

# Compound climate extremes and exposed population in Africa using CORDEX-CORE projections

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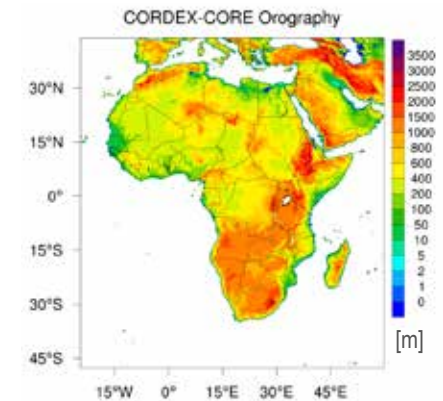
## ■ Introduction

- Africa is considered to be one of the most vulnerable continents due to its high exposure and low adaptive capacity related to climate change (Niang et al., 2014).
- The African continent exhibits the second largest population after Asia with high rates of population growth, which is projected to double by the middle of this century (UN DESA).
- Exposure to multiple and compound climate-related risks is projected to increase even for lower global warming (Hoegh-Guldberg et al., 2018).
- Compound climate events are the combination of multiple drivers and/or hazards that contributes to societal or environmental risk (Zscheischler et al., 2018).
- Sector relevance
  - Heatwaves: Agriculture, health, infrastructure
  - Droughts: Agriculture
  - Extreme precipitation: Agriculture, infrastructure

## ■ Model data and indices

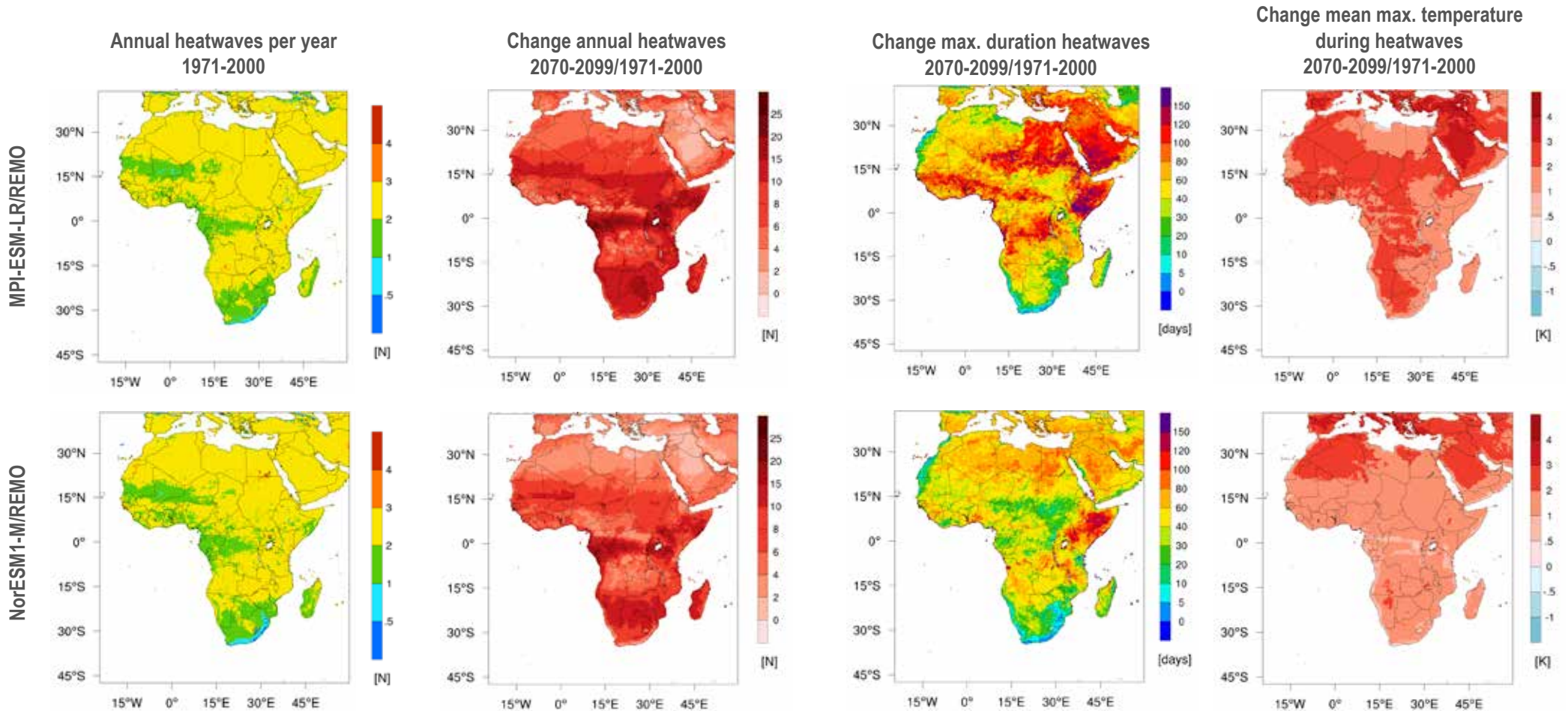
- **Regional climate projections from CORDEX-CORE AFRICA**
  - REMO (2015) generating daily data with a spatial resolution of  $0.22^\circ$  (~25 km)
  - Time periods 1971-2000 (historical) and 2070-2099 (RCP8.5)
  - Two different forcing data MPI-ESM-LR and NorESM1-M
- **Population data**
  - Gridded Population of the World, Version 4 (GPWv4): Population Count Adjusted to Match 2015 (SEDAC)
  - Global Population Projection Grids Based on Shared Socioeconomic Pathways (SSPs), (Jones and Neill, 2017)
    - > SSP3 (2090) consistent with RCP8.5 (Liu et al., 2017)
- **Indices**
  - Heatwaves: *Number of periods of three or more consecutive days with daily maximum temperature above the 95th percentile of the reference period 1971–2000, but with at least  $25^\circ\text{C}$  (Liu et al., 2017)*
  - Droughts: *Number of periods of five or more consecutive days with daily precipitation below 1 mm*
  - Extreme Precipitation: *Wet days ( $\geq 1$  mm) with precipitation higher than the 95 percentile of the reference periods 1971-2000*
- **Compound event**

Simultaneous occurrence of two hazards (e.g. heatwave/droughts or heatwave/extreme precipitation) at the same day



# Heatwaves

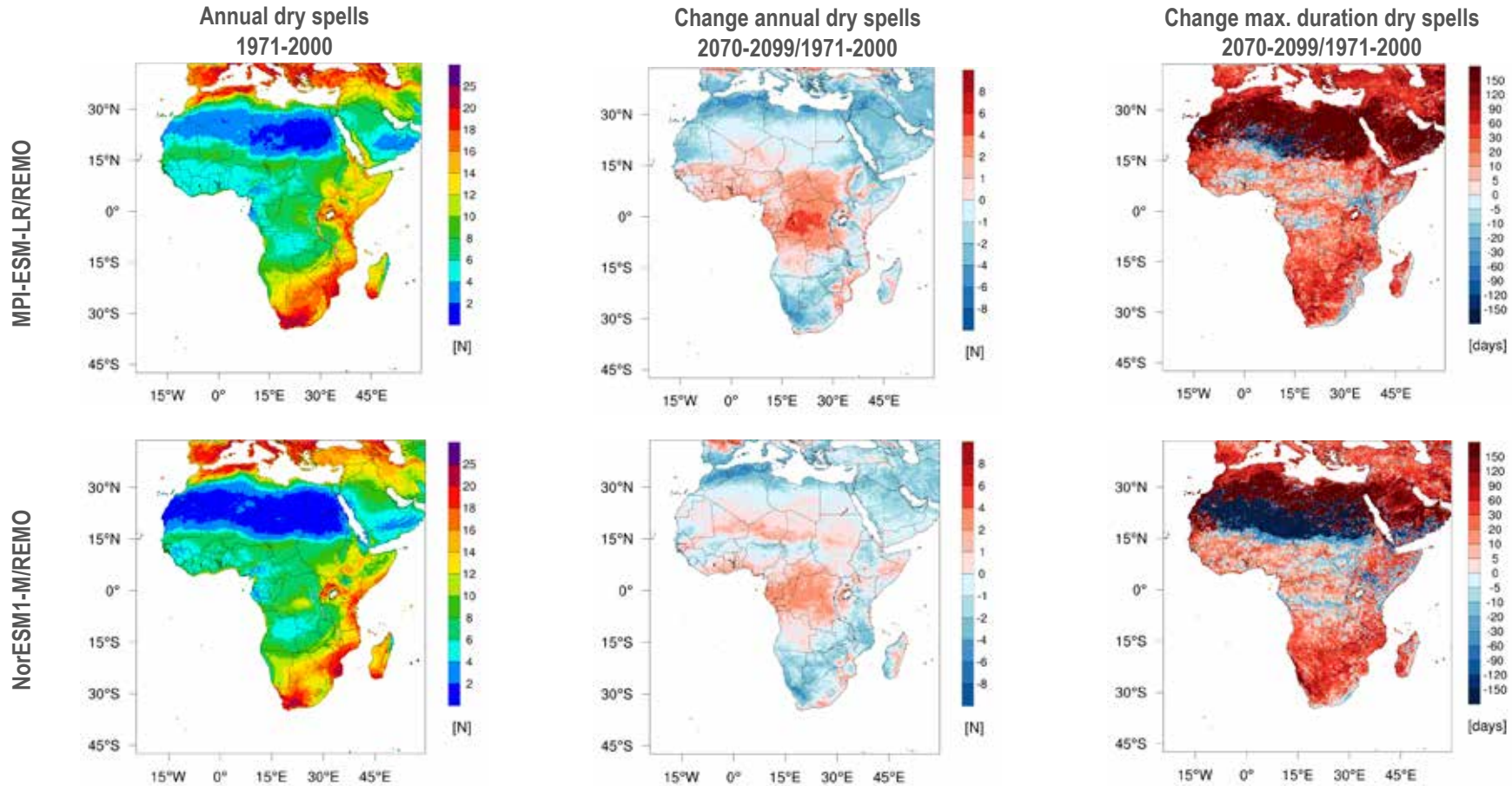
Emission scenario RCP8.5



Increase in frequency, max. duration and intensity

# ■ Droughts – Dry spells

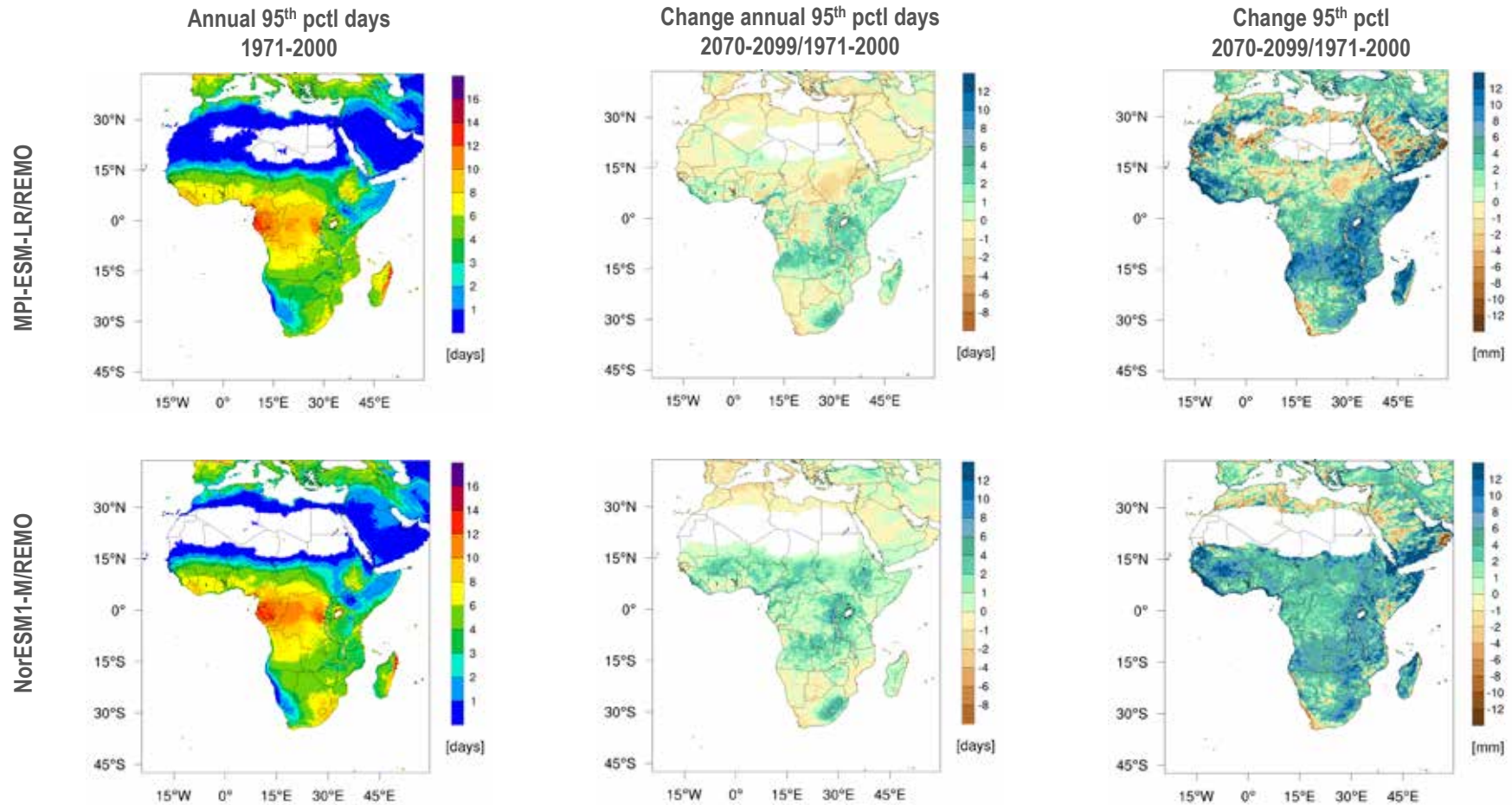
Emission scenario RCP8.5



**Increase/decrease in freq., mainly increase max. duration**

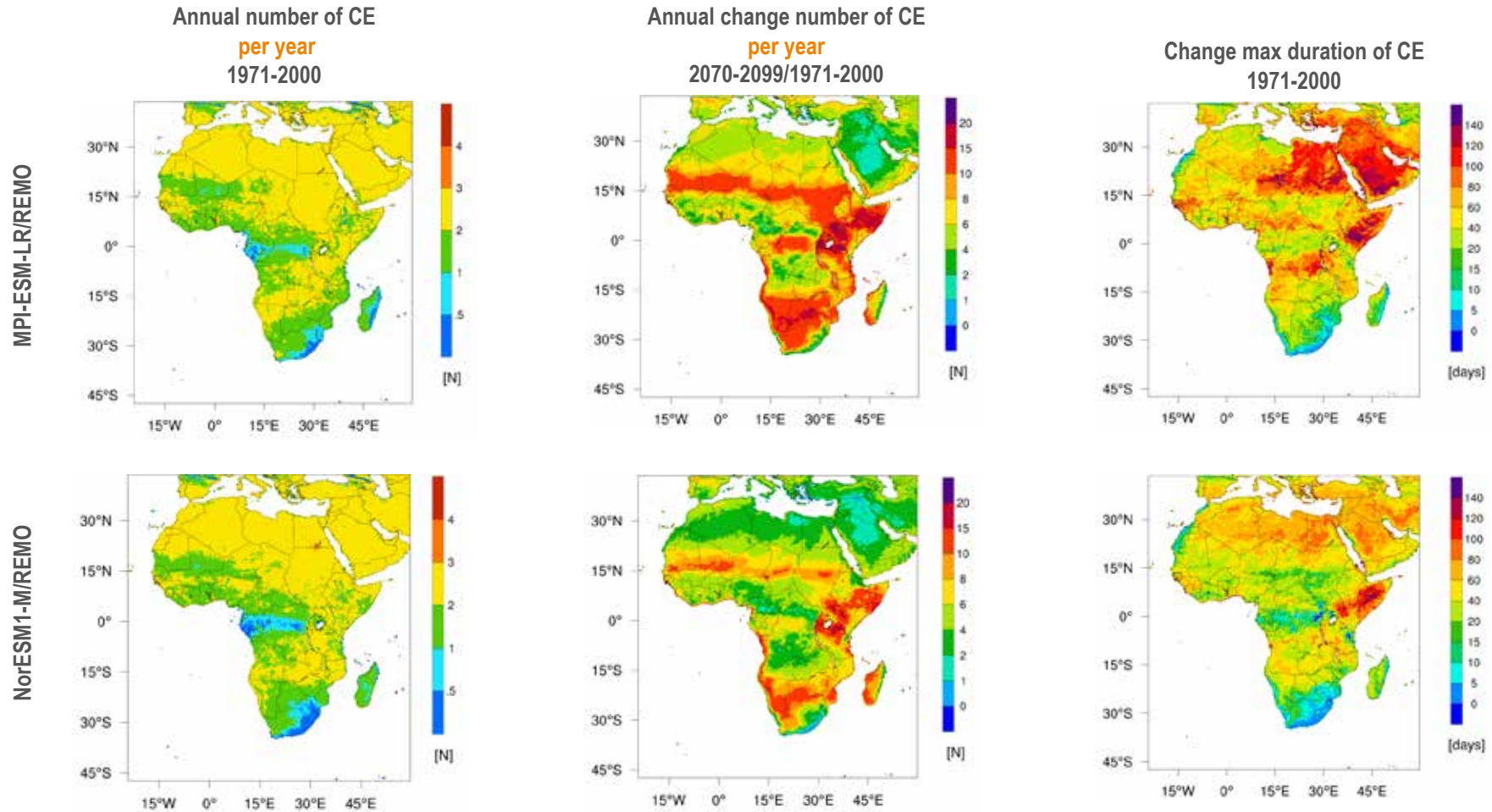
# Extreme precipitation

Emission scenario RCP8.5

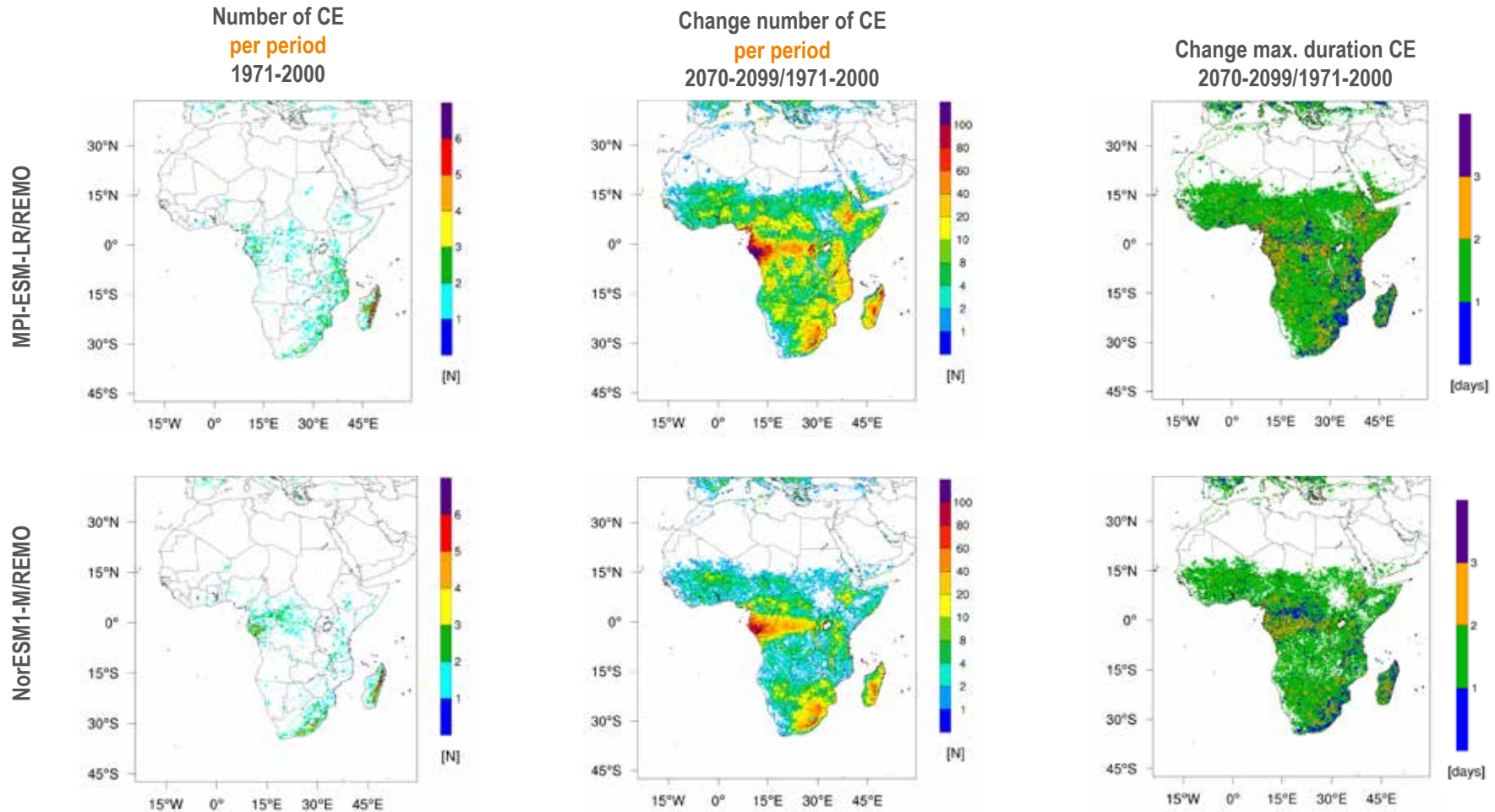


**Increase/decrease in freq., mainly increase in intensity**

# Compound event (CE) – heatwave and drought (RCP8.5)

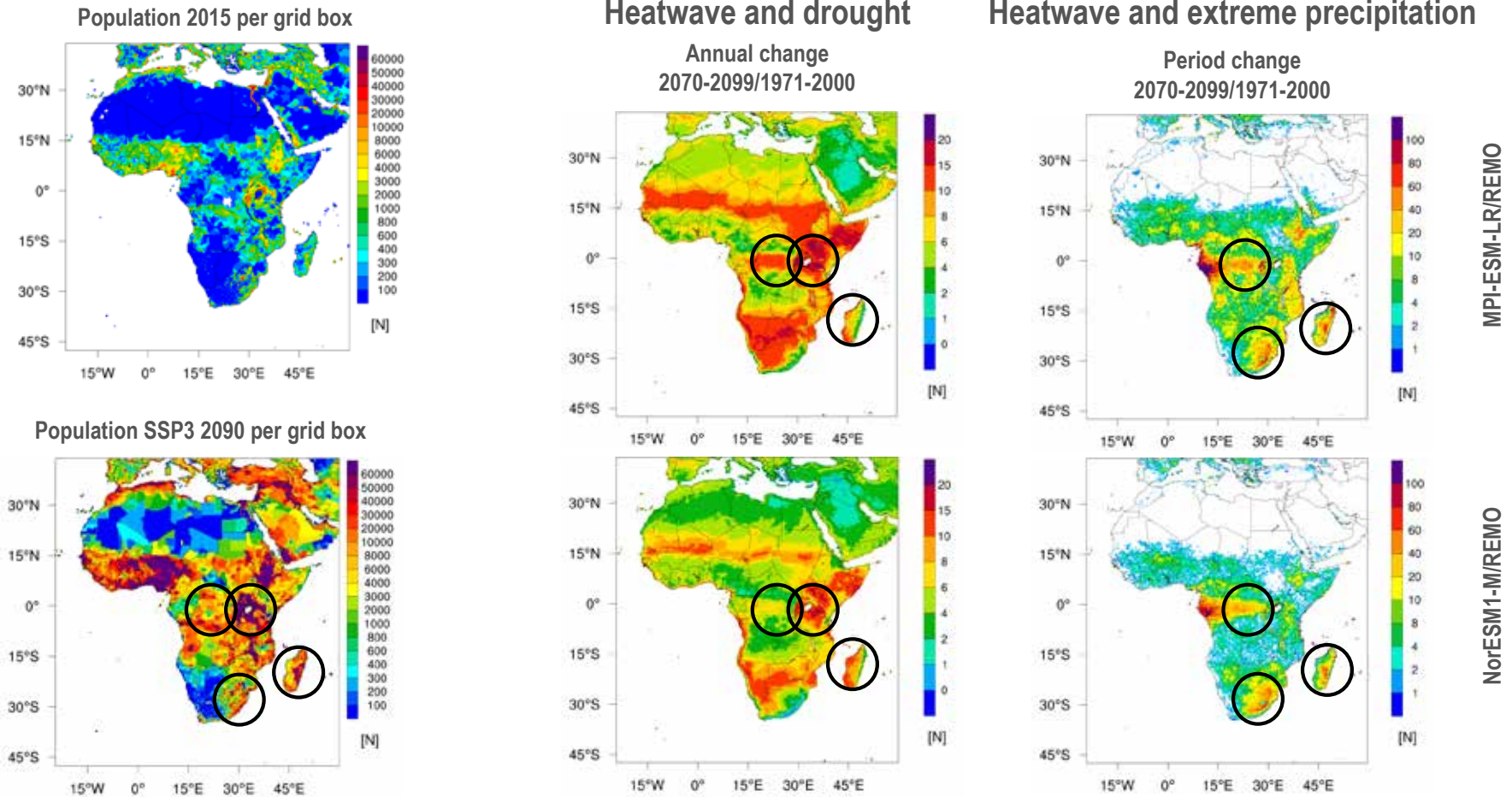


# Compound event (CE) – heatwave and extreme precipitation (RCP8.5)





# Compound events (RCP8.5) and exposed population



## ■ Summary and outlook

- Increase in CE regarding their frequency, duration, and intensity in RCP8.5 for the end of the century
- Regional differences of CE in the incidence as well as in their intensity
- Hotspots where strong population growth and strong increase of CE coincide are:
  - heatwave and droughts: DR Congo, surrounding region of Lake Victoria and Madagascar
  - heatwave and extreme precipitation: DR Congo, south-eastern Africa and Madagascar

### Next steps

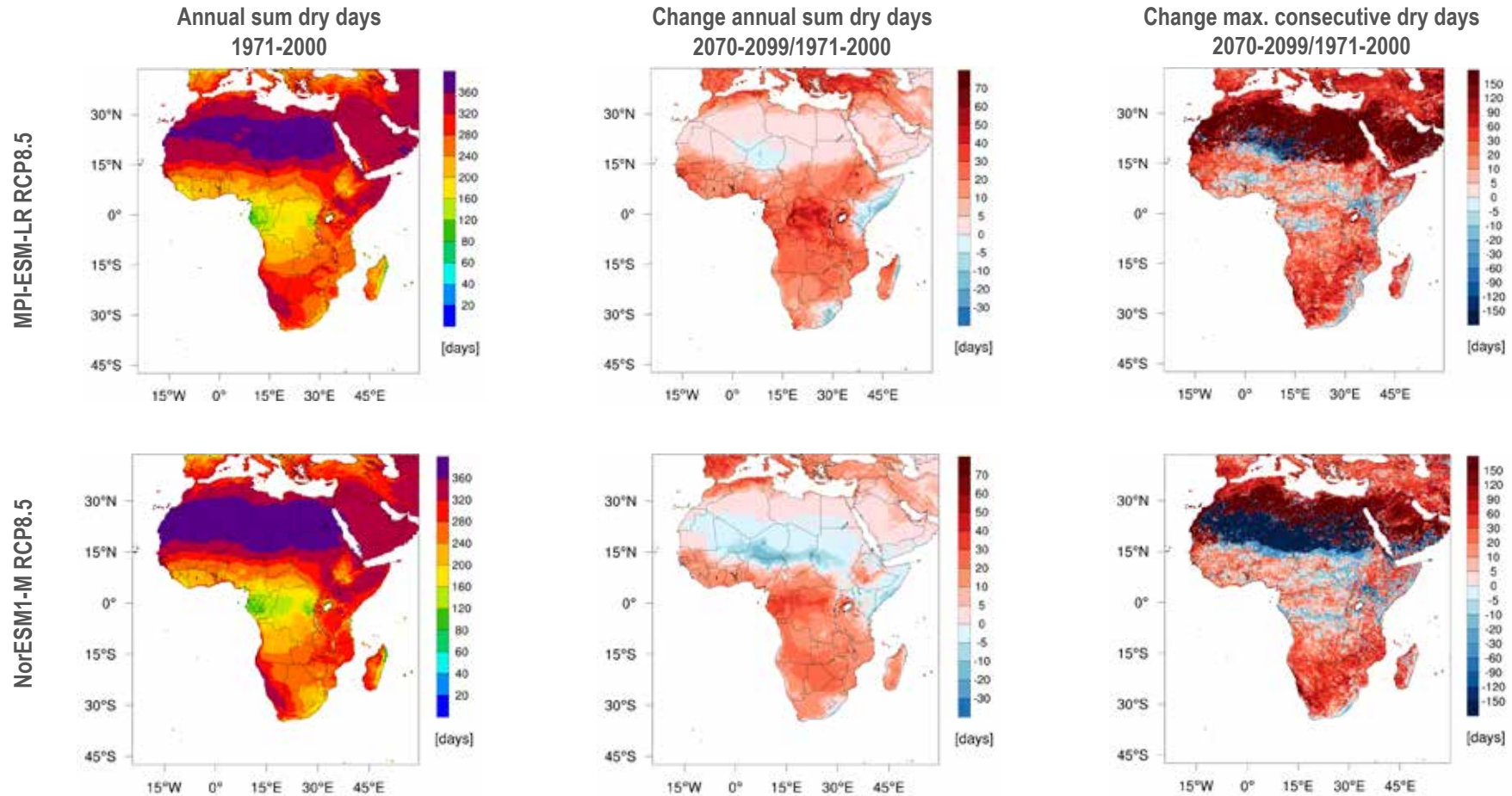
- Usage of the whole CORDEX-CORE database to apply the ensemble approach
- Analysing the low emission scenario RCP2.6 together with other SSPs
- Time window phasing analysis of CE



# Thank you for your attention!

# ■ Droughts – Dry days

Emission scenario RCP8.5



Mainly increase in freq. and max. cons. dry days for sub-Saharan regions