Department of Geography Giessen

Climatology, Climate Dynamics & Climate Change

Climate and environmental changes in the Mediterranean region

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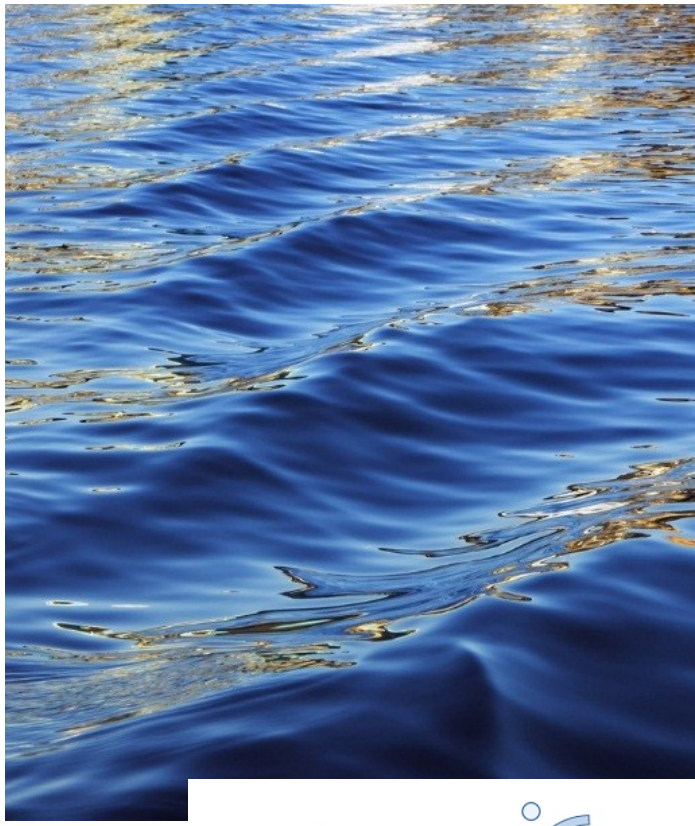
&

The Mediterranean Experts on Climate and environmental Change (MedECC)



MedECC

Mediterranean Experts on Climate and environmental Change

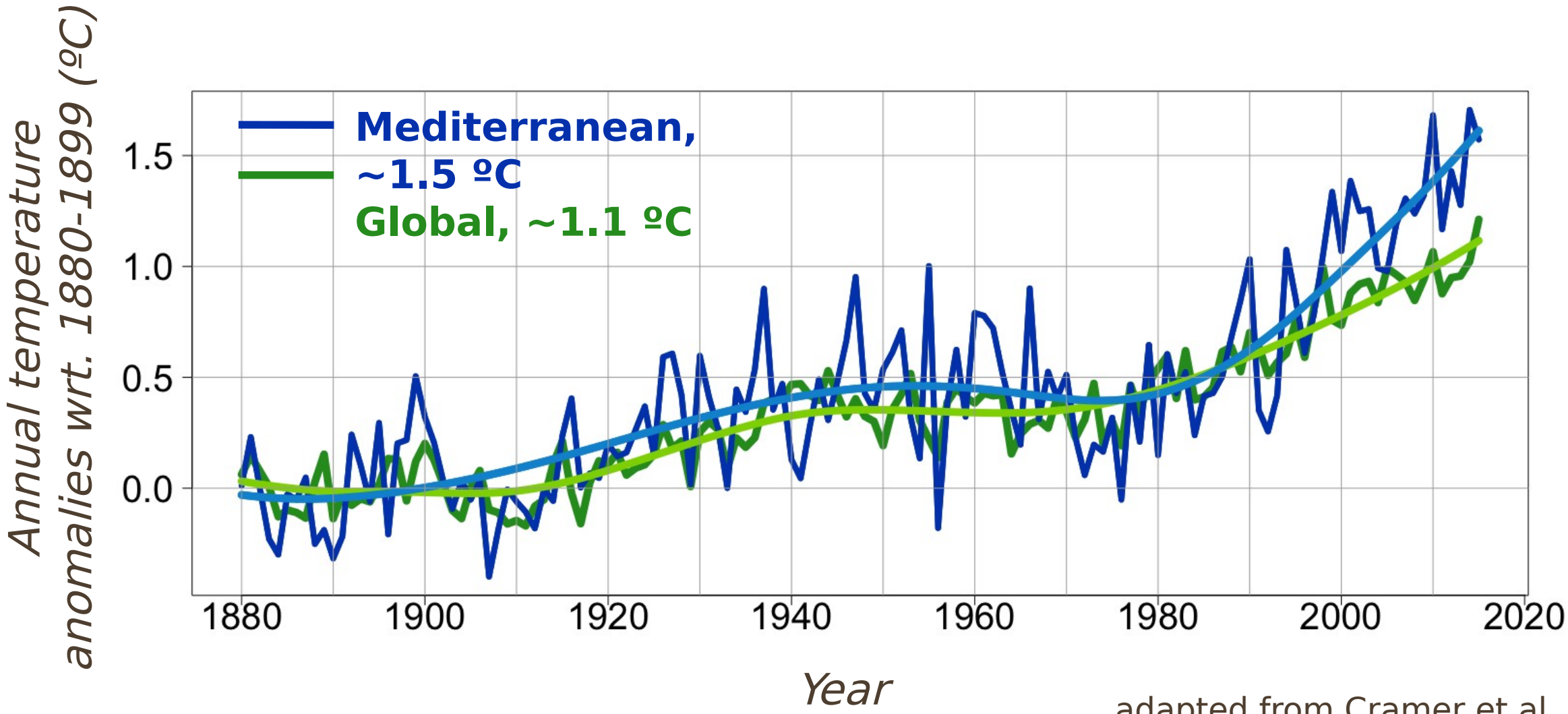
The Mediterranean area

The sea; 22 countries; the EU; UNEP-MAP; Barcelona Convention; UfM

One eco-region: 46.000 km coastline, 10% of vegetation species, 7% of marine species

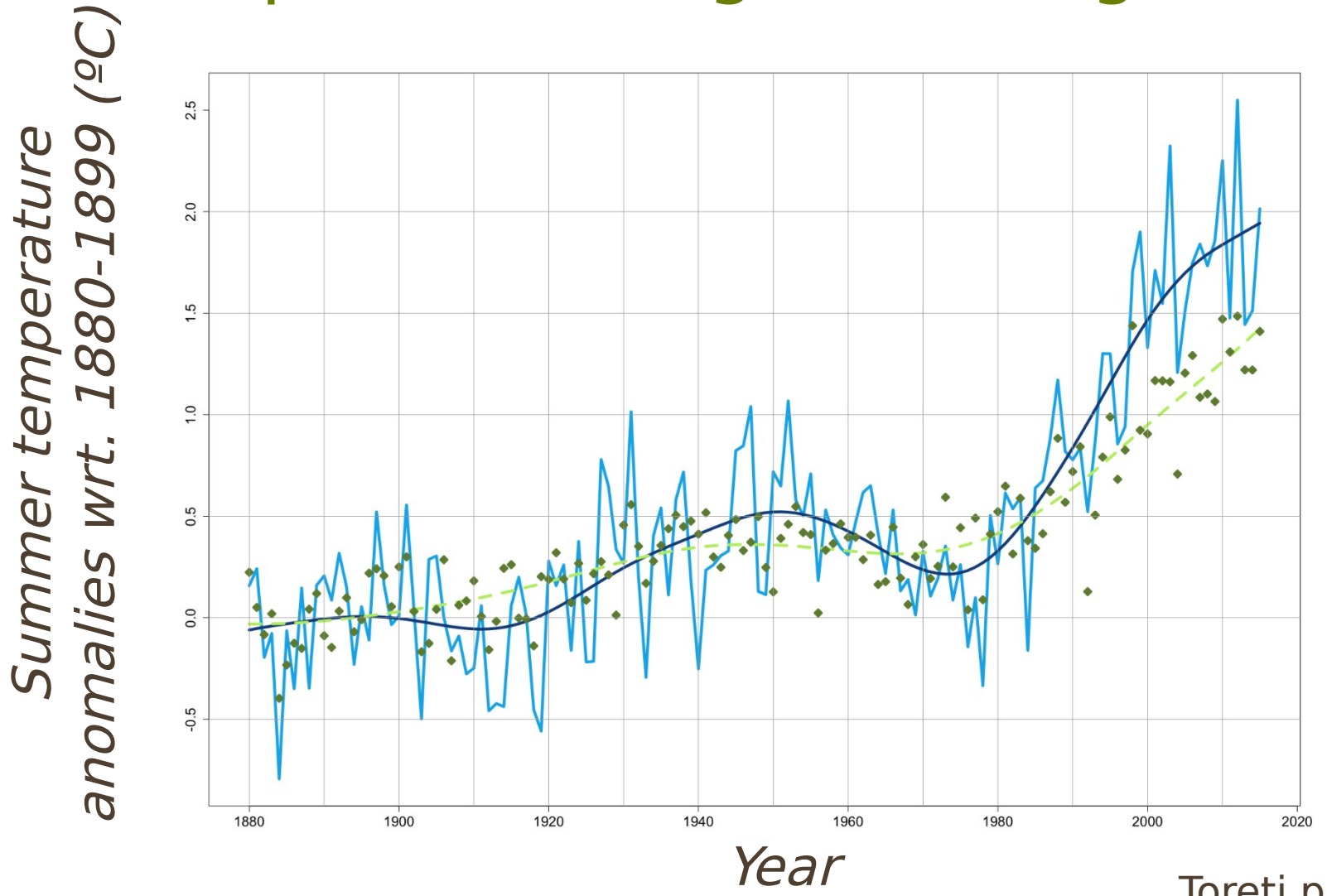
≈480 Mio inhab., 6% of world pop., 10% of world GDP, 1/3 of

Air Temperature: regional vs. global



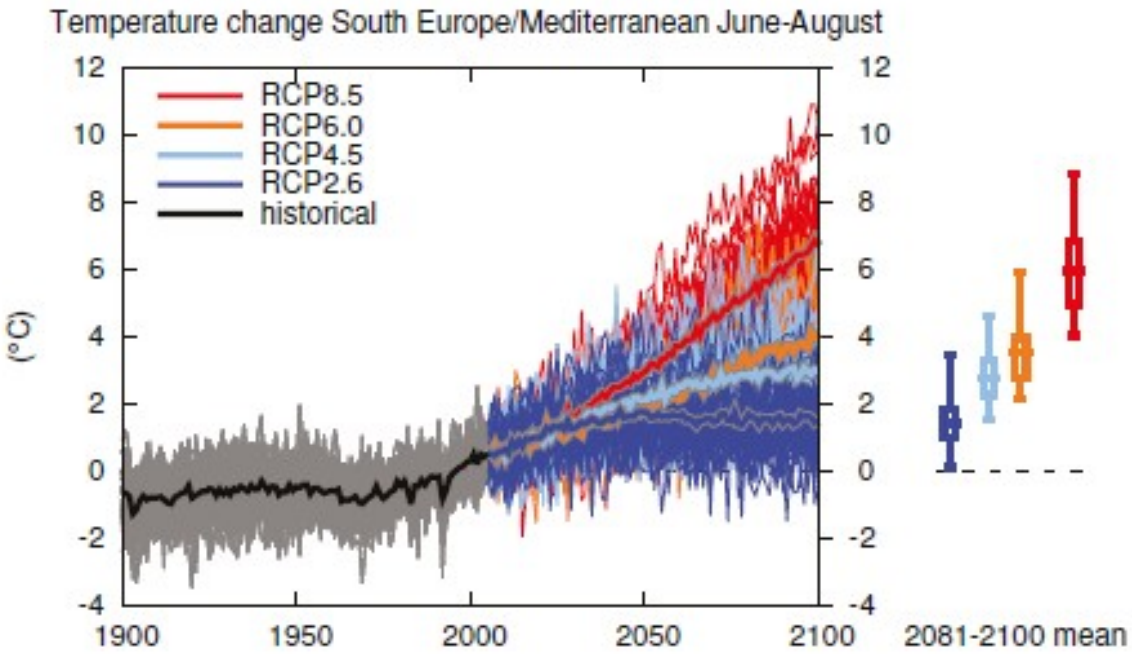
adapted from Cramer et al., 2018

Air Temperature: regional vs. global



Toreti pers. com., 2018

Future summer air temperature change



IPCC, 2013, Annex I, van Oldenborgh et

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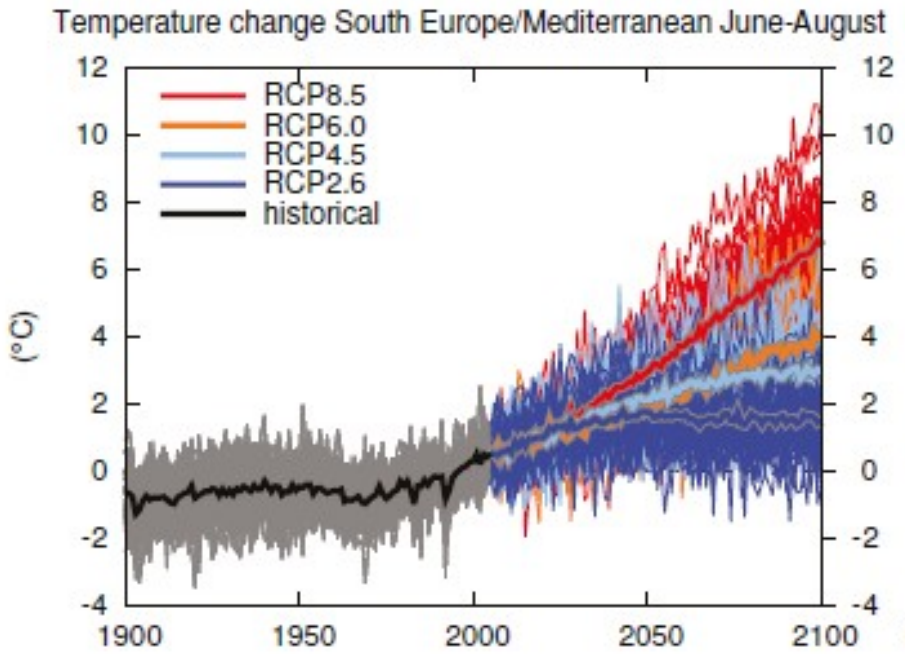
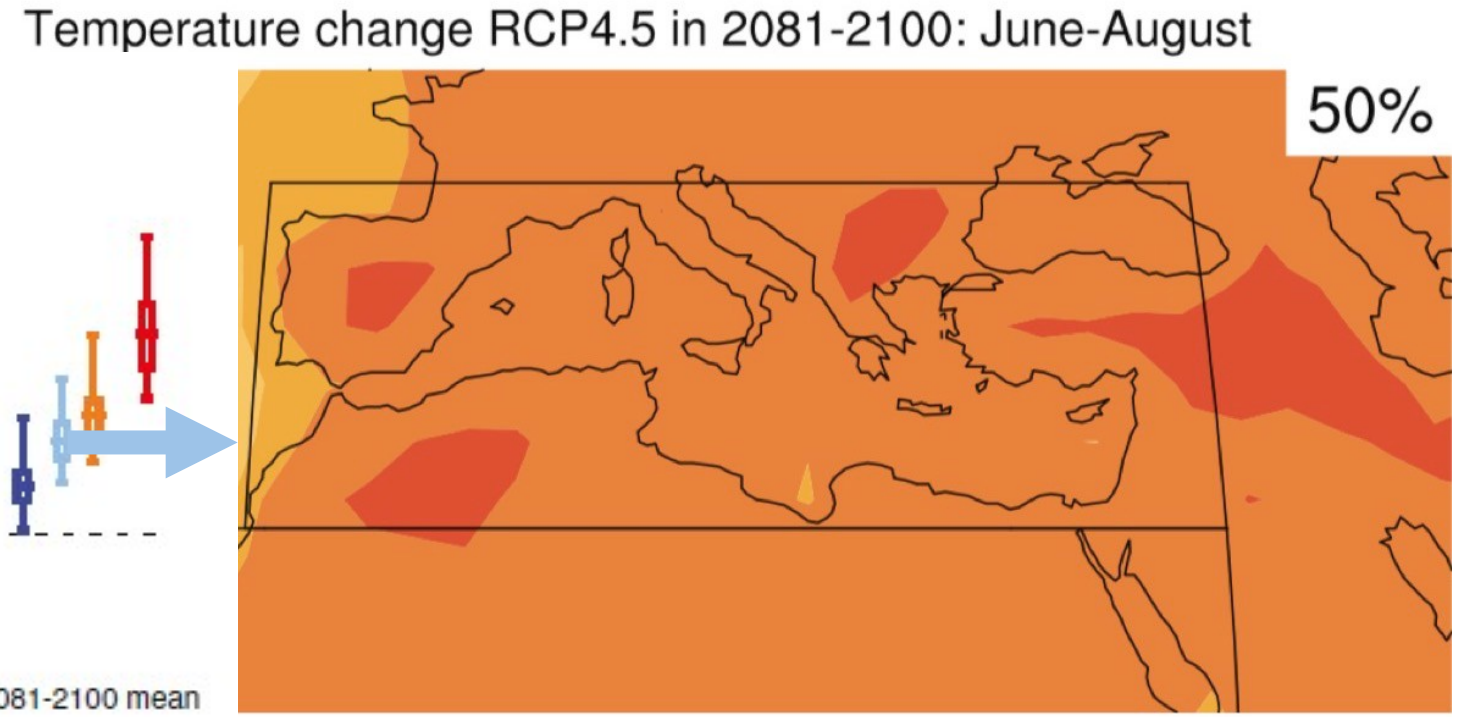


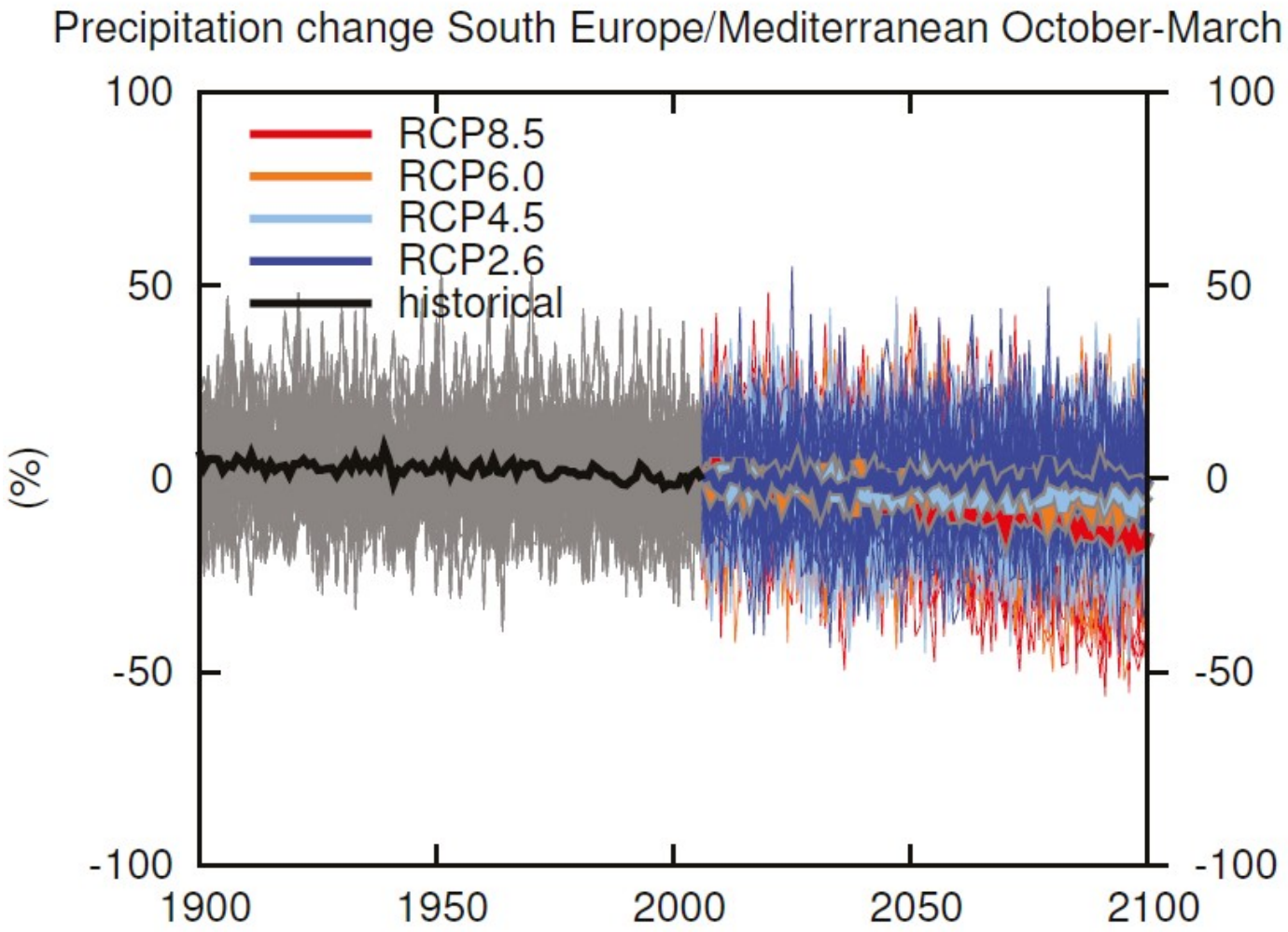


wrt. 1986-2005

+ 0.85 ºC, wrt. 1880-1899

IPCC, 2013, Annex I, van Oldenborgh et

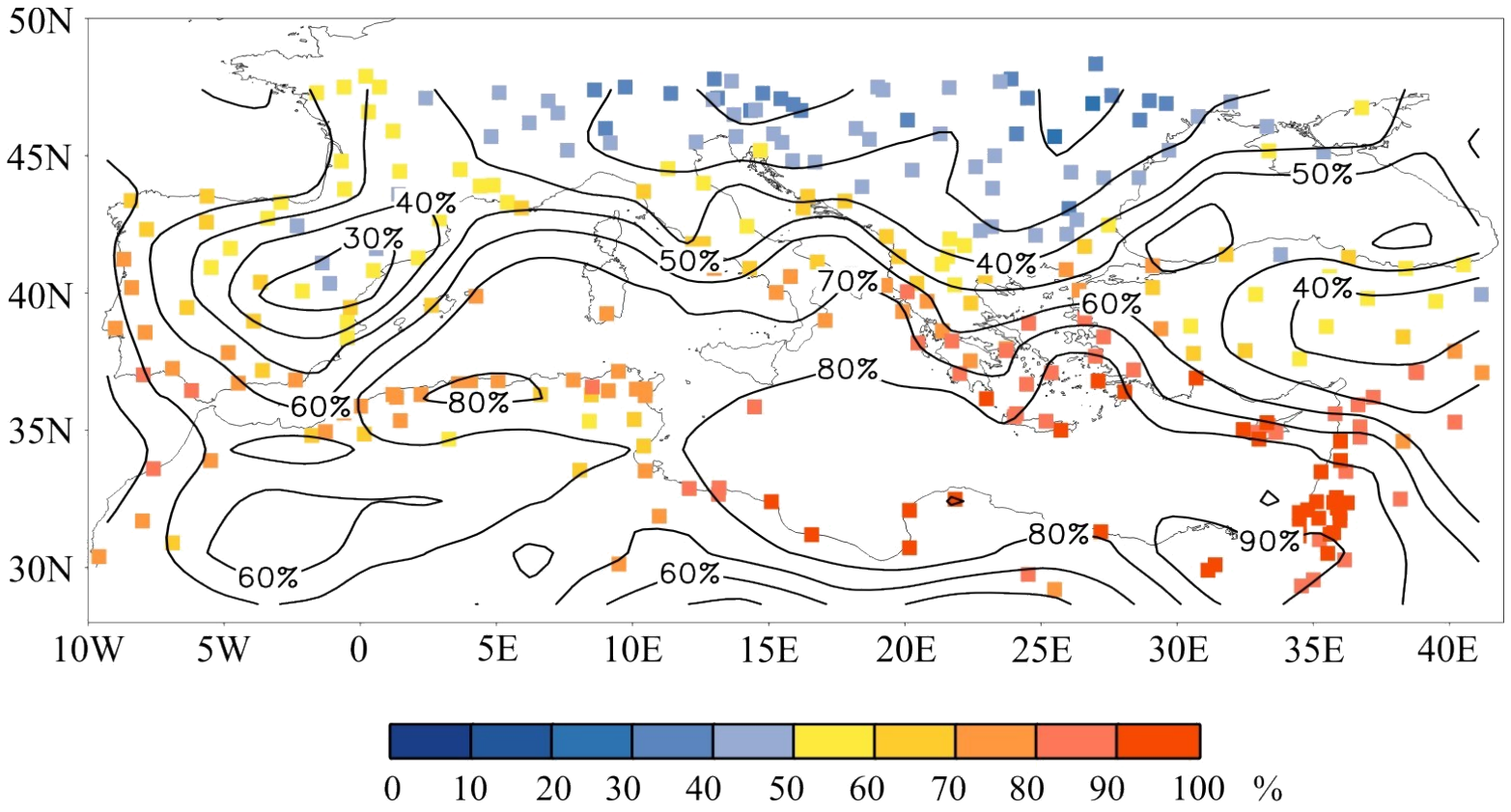
Future wet period precipitation change



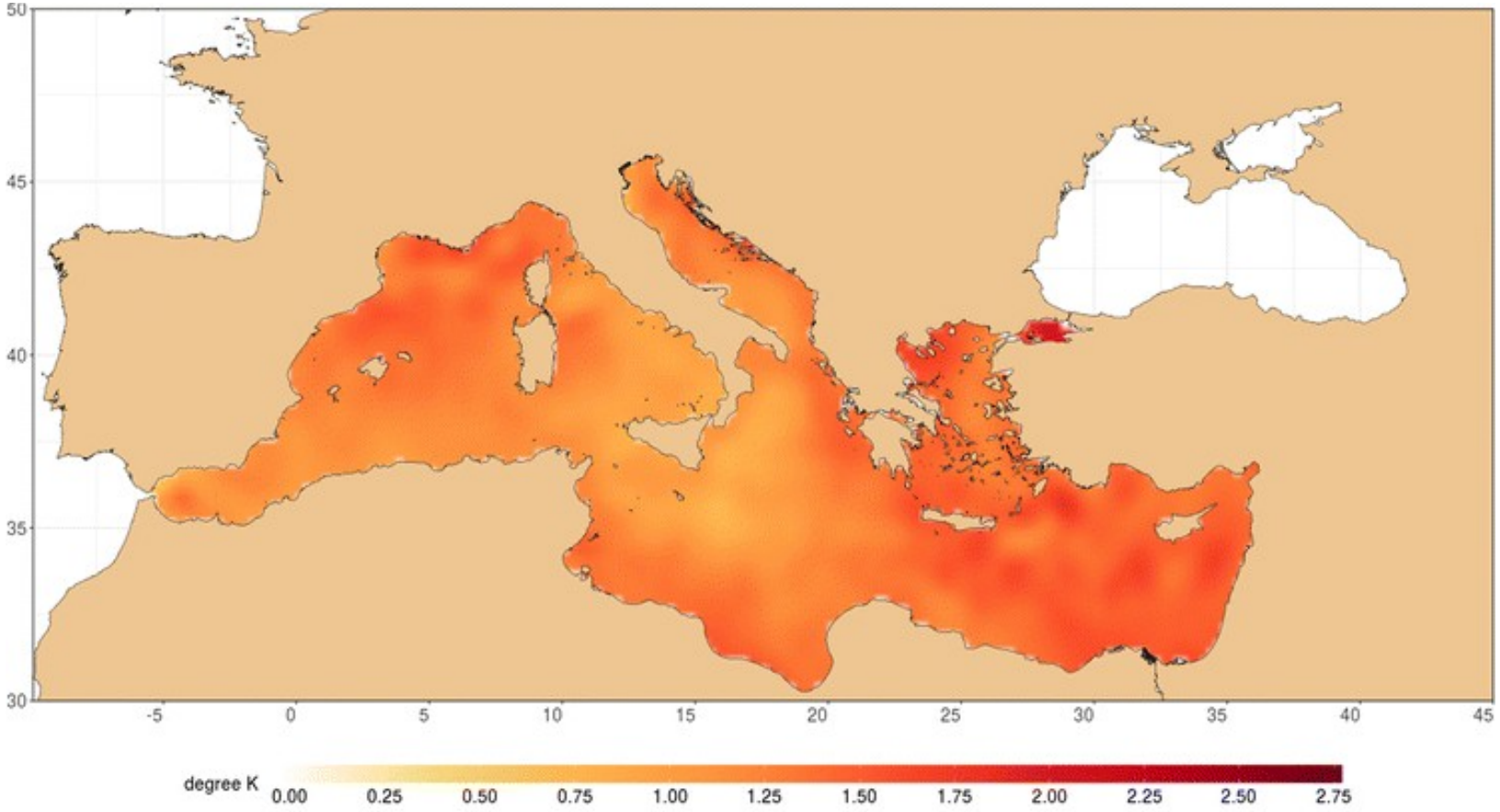
Temporal & spatial distribution?

IPCC, 2013, Annex I, van Oldenborgh et

Wet period precipitation contribution

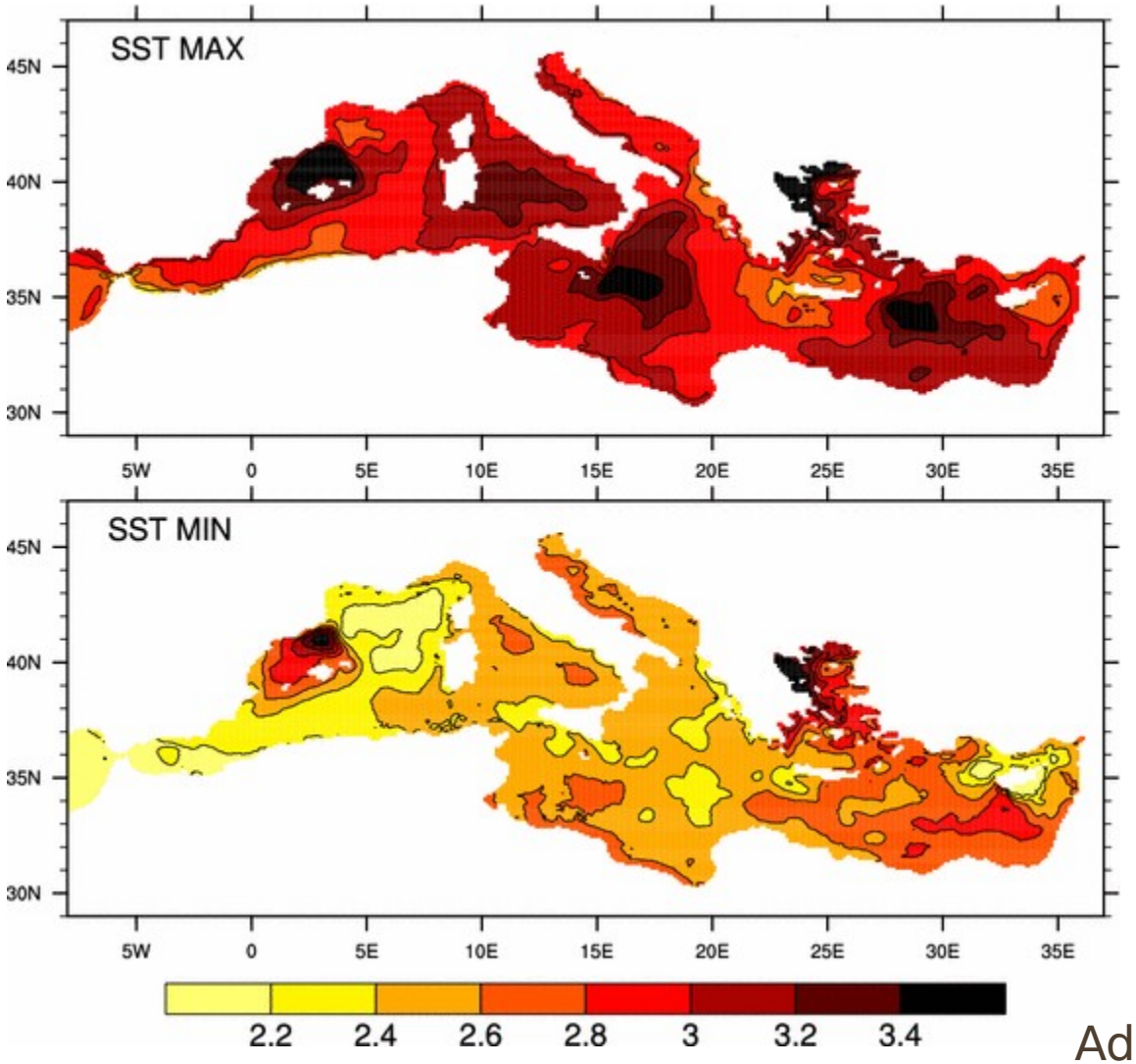


Sea surface temperature change, 1982-2016



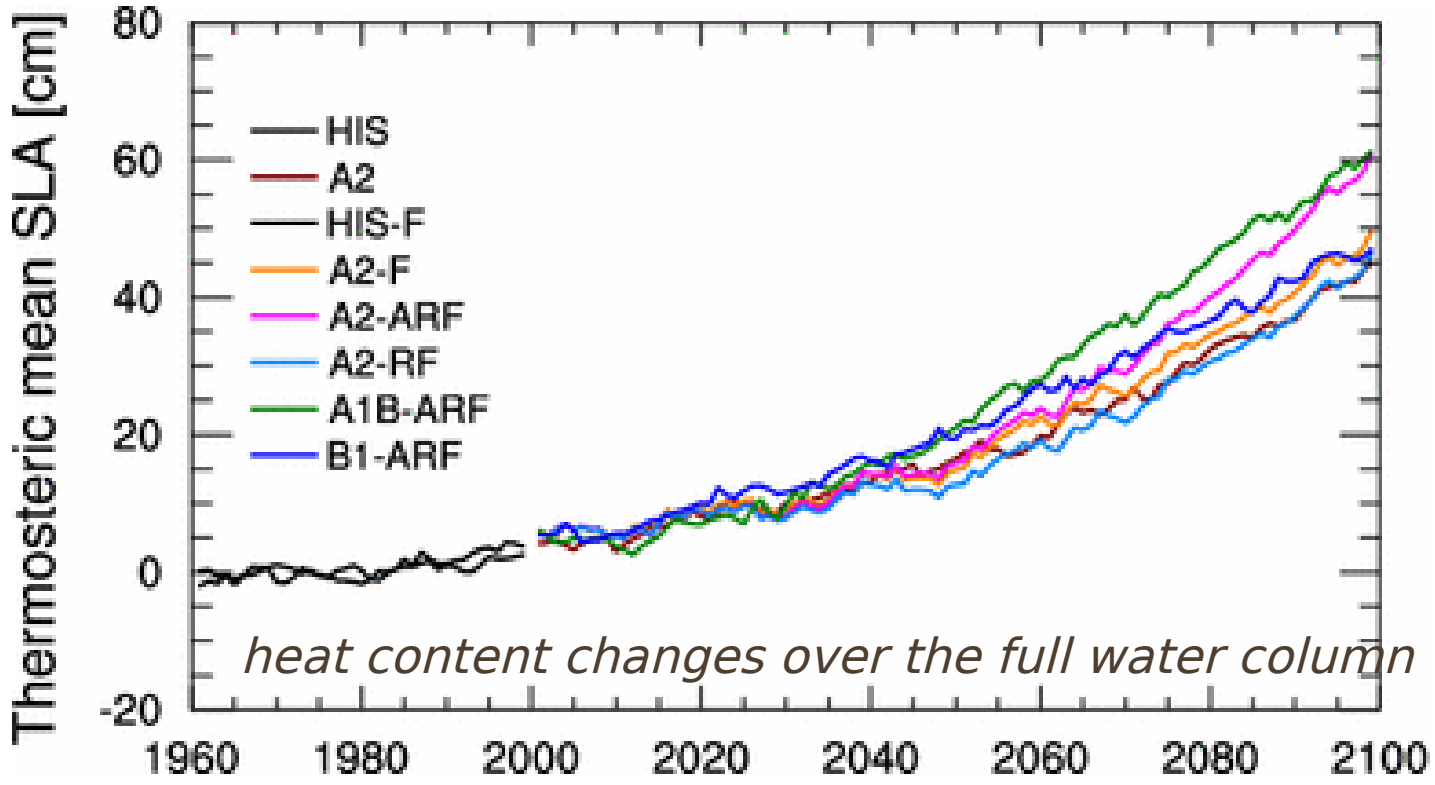
Pastor et al., 2018

Future maximum & minimum change in sea surface temperature 2070–2099 vs. 1961-1990



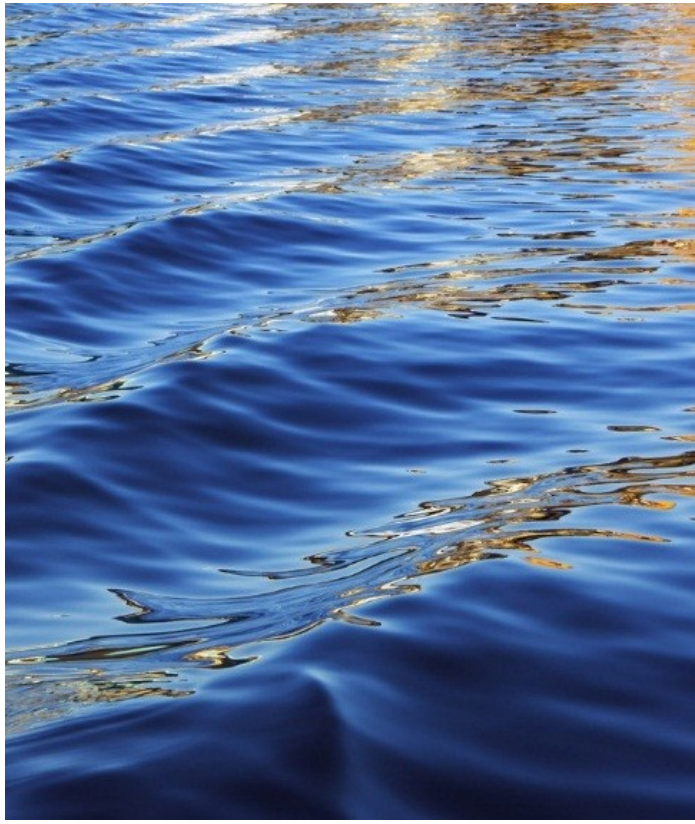
Adloff et al., 2015

Future sea level



Adloff et al., 2015

Impacts of climate and environmental changes and associated hazards



Climate and environmental change impacts

Direct impacts

- Heat waves
- Heavy rainfalls
- Floods
- Cold spells
- Dry spells
- Drought
- …

Indirect, combined impacts

- Pressures on water resources
- Deforestation, desertification
- Land degradation
- Livelihood
- Food production, food security
- Civil security, migration
- Political conflicts

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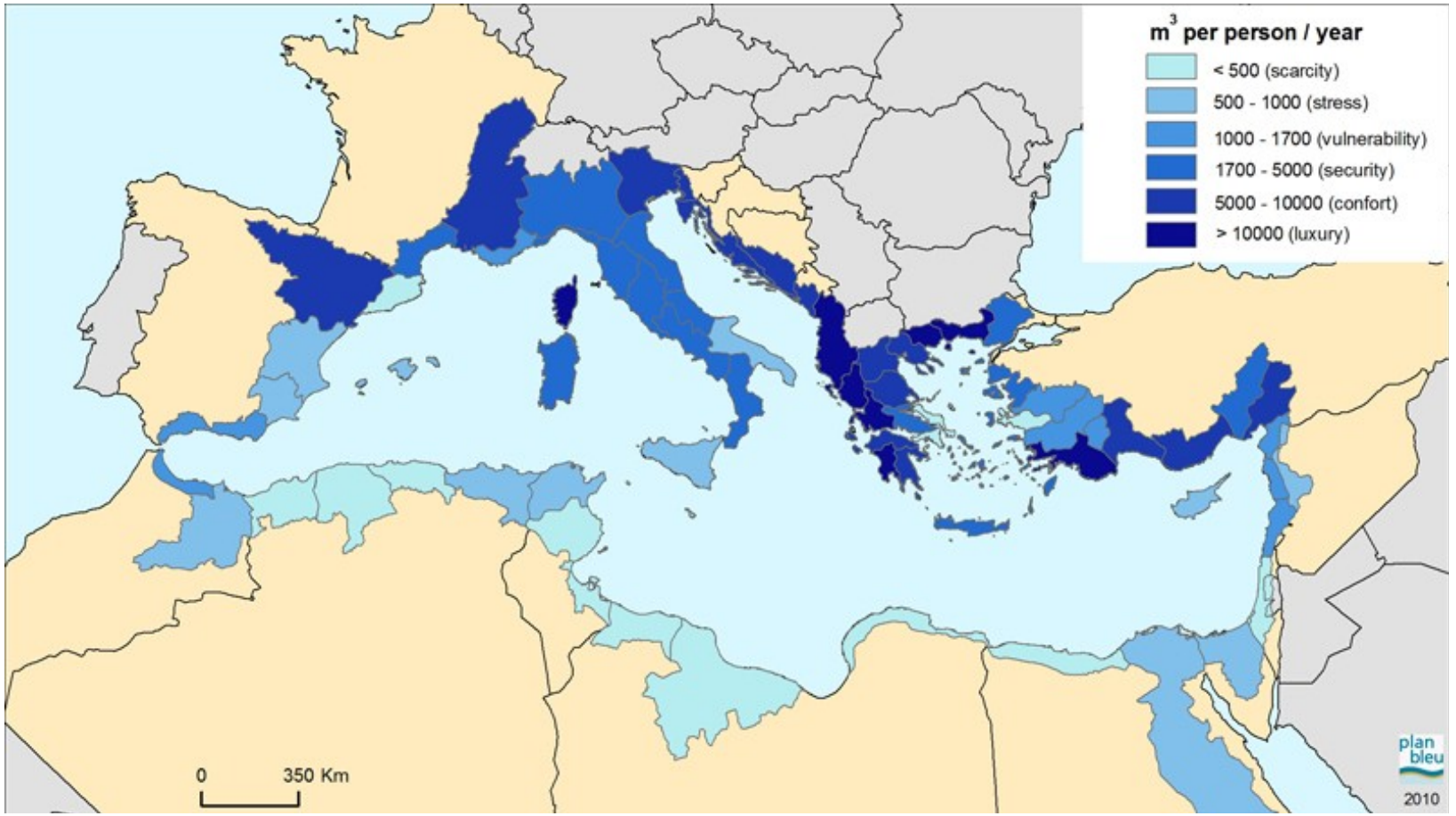
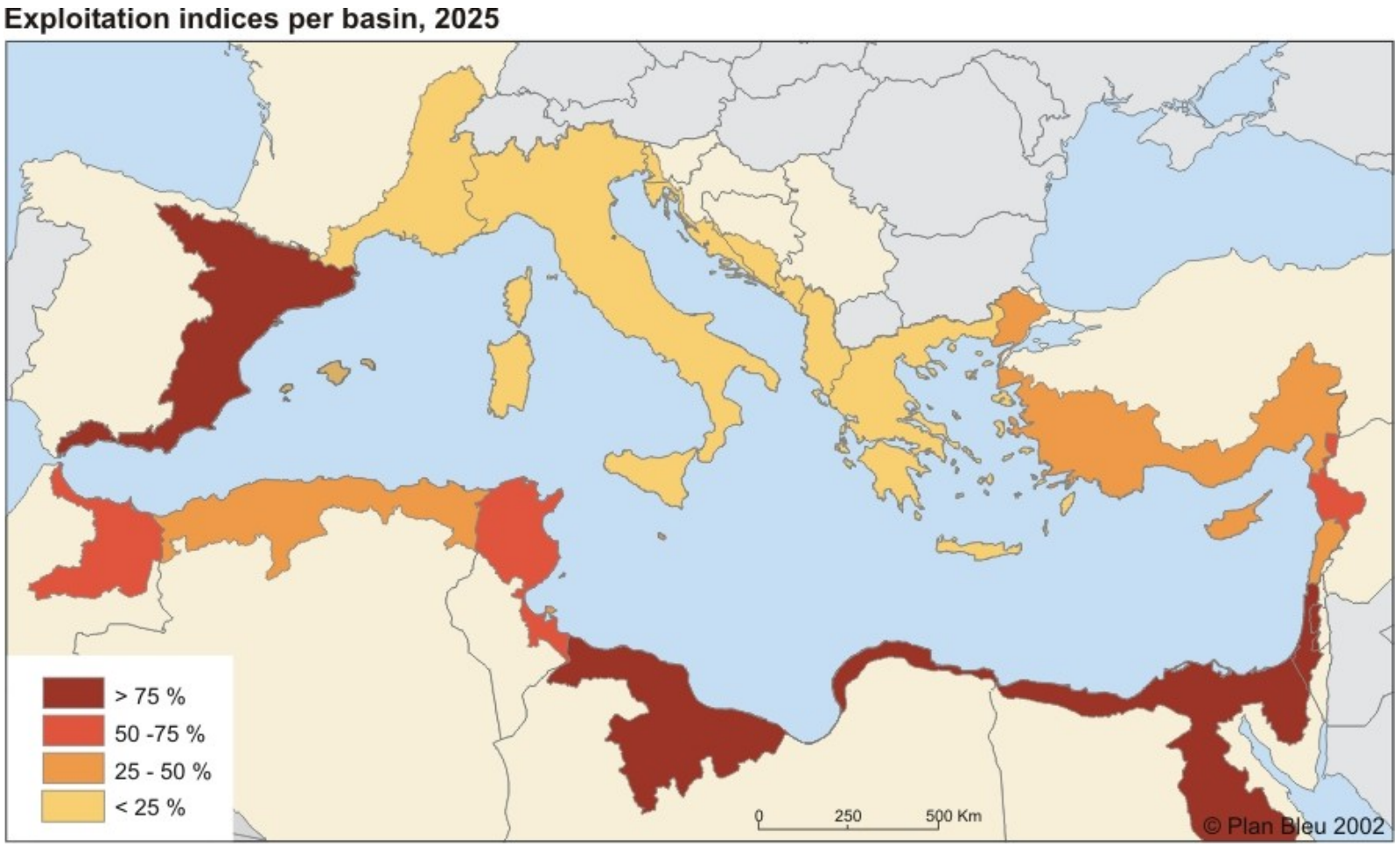
Annual natural renewable water resources



- **Precipitation decrease**
- **Temperature increase**
- **Population growth**
- Fresh water availability for 2°C warming is likely to decrease by 2 – 15%
- Water availabilities may drop to below 500 m3 per capita per

Water resource exploitation 2025



Mediterranean population classified as “waterpoor” (< 1000 m3 per capita per year) is projected to increase to over 250 million within 20 years

UNEP/MAP (2013)

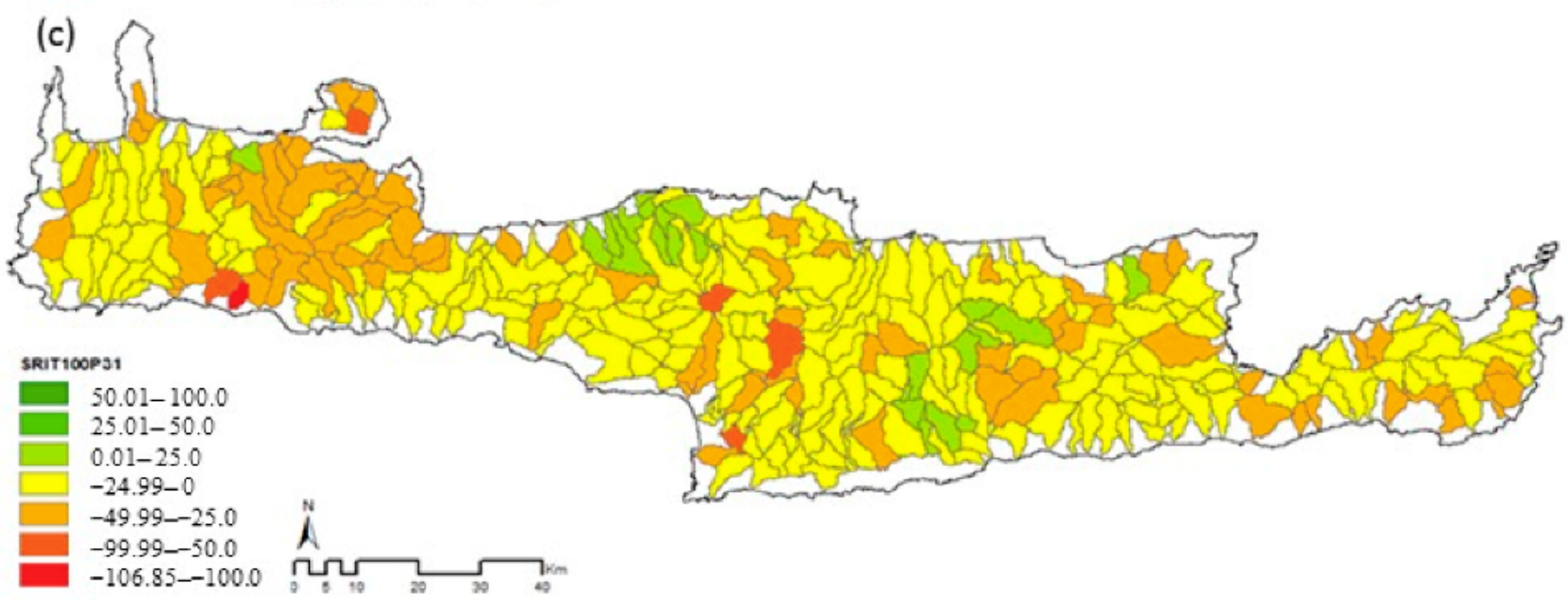
Water resources

- Intensive exploitation of **groundwater** resources
- **Groundwater quantity** decreases; Groundwater **deteriorates**
- Increasing **water pollution**: new industries, urban sprawl, tourism development, migration and population growth

- Increasing **water demand**
- **Irrigation**: 50-90% of total
- **Population growth**, especially coastal areas
- Increasing **urbanisation**
- **Manufacturing**

↳ Frequent **floods** will diminish water availability: damaged water systems, drinking water supplies, transportation systems

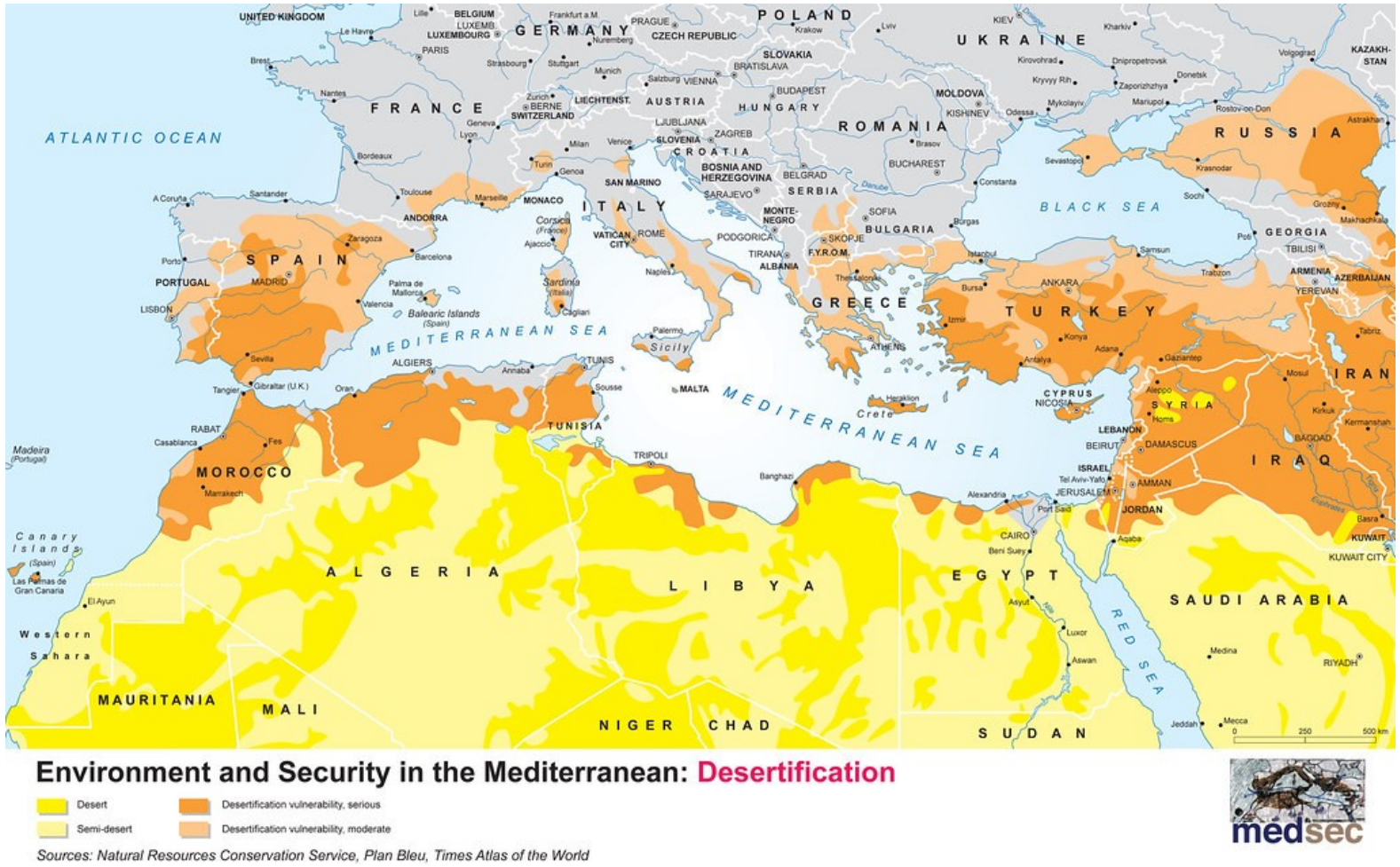
Future hydrological droughts



- Hydrological drought conditions of **higher severity** are expected on the island of Crete in 2075–2100 compared to 1985-2010 in the largest part of the island

Tapoglou et al., 2019

Desertification in the Mediterranean



- The coupled effect of **warming** and **drought** is expected to lead to a general increase in aridity and subsequent desertification of many Mediterranean land ecosystems

Food production, food security

Factors affecting agriculture and livestock production

- Water scarcity
- Soil degradation, erosion
- Fires, plant species composition

- Extreme events
  - Production loss, crop yield variability
- Pests, mycotoxins
  - Food safety

- CO_2 fertilisation
  - Increased biomass, decreased quality?
- Consumption patterns & population growth: increased meat demand, dependence on imported feed grain

- Fisheries: overexploitation, 90% of stocks overfished
- The expected migration of species to cooler areas as the ocean warms up is limited in

Human health

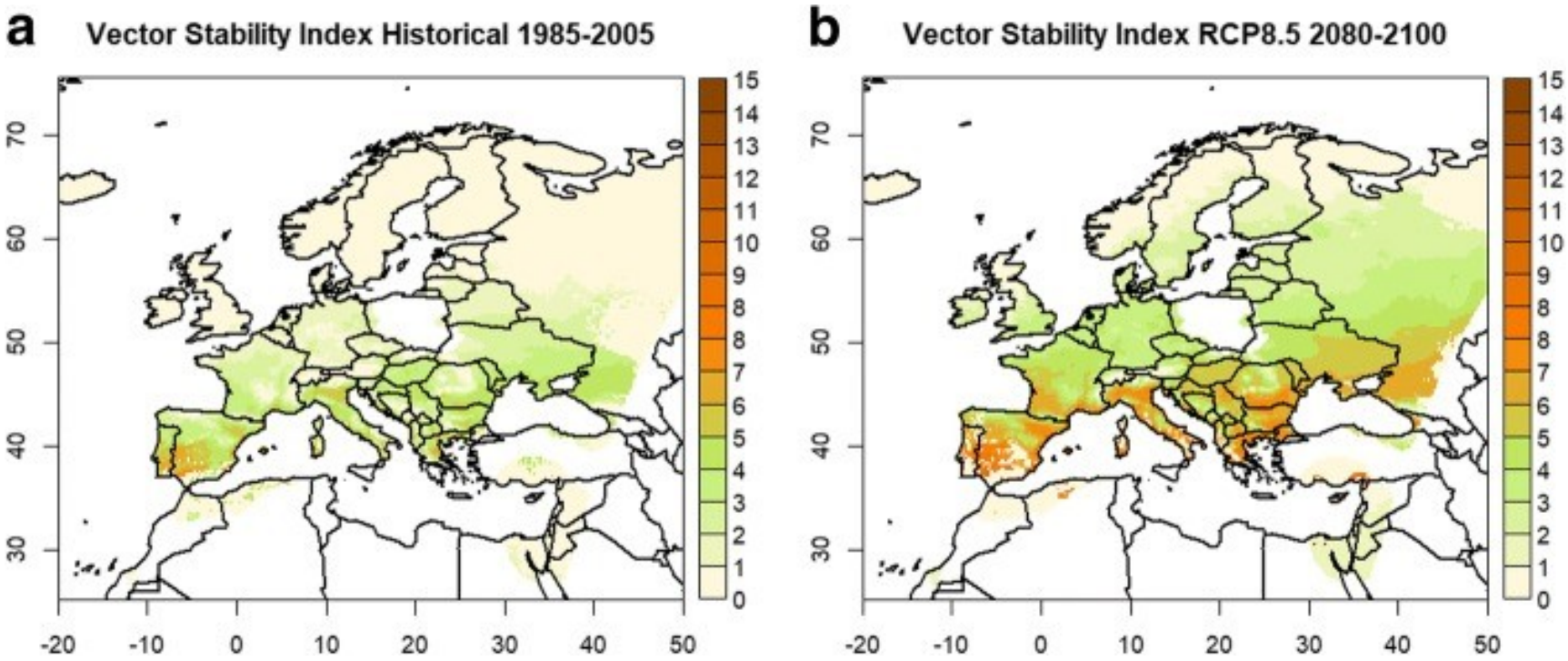
Direct effects

- High temperatures, heat waves – heat related morbidity, mortality
  - cardiovascular, respiratory
  - violence
- UV-radiation
- Floods
- Storms

Indirect effects

- Vector-borne diseases
- Water-borne diseases
- Air pollution
- Soil deterioration
- Water quality
- …

Anopheles vectors stability

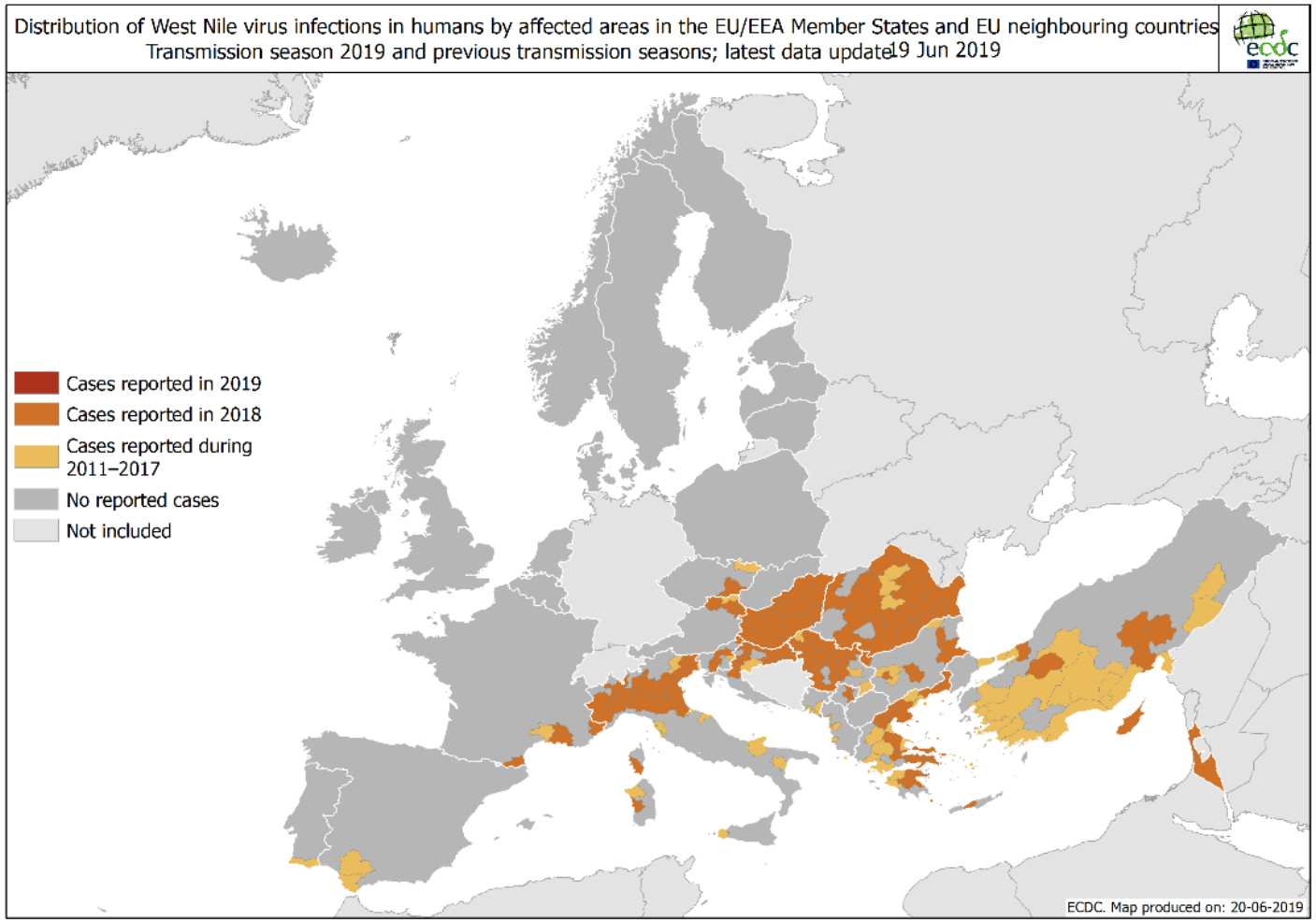


High stability of potential malaria transmission in southern Europe

Results consider the counteractive effects of reduced precipitation

Hertig, 2019

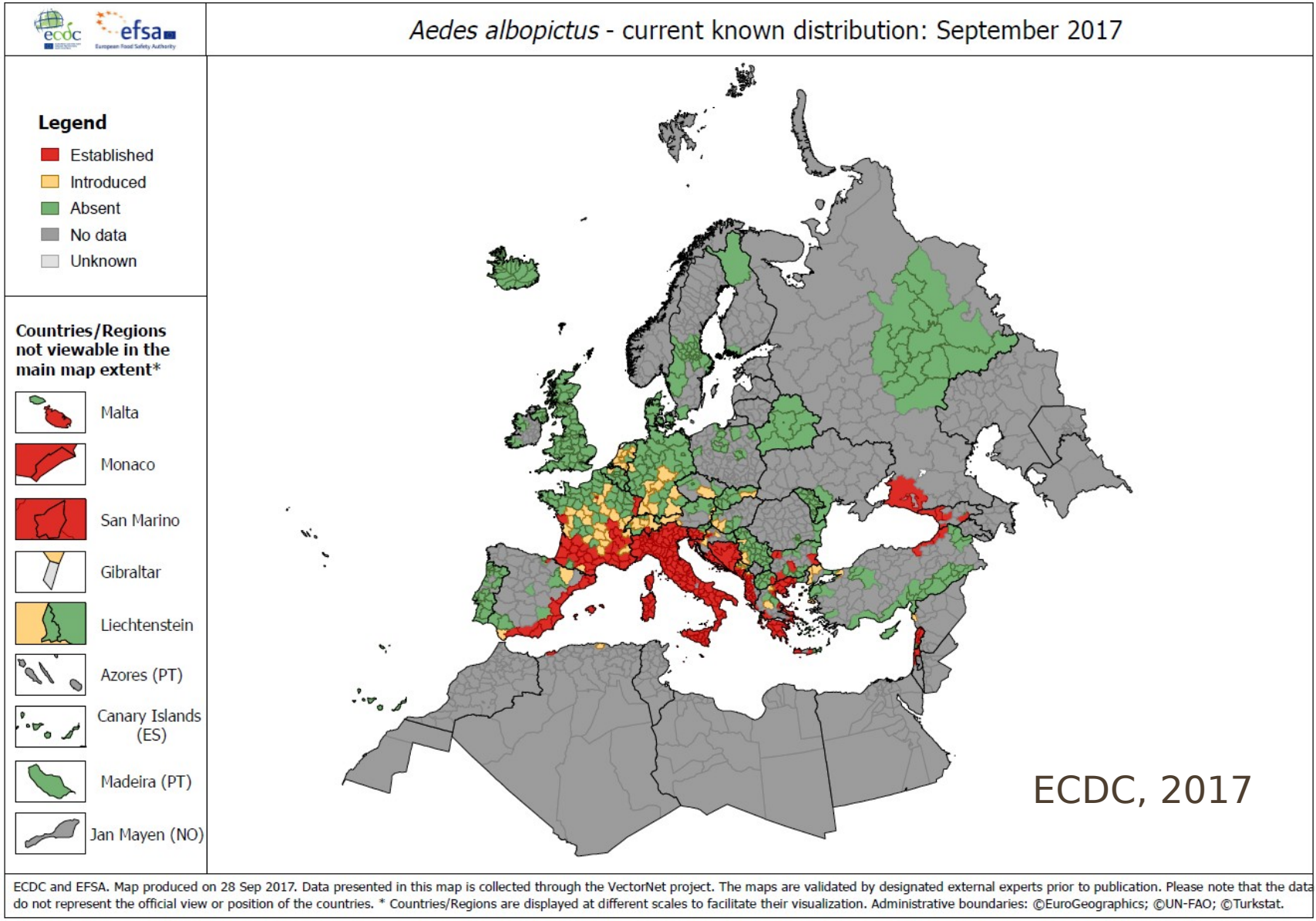
West Nile Virus human infections



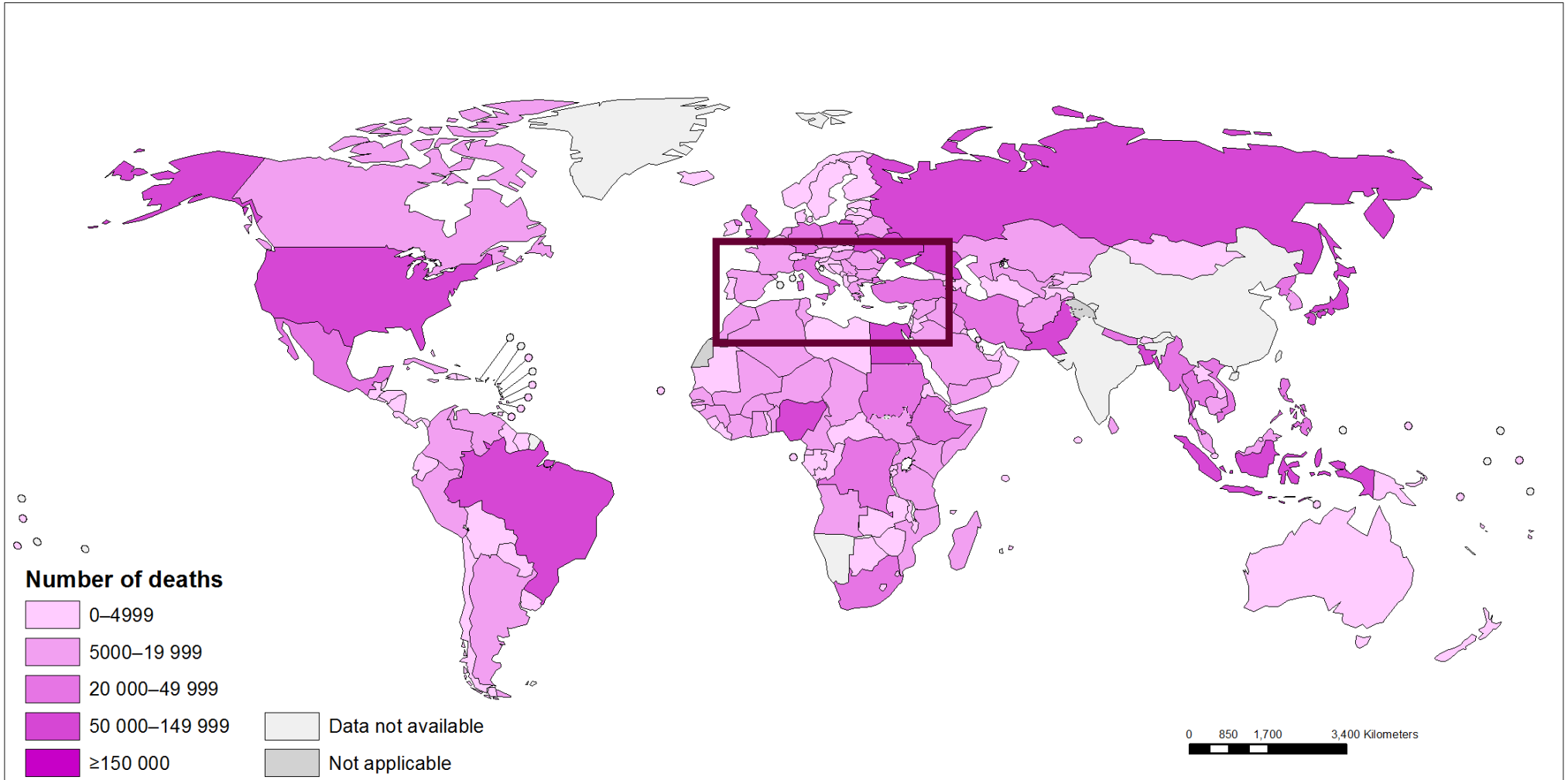
Areas with elevated probability for West Nile infections, linked to climate change, will likely expand and eventually include most of the Mediterranean countries

ECDC, 2019

Chikungunya cases



Deaths attributable to ambient air pollution, 2016



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Information Evidence and Research (IER)
World Health Organization

World Health Organization

Human security

- Climate and environmental changes
- Societal instability
- Economic instability
- Political instability
- Southern and eastern regions particularly vulnerable
- Adaptive capacity

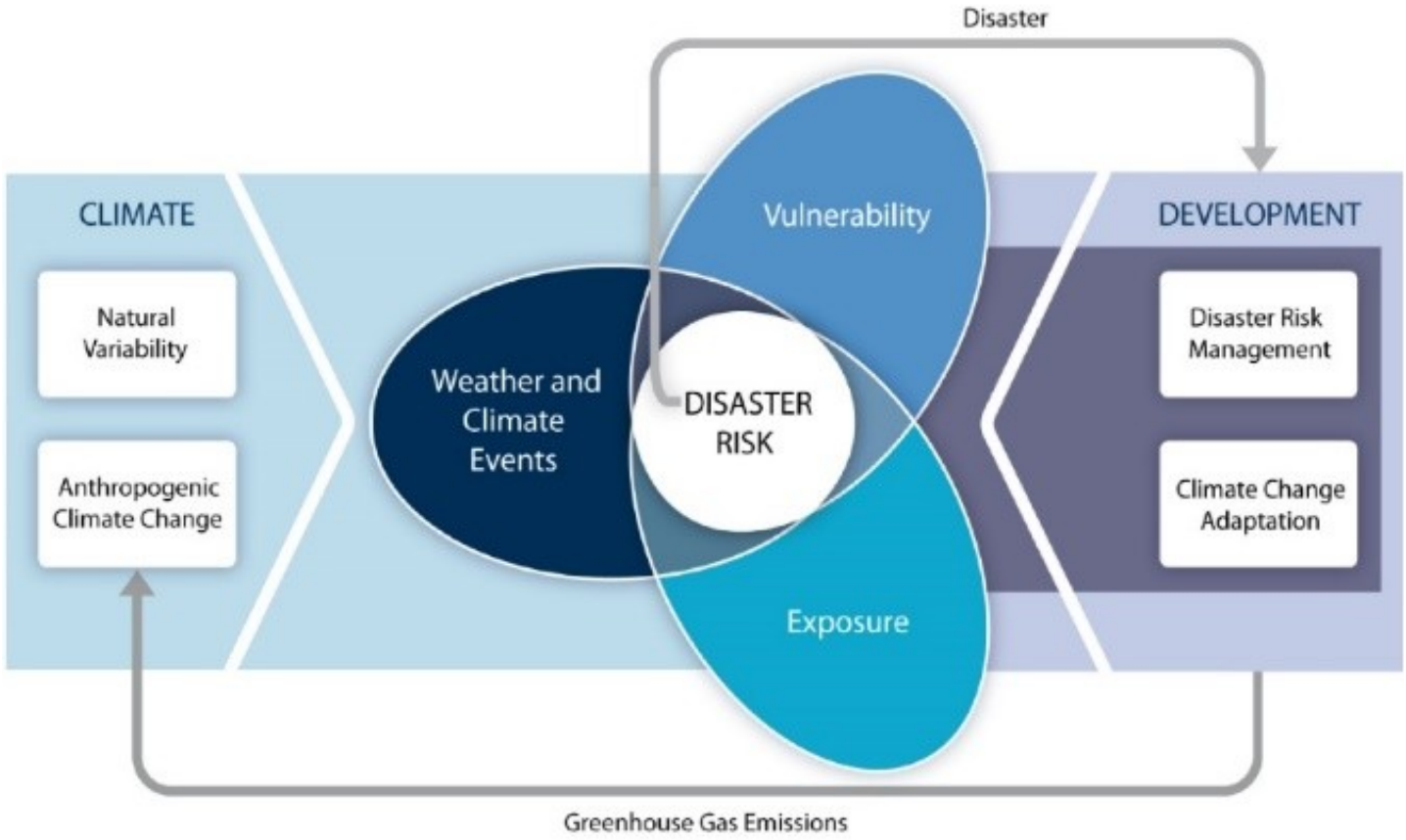
- rising sea levels, storm-surges, flooding, erosion, local land subsidence

impact:

harbours, port cities, coastal infrastructures, wetlands, beaches, World Heritage Sites

- groundwater salinization
- flood risk, flash floods
- increased frequency and severity of fires
- social instability, conflict,

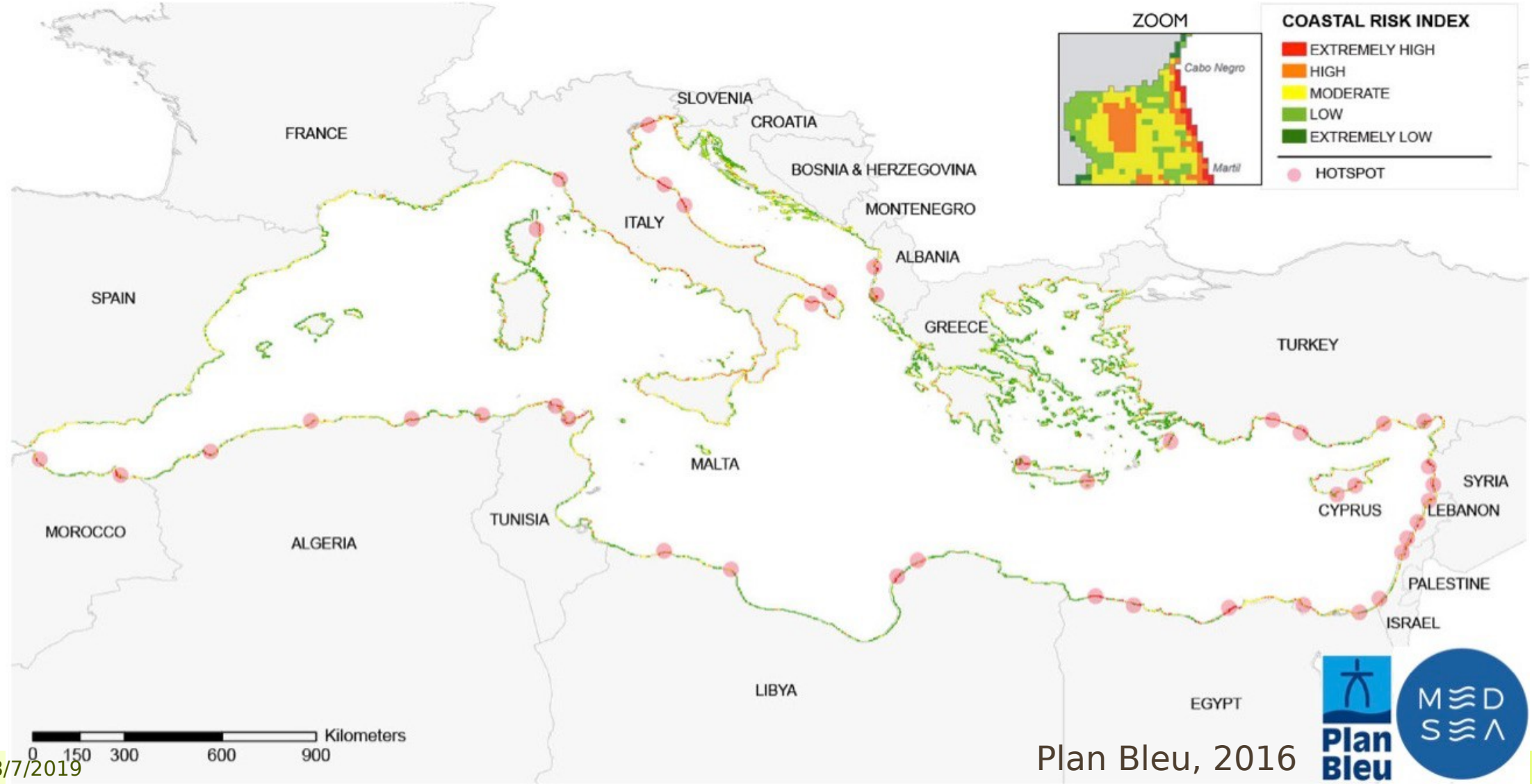
Risk and human security



Risk is defined as the results of the interaction of hazards with vulnerability and exposure of human and natural systems

SREX 2012

Coastal areas at risk



Plan Bleu, 2016

Conclusions

- Recent accelerated climate change has exacerbated existing environmental problems in the Mediterranean
- Substantial risks are associated to climate and environmental change in the Mediterranean Basin
- Policies for the sustainable development of Mediterranean countries need to mitigate these risks and consider adaptation options, but currently lack adequate information
- A comprehensive synthesis and assessment of recent trends, likely future development and the consequences of environmental change for natural systems, the economy, and the human well-being is still missing

An improved scientific assessment of climate and environmental change in the Mediterranean Basin

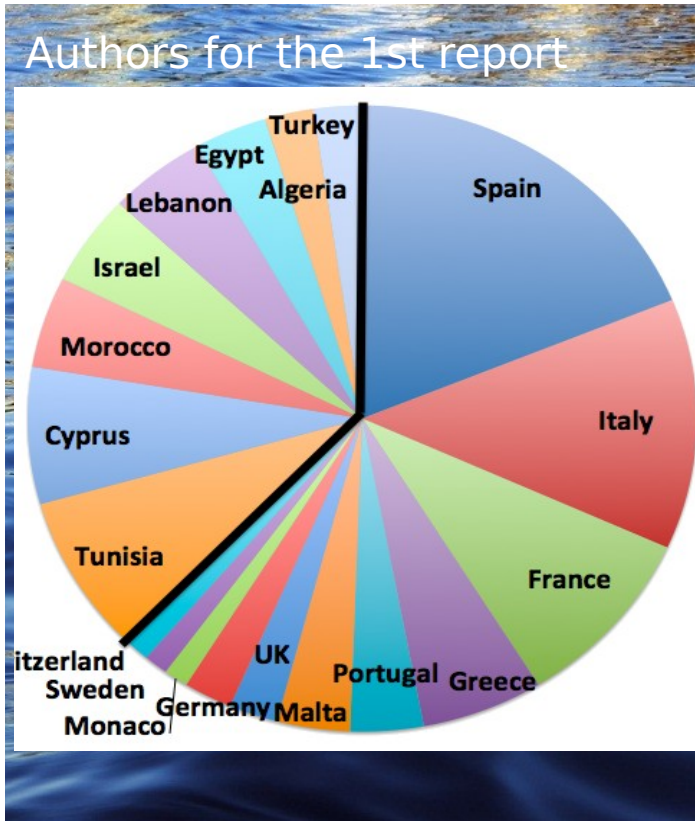
MedECC
Mediterranean Experts on Climate and environmental Change

600+ scientists (individual memberships)

- support from the Union for the Mediterranean, Swedish Int. Dev. Coop. Agency, Plan Bleu (UNEP/MAP Regional Activity Center), ADEME, AMU, IRD …

OBJECTIVES:

- Compile the best scientific knowledge and render it accessible to policy-makers, key stakeholders and citizens (1st report in 2020, transparent review)
- Identify gaps in research & capacity building
- Promote cooperation between countries



http://medecc.org

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