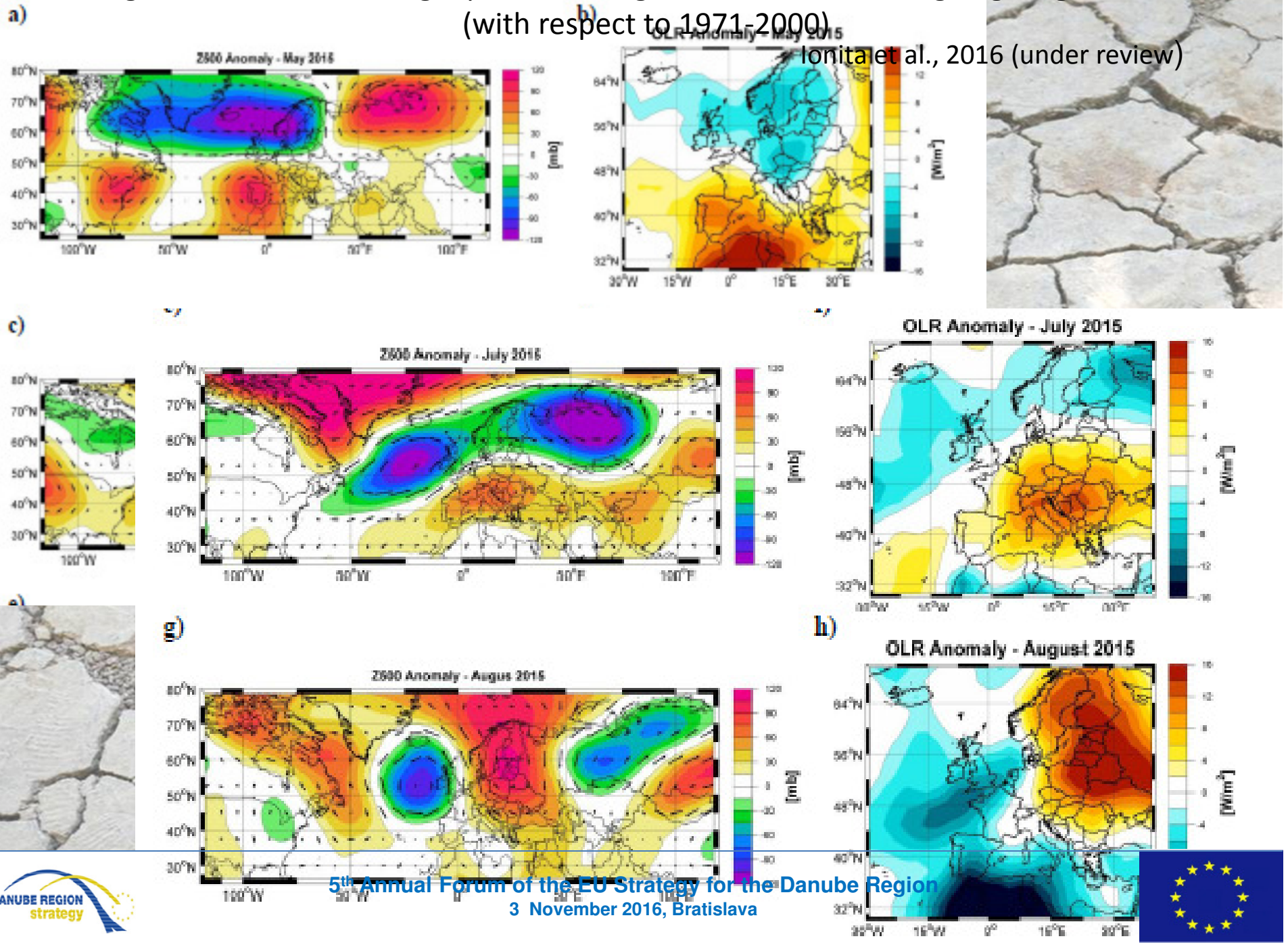


DANUBE REGION strategy

5th

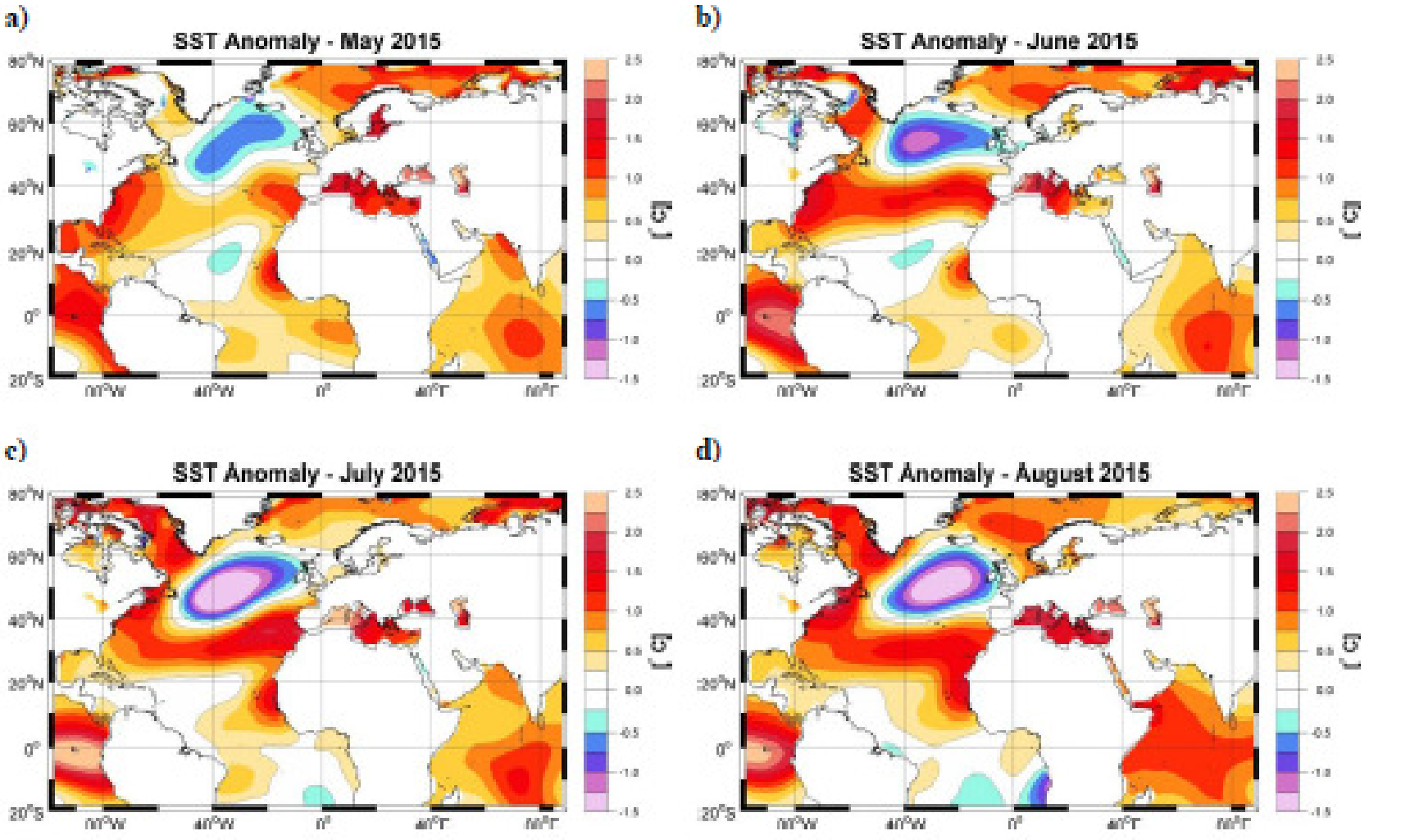
Blocking anomalies in 2015 – geopotential height at 500 hPa and outgoing longwave radiation (with respect to 1971-2000)

Ionita et al., 2016 (under review)



2015 SST anomalies

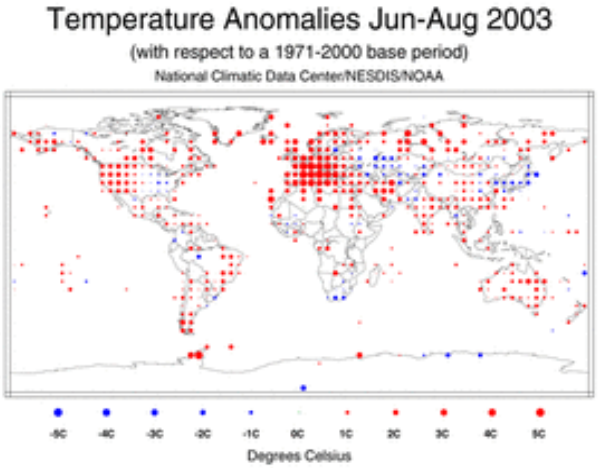
Ionita et al., 2016 (under review)

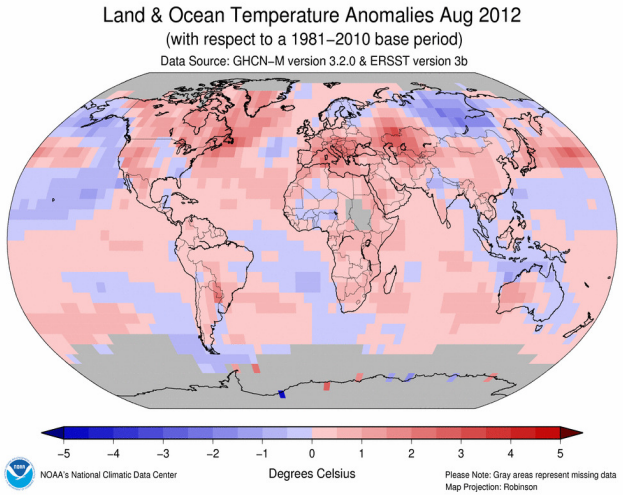


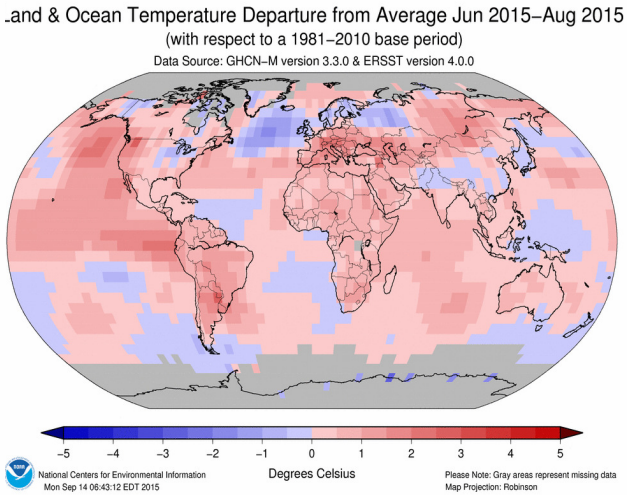
Factors controlling occurrence of the hydrological drought (warm part of the year)

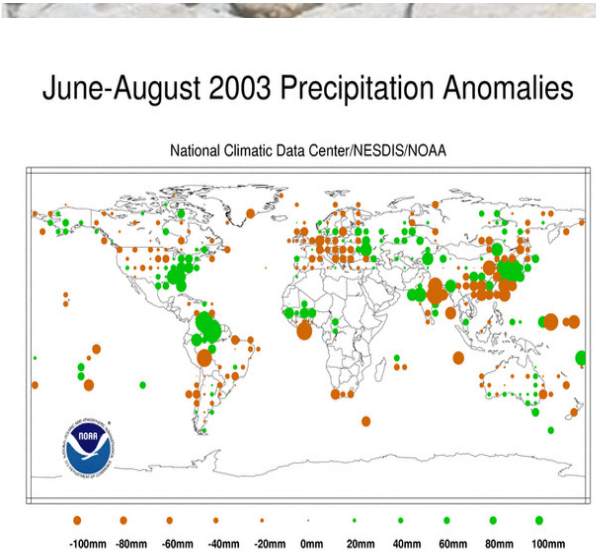
- Meteorological drought occurrence, duration and severity
- Physical properties of the catchments (altitude, geological and hydrogeological conditions, vegetation cover, land use ...
- Wetness pre-conditions in the catchments

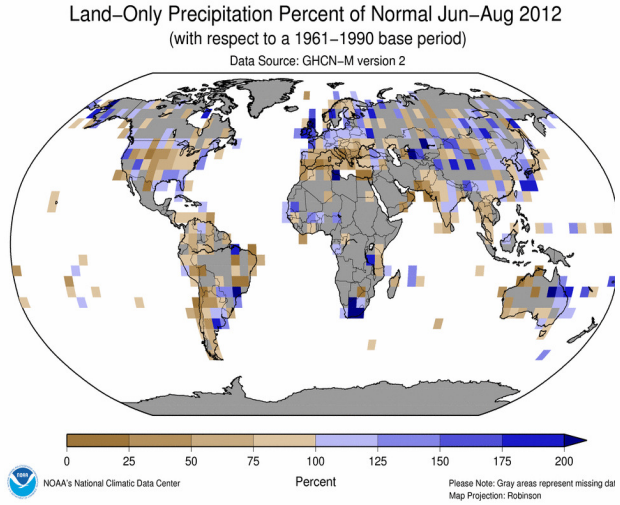
From the scientific point of view

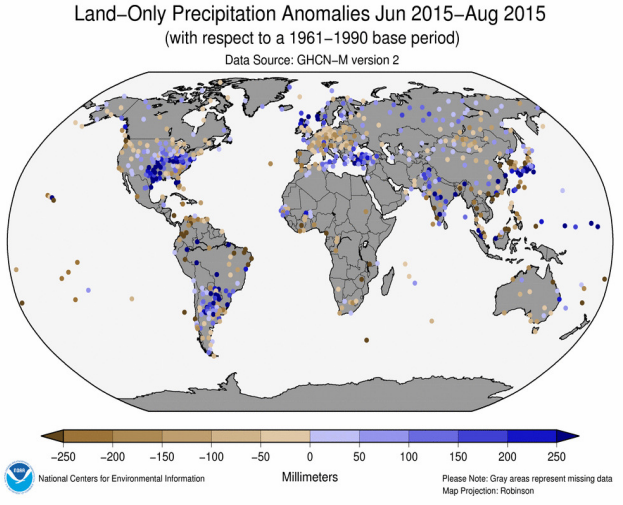












deficit of surface and groundwater resources

How the drought should be characterized?

Three basic questions should be answered:

1. **How extreme was the period of drought from the point of view of hydro-meteorological characteristics**
2. **How extreme was the drought period according to its consequences**
3. **How successful were the consequences managed**

CHALLENGES

Scientific challenges in further drought knowledge helping to institutional and strategic drought management :

1. Improving knowledge and data collection – meteorological and near real-time hydrological data should be available as quick as possible
2. Defining sector-oriented drought indices
3. Defining and implementing ecological flows
4. Promoting resilience to climate change
5. Identification of sensitive and vulnerable areas with respect to possible development of water resources and modelling of possible solutions by securing of needed water resources
6. Integrating of Water Scarcity and Droughts measures in the RBMPs

Thank you for your attention