

TOPIC: Coping with Droughts

- Oral or Poster Presentation

Propagation of drought in semi-arid river basins in the Americas, revisiting the report of Changnon (1987)

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In 1987 Changnon wrote about drought events in Illinois (USA), studying how precipitation deficit develop within the hydrological cycle. His report is mainly known for a figure showing drought propagation by different physical variables, from precipitation to soil moisture to streamflow and finally to groundwater. The questions posed about drought propagation remain valid and partly unresolved even 30 years later.

Our research asks three questions that follow in the vein of Chagnon's work (1987) on drought events: How can we show drought propagation? Do drought events behave similarly or is each one unique? Is it possible to identify a "drought function", describing its propagation within a river basin? We have chosen semi-arid river basins in the Americas, recognizing that data gathering is an obstacle for on-time drought assessment. Selected river basins are: Mendoza (Argentina), Tapacura (Brazil), Maipo (Chile), and Santa Cruz (USA). The applied methodology is based on standardized drought indices: the Standardized Precipitation Index (SPI), Standardized Precipitation Evapotranspiration Index (SPEI), Standardized Streamflow Index (SSI), and the Standardized Soil Moisture Index (SSMI). Precipitation and streamflow data are taken from official measuring stations, and soil moisture data is derived from the European Space Agency – Climate Change Initiative (ESA CCI SM v03.2). Preliminary results for the Maipo basin show that soil moisture responds within the same accumulation period to precipitation deficit whereas streamflow takes longer (up to 2-3 accumulation periods) to show the drought event. Recuperating periods show similar behavior; soil moisture recovers faster from a drought than streamflow, which still detects drought conditions, but precipitation shows no deficit. We aim to provide insights of drought propagation from selected river basins in order to improve drought understanding.

Reference:

Changnon, S.A., 1987. Detecting Drought Conditions in Illinois. Illinois State Water Survey, State of Illinois, 41 pp.