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Enhanced capability to monitor drought using citizen weather stations

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Recent studies indicate that global warming changes the global hydrological cycle and may trigger drought or expand and deepen existing drought conditions at our planet. During the summer of 2018 the Netherlands experienced extreme drought conditions, matching the previous drought record from 1976. This climatic extreme has been monitored using a cumulative metric based on the difference between (potential) evaporation and precipitation. In an effort to provide exhaustive drought monitoring facilities, the Netherlands Meteorological Service (KNMI) developed a drought monitor based on the Standard Precipitation Index (SPI) using 40 years of daily rainfall (1971-2010) from our official network of rain gauges for calibration. The daily SPI maps help decision makers to assess the status of meteorological drought in the Netherlands, thus enabling preventive measures mitigating its negative impacts on different socio-economic sectors.

In the past two decades our global society has witnessed the advent of new technological and scientific advances that have reshaped the way we collect weather observations. Increasing numbers of citizens are joining the effort of monitoring the weather by installing citizen weather stations (CWS) in private spaces (e.g., home, schools), thus conforming novel sources of weather data. In 2015, the KNMI joined as a partner the Weather Observations Website (WOW) consortium, a citizen science initiative promoted by the UK Met Office bringing together weather enthusiasts all around the world. WOW-NL CWS have collected 100+ million observations between 2015-2019. However, it is still unclear how to use this remarkable volume of observations, or what is the added value (e.g., economic, operational, research) they provide with respect to the official network.

In this ongoing work, we combined the newly developed SPI drought monitor with WOW observations from the Netherlands to obtain an 'SPI-WOW' indicator. Our goal is threefold: 1) illustrating how to turn WOW-NL data into operational value; 2) assessing the possibility of

providing higher resolution drought maps including WOW-NL rainfall data; 3) enable the possibility for underrepresented regions to obtain (relevant) local drought metrics.

We extracted 12 million precipitation observations for 2019 and, for each day of the year, we computed the daily rainfall accumulations for the previous 30 days (i.e., SPI-1). Note that the precipitation observations are not quality-controlled (QC). The calibrated model is tested with these newly created rainfall accumulations to obtain the SPI-WOW values. Our preliminary results compare the official vs alternative values of SPI at the location of each WOW-NL CWS. For each month we observe a moderate positive correlation, and there are CWS in the network capable of providing measurements close to the official ones. Further work to achieve the above-mentioned goal should include a) the application of a QC to the rainfall data to remove the outliers beforehand; b) thoroughly comparing the values of both networks in space and time across different scenarios; c) identifying the WOW-NL stations providing the best SPI metrics and its characteristics; d) assess the inclusion of radar data for the hi-res maps.