CLIM-RUN Product Information Sheet: June 2013

Near-future changes in indices of precipitation extremes at the Croatian Adriatic coast

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Target groups

- **Water energy**
- **Power planners and managers, potential investors**
- **Water authorities**

Relevance to the case-study requirements

Information on changes in precipitation extremes may be essential for water sector particularly for hydro energy systems (planning and construction of hydro-power plants). It is therefore important to assess their changes in the near-future climate which is of particular interest for stakeholders.

Change in frequency of heavy precipitation events (e.g. R95) and intensity of multi-day precipitation (e.g. Rx5d) may have impacts on changes in water balance components and consequently on river water level and discharge that are included in planning and construction of hydro-power infrastructure (plants, dams, reservoirs). In case of increase, inflow in the reservoir may cause flooding and have implications on dam safety.

The approach

Five indices of precipitation extremes, which indicate intensity and frequency of extreme rainfall events, are analysed over the Croatian Adriatic on seasonal and annual basis in the reference (1961-1990) and the near-future (2011-2040) climate from a 3-member ensemble of the Regional Climate Model (RegCM3) simulations. RegCM3 was forced by three realisations of the coupled atmosphere-ocean general circulation model ECHAM5/MPI-OM which differ in the definition of initial conditions. Future climate integrations were performed under the IPCC A2 emission scenario. The RegCM3 horizontal resolution was 35 km. More detailed description of our simulations is given in Branković et al. (2012).

The following indices of precipitation extremes are used: number of dry days (DD) which includes all days with daily precipitation (R_d) below 1.0 mm; simple daily intensity index (SDII) which corresponds to seasonal (annual) precipitation at wet days (when $R_d \geq 1.0$ mm) divided by seasonal (annual) number of wet days; very wet days (R95) which include days with rainfall above 95th percentile of daily amounts; the fraction of annual and seasonal precipitation amounts occurring during the very wet days (R95T); maximum 5-day precipitation amounts (Rx5d).

Simulated precipitation and indices of precipitation extremes in the reference climate are validated by observations from 19 meteorological stations along the Croatian Adriatic coast and on the islands. Model overestimates precipitation in all seasons except summer, mostly because of too large precipitation amounts in the upper quartile of daily precipitation distribution. Interannual variability and sign of trends are well reproduced with a tendency of the model to overestimate the variability and underestimate the magnitude of trends.

Near-future changes in indices of precipitation extremes are calculated as differences in 30-year ensemble means between the future and referent climates. Although a single regional climate model was used, the spread among projections from 3 ensemble members was even larger than spread of projections from five regional climate models that participated in ENSEMBLES project and were forced by one realisation of ECHAM5/MPI-OM model.

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The product

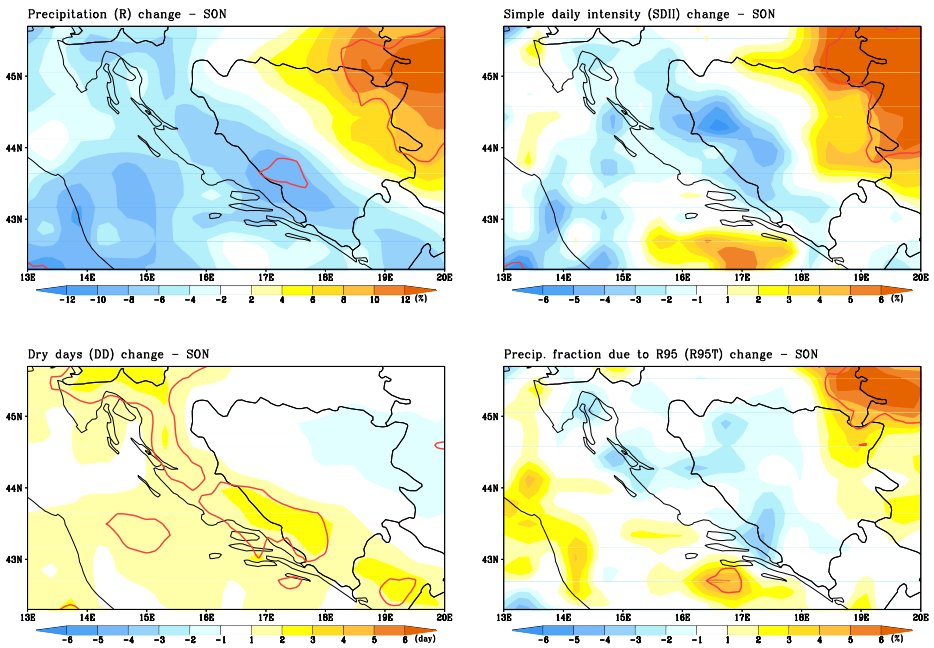

Fig. 1. Near-future (2011-2040) changes (in %) relative to the reference period (1961-1990) of autumn precipitation (top left) and SDII (top right), and differences between the near-future and referent DD (bottom left) and R95T (bottom right). Areas with statistically significant climate change at the 95% confidence level are enclosed by thick red line.

The largest change in seasonal precipitation is expected in autumn when a decrease of precipitation between 2% and 8% is seen along the entire Croatian coast. SDII is reduced over the greater part of the coast which is consistent with the precipitation change, but it is spatially less uniform. Due to the increase of autumn DD (i.e. decrease of wet days), SDII may increase over the northwestern Istria and southern Adriatic. Although the autumn precipitation changes are mostly negative, the fraction of precipitation from very wet days (R95T) is projected to increase over northwestern Istria Peninsula (1-3%) and over the southern Adriatic islands. For moderate very wet days (R95) changes in the near-future climate are essentially non-existent.

Making the product usable

The CLIM-RUN team is seeking collaborations with stakeholders in the water energy sector to make these climate products usable. The above results refer to the area where the most of the hydro power plants are located. Areas for potential cooperation include: tailored indices based on statistics of precipitation extremes and extension of the analysis to any region of interest.

Because the use of only one regional model poses a limitation of our study to estimate the uncertainty in future precipitation changes, further steps would be to use the ensembles of regional models forced by several global climate models, preferably at a higher horizontal resolution. Additionally, the analysis could be extended to other meteorological parameters such as air temperature extremes.

References:
Branković Č., Patarčić M., Güttler I., Srnec L, (2012) Near-future climate change over Europe with focus on Croatia in an ensemble of regional climate model simulations, Climate Research 52, 227-251.

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