OASIS Future Danube River Segment Drought Event Set

Description

The OASIS Future Danube River Segment Flood Event Set provides current and future drought risk for the entire Danube basin and over 13'000 river segments. Mean multi-day (7, 21, 63 days) discharge (m^2s^{-1}) for a range of recurrence intervals (e.g. 100, 500 or 10000-year minima) is included. The unique features are the adherence to both insurance industry and climate impact science standards: It is simulated by a continuous, distributed hydrological model driven by a state of the art stochastic weather generator over 10000-year synthetic climate periods under IPCC climate change scenarios (RCP-4.5, RCP-8.5 and 4 GCM-RCM model combinations). Historical flood intervals relate to the baseline period 1970-1999 and future periods are the medium (2020-2049) and long-term (2070-2099). Data columns provide future recurrence interval (years) as well as climate model uncertainty ranges of one standard deviation (years).

Column name	**Description**
ac_average	River segment catchment size [km²]
subbasinID	SWIM subbasin ID
FIPS	FIPS country code
cntry_name	Country name
t*[t]*s*[s]*p*[p]* *(200 columns)*	Mean discharge over the X-day period (m^2s^{-1}) *, naming convention: *t* = historical recurrence interval: 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000 years *s* = IPCC RCP scenario: 0: historical reference, 1: RCP-4.5, 2: RCP-8.5 *p* = period: 0: 1970-1999, 1: 2020—2049, 2: 2070—2099
e*[t]*s*[s]*p*[p]* *(200 columns)*	Climate model (4 GCM-RCM combinations) uncertainty range (single standard deviation)*, naming convention same as for the flood volume.

* The sample dataset includes only 4 data columns for a 21-day drought.

Methodology

Modelling strategy

The distributed hydrological model SWIM was calibrated to 18 gauging stations to the daily EOBS climate reanalysis dataset via a multi-objective, evolutionary algorithm to find suitable parameter trade-offs between average hydrology and flood conditions. The model was then driven by the 10,000-year synthetic climate data (provided by IMAGE, Imperial College London) to obtain a comprehensive set of flood recurrence intervals for the reference period the medium (2020-2049) and long-term (2070-2099) under two standard, IPCC climate change scenarios (RCP4.5 and RCP8.5). In general, results indicate the potential for large shifts in recurrence intervals, i.e. higher order floods may occur more frequently. For example, the present 1000-year flood at Nagymaros station (Danube at Budapest) would occur at a frequency of 600 years in the far future under the RCP4.5 scenario and every 250 years under the RCP8.5 scenario. The model is able to provide this assessment for all stream segments of the upper Danube basin with climate model uncertainty range.

Models used

The Soil and Water Integrated Model (SWIM) is an eco-hydrological model that was developed at PIK Potsdam to investigate impacts of climate, land use, and water management (reservoirs and irrigation) changes on the catchment hydrology (including floods and droughts) and vegetation processes (e.g. crop yields) at the regional scale (Hattermann et al., 2014; 2016, Stagl and Hattermann, 2016). It is a spatially semi-distributed model that operates at the daily time step. In the Future Danube modelling suite, the hydrological module creates the link between the weather/climate (IMAGE) and the risk modules.

IMAGE (Imperial College Weather Generator) a new weather generator captures both the point statistics and spatial temporal correlation of single and multiple variables. IMAGE can be based on spatial observations, re-analysis or models to capture the spatial-temporal statistics. The simulation can then be run for thousands of years to generate footprints of very extreme events which are out of sample of the initial data but obey the same statistical rules.

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