AI-enhanced climate services

identifying, monitoring, and predicting areas of concern

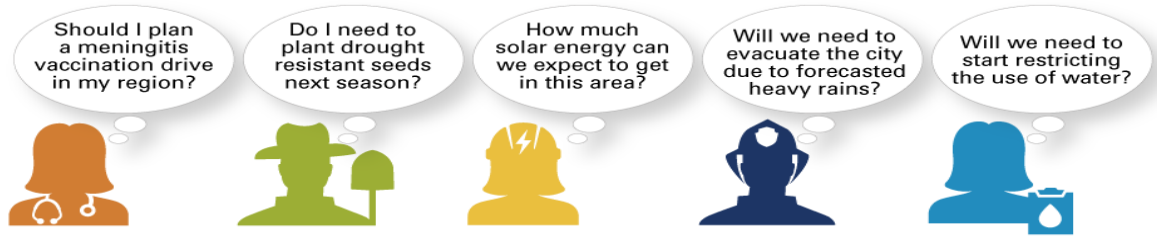
Andrea Toreti

European Commission, Joint Research Centre

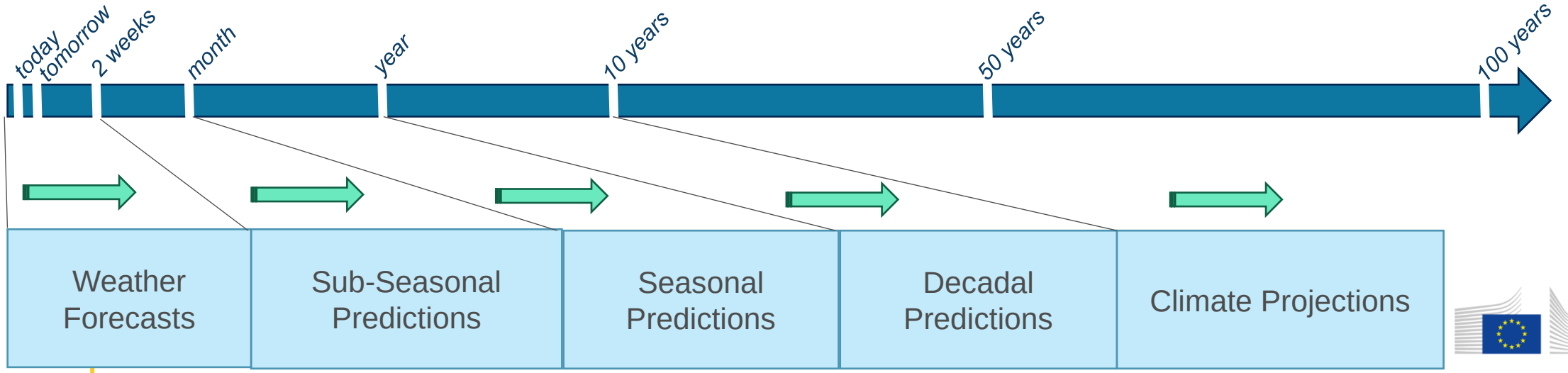
Climate Services

an essential component of any effective ***sustainable adaptation strategy***

Climate Service provides a sector with dedicated ***climate information*** *to support evaluations and decisions*

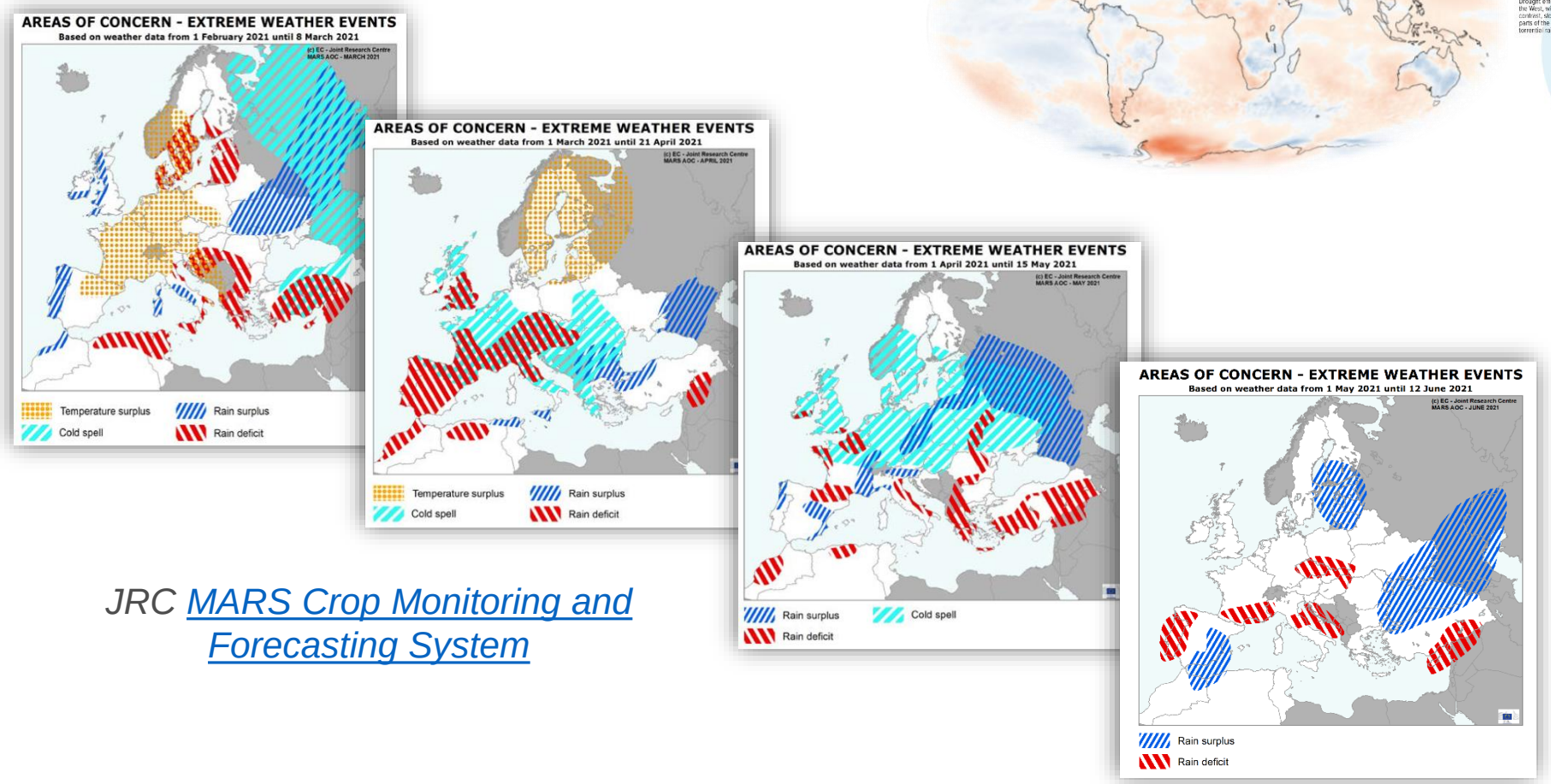


@WMO



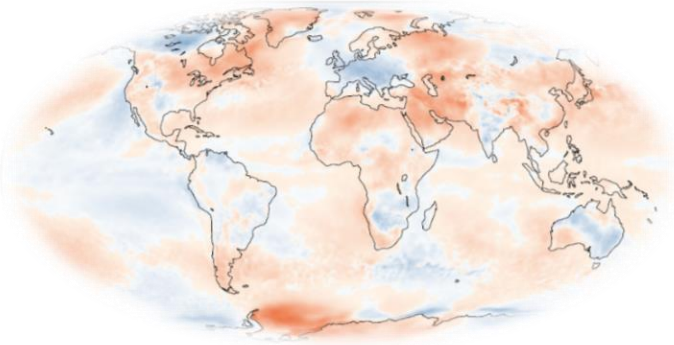
European Commission

Climate Services

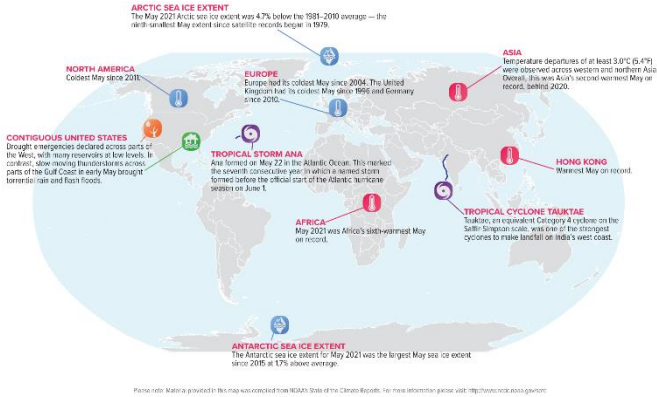


JRC [MARS Crop Monitoring and Forecasting System]

Temperature anomalies March-May 2021. Source: Copernicus C3S



Climate anomalies and events May 2021. Source: NOAA

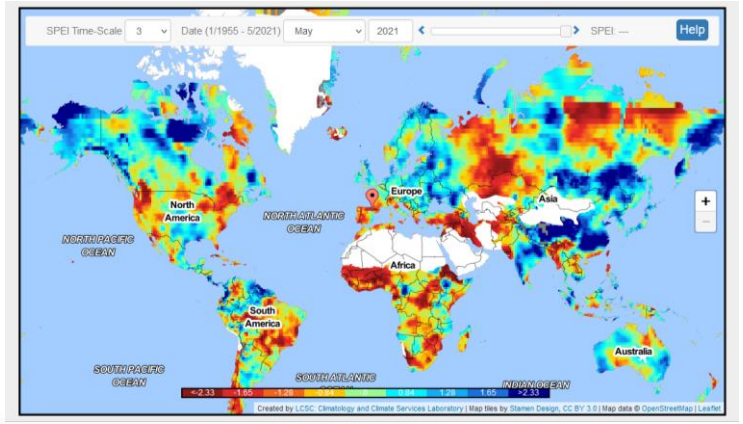


Monitoring extremes harmful for the agricultural sector

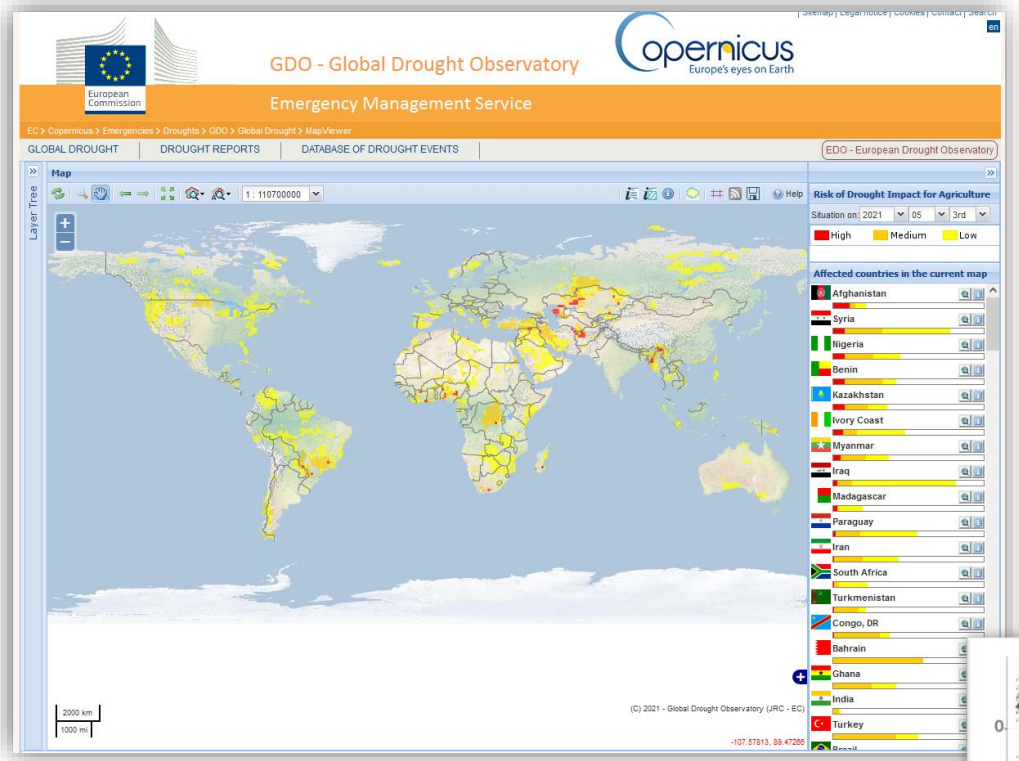
European Commission

Climate Services

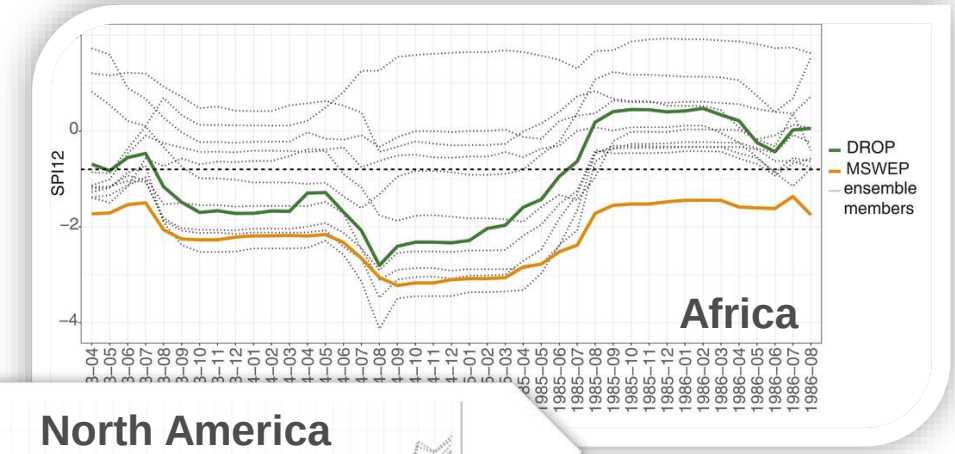
SPEI-3, May 2021. Source: SPEI Global Drought Monitor

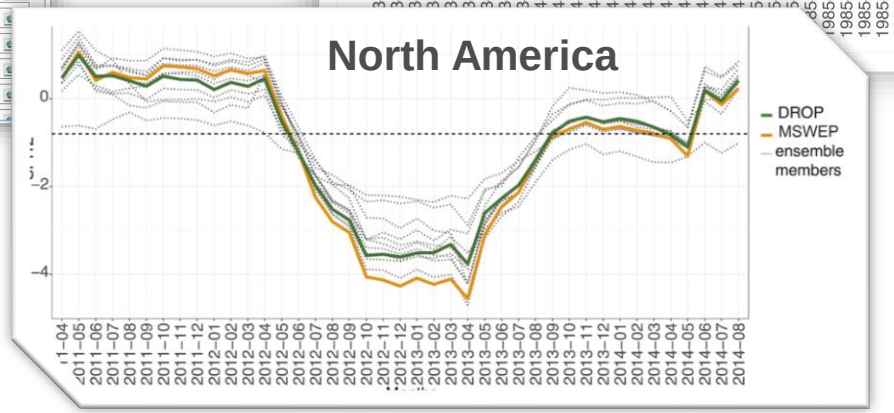


Monitoring drought



*JRC **E**uropean and **G**lobal **D**rought **O**bservatory*

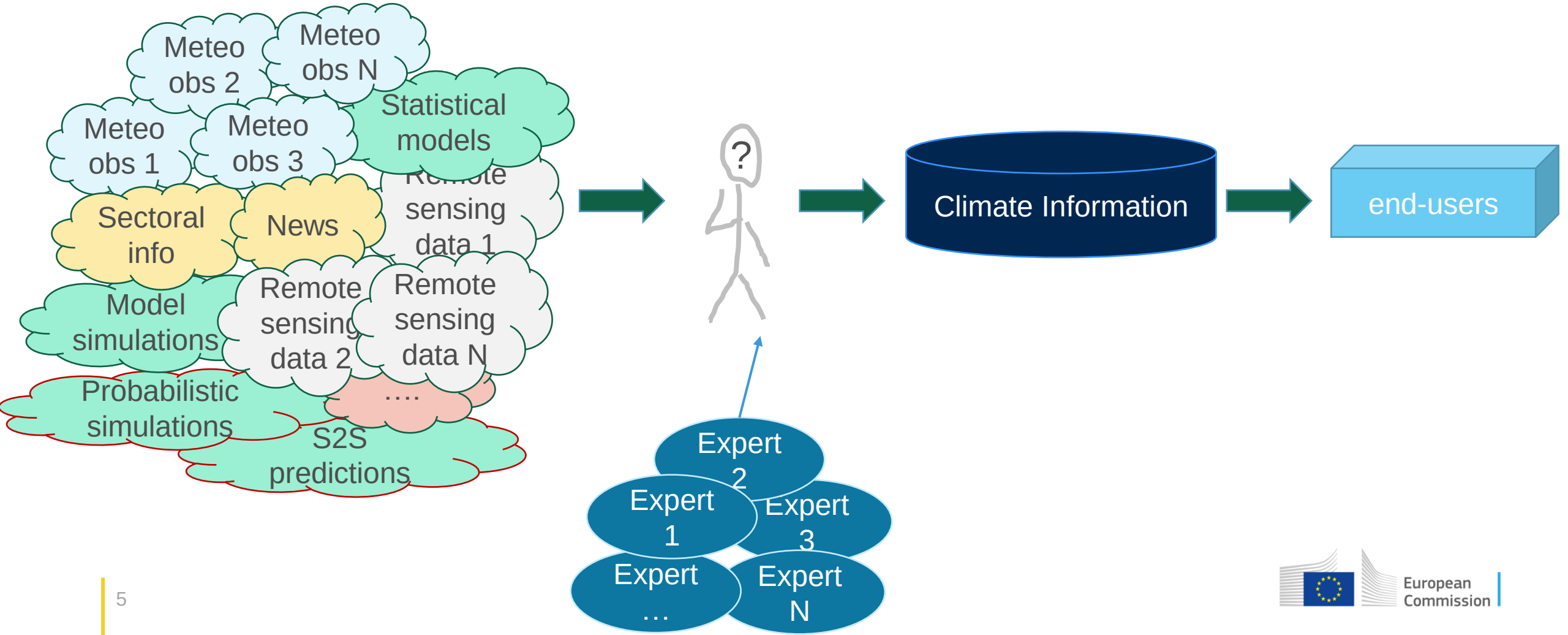




SPI-12 estimated by using different obs/reanalysis. Two case studies. Source: Turco et al., BAMS 101, 2020

European Commission

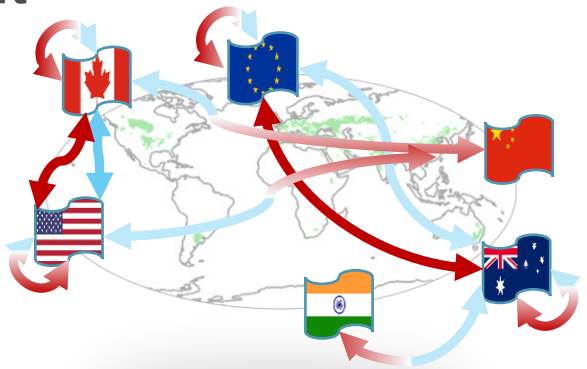
From data to information



European Commission

Where **AI** comes into play

- Learning predicting spatio-temporal dynamics of (in)dependent extremes
- Learning and predicting from extremes co-occurring in other regions
- First guess AoC to support experts' decisions
- Characterising the uncertainties and building optimal ensembles
- Explore precursors to enhance predictability

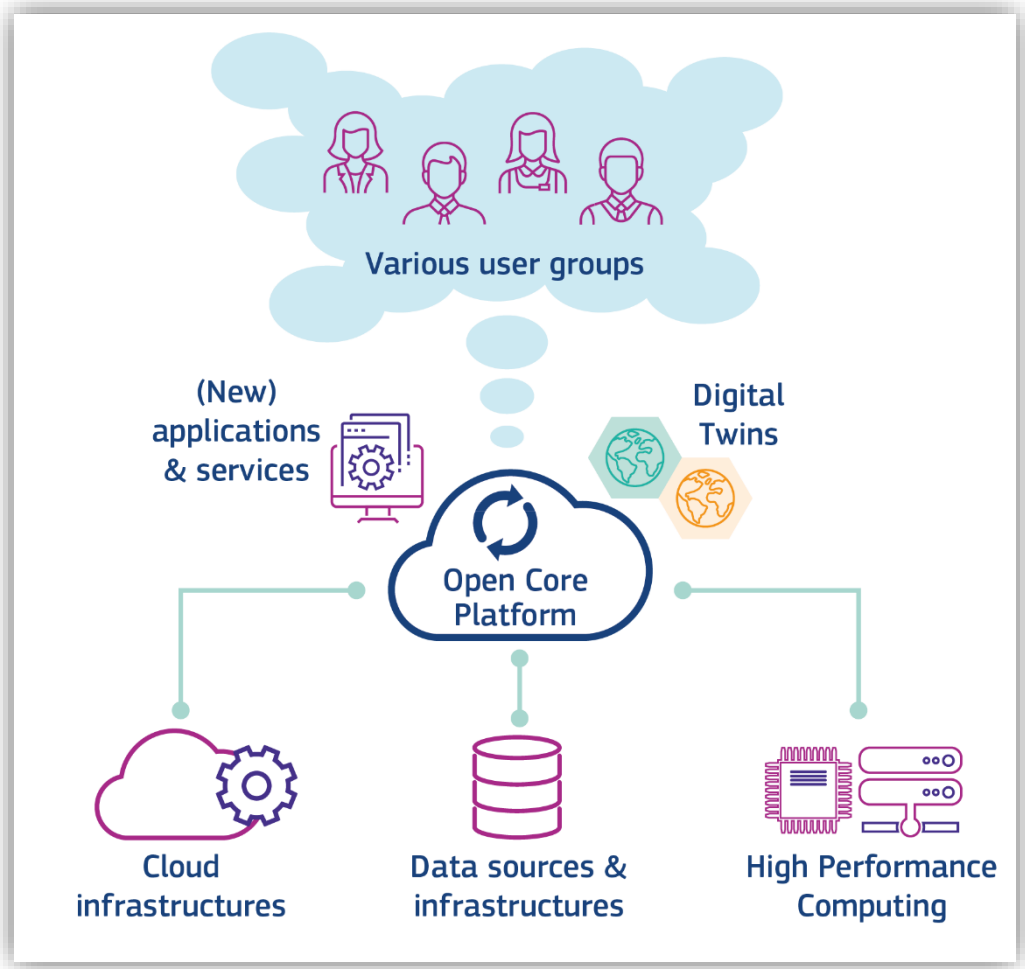


Adapted from Toreti et al. Sci. Rep. 9, 2019

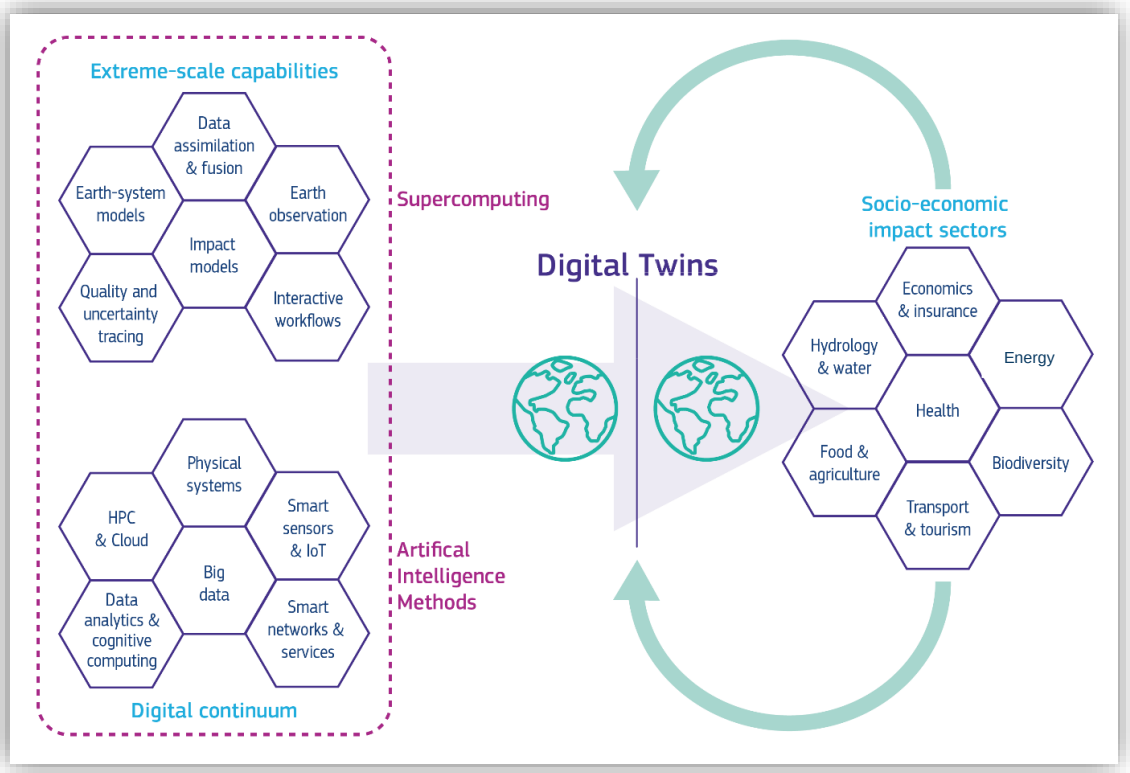
Where **AI** comes into play

- Integrating land-use and its changes
- Efficient use of other sources of impacts' information
- Bridging the scale gap
- Building sectoral Digital Twins (e.g. farm)
- Upscaling the local information and knowledge from DTs

Key initiative



Destination Earth



@ECMWF. Adapted

European Commission

Conclusions & Discussion

- Broad range of opportunities (and challenges)
- Experts' involvements from different sectors is crucial
- Data & infrastructure: a decade of changes
- Physics-Informed AI
- Hybrid approaches

Thank you

andrea.toreti@ec.europa.eu

EU Science Hub: ec.europa.eu/jrc

@EU_ScienceHub

EU Science Hub – Joint Research Centre

EU Science, Research and Innovation

Eu Science Hub

European Commission