Outline of the EEA ETC Technical Paper on *Extreme Climate and Weather Events*

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Objectives of the Technical Paper

Draft an ETC/CCA Technical Paper on extreme climate and weather events presenting the latest scientific knowledge on metrics, observed trends and modelled projections. The paper will assess scientific literature to provide:

1. a description of past trends at European or smaller scales;
2. a description of projected changes at European or smaller scales;
3. an assessment of links between these events in Europe and global climate change;
4. a description of selected cases of European extreme-weather events in recent years;
5. an overview of different national and international projects working on this topic

Scope

1. Extreme temp (hot and cold), Heavy precip, Hail, Drought (including hydrological)
2. European region
3. Research published after EEA 2012 CCIV report
4. European projects

Timeline of the Technical Paper

Timeline:

1.	Workshop	20 March
2.	First draft	30 April
3.	Second draft	31 July
4.	Final draft	30 September

Authors of the Technical Paper

Authors:		
Andre Jol	EEA	Climate change
Blaz Kurnik	EEA	Climate change
Paul van der Linden	Met Office	Knowledge integration
Robert Dunn	Met Office	Temperatures
John Caesar	Met Office	Modelling extremes
Peter Dempsey	Met Office	Precip, drought, hydrology
Jaroslav Misiak	CMCC	Impacts, socio-economics
Reviewers:		
Lizzie Kendon	Met Office	
Mikael Hilden	SYKE	
Andreas Marx	UFZ	

Meeting outputs

1. Thorough exploration of the scientific issues
2. Identification of key publications / papers
3. Identification of key subjects (for the outline)
4. Description of scientific links, gaps, issues
5. Short Report / outline (to be prepared by the author team after the meeting)

Key Questions for the sessions

Session 1: Observations and projections

1. From observations of the climate variable to detection of extreme events
2. The availability of timeseries
3. Spatial scale and regional differences
4. Representation of extremes in climate models

Session 2 (part 1): Droughts

1. What are the pros and cons of combining different aspects of drought-related information in EEA indicators?
2. How to define hydrological droughts? What are the pros and cons of different methods?
3. How good is the data availability regarding observations of further indices on hydrological drought? Could these indices provide substantial additional information for development of the drought indicator?
4. What are the causes for substantial differences in drought projections and what are the implications for decision-makers?
5. In Europe, ground based measurements of soil moisture are either not available, not harmonised or not available for sufficiently long time periods. However, satellite derived soil moisture data are now available for Europe.
6. Currently studies about drought climatology for Europe use simplified drought indices, like SPI or the (PDSI). What are the limitations of using these indices for assessing drought climatology in Europe?
7. For what past time period can the combined drought indicator (CDI) be calculated? Is it possible to combine the CDI with information on agricultural droughts from the revised soil moisture indicator?
8. What are the links between heat waves and droughts?

Session 2 (part 2): Extreme temps

1. What are the relative advantages of the different indices for presenting observed and projected changes in extreme high temperature?
2. Is the Heat Wave Magnitude Index (HWMI) suitable for use as an indicator about temperature extremes?
3. Has the HWMI or another heat wave index been systematically linked to observed impacts from heat waves in Europe (e.g. on human health or agricultural crop yields)?
4. How useful are the spatial and temporal projections of heatwaves from climate models?

Session 3: hail and heavy precipitation

1. What are the relative advantages of various indices (such as extreme daily precipitation, R95, and wet spell length, WSL) for presenting observed and projected changes in heavy precipitation?
2. Are data on observed changes in R95 easily available for Europe, and for which time period?
3. What are the observed trends in heavy precipitation and how well are precipitation extremes represented in gridded (low spatial resolution) datasets?
4. Are data on projected changes in WSL from GCMs and/or RCM ensembles easily available for Europe?
5. How relevant and important is the bias correction of climate models?

Other questions

1. What are the links with larger scale climate/weather phenomena?
2. How well can climate extremes be characterised against decadal variability?
3. How does observational uncertainty relate to validating models and bias correction?
4. Could multiple indicators be considered together for other effects e.g. Fire? (temp, prcp, soil moisture, wind)
5. Are existing indicators and metrics useful in adaptation and other applied research?

Met Office

Questions

Session 2 (part 1): Droughts

1. Currently aspects of meteorological, hydrological, agricultural and socio-economic droughts are covered by various CLIM indicators. What are the pros and cons of combining different aspects of drought-related information in EEA indicators?
2. How to define hydrological droughts? What are the pros and cons of the choice of different return periods for minimum river flow?
3. How good is the data availability regarding observations of further indices on hydrological drought? Could these indices provide substantial additional information for development of the drought indicator?
4. What are the causes for substantial differences in drought projections and what are the implications for decision-makers?
5. In Europe, ground based measurements of soil moisture are not available for many regions. Measurements are also not harmonised and they are also not available for sufficiently long time periods. However, satellite derived soil moisture data are now available for Europe.
6. Currently studies about drought climatology for Europe use simplified drought indices, like SPI or the Palmer Drought Severity Index (PDSI). What are the limitations of using these indices for assessing drought climatology in Europe?
7. For what past time period can the combined drought indicator (CDI) be calculated? Is it possible to combine the CDI with information on agricultural droughts from the revised soil moisture indicator?
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- Choice of baseline.
- Selection of thresholds.
- Choice of spatial resolution.
- Choice of indices e.g. drought, heat waves, heat stress, multi-variate indices. WMO extremes indices/sector-specific indices. Which are most relevant to key impacts?
- Indices of local relevance, but also ones which we can compare with different parts of the globe.
- Time resolution - annual, monthly, daily, sub-daily extremes.
- Issues with bias correction - e.g. observational uncertainty, de-coupling physically related variables in models (multi-variate bias correction), producing unrealistic values
- Small scale severe weather events e.g. hail. Difficult to model, and observe to some extent.
- What timescales are we interested in - signal emergence issue on shorter timescales?
- Decadal variability - more important on shorter timescales. Understanding shorter timescale variability - e.g. interannual, warming 'hiatus'.
- Teleconnections affecting Europe. How might these change?
- Tipping points. Low probability high impact events. Change of climate regimes.
- Observational uncertainty and how it relates to validating models and bias correction.
- Rainfall - RCPs do not take into account range of aerosol loadings which may influence rain amounts.
- Should wild fire weather be considered? (e.g. temp, prcp, soil moisture, wind). Important in southern Europe.