Geophysical Research Abstracts
Vol. 19, EGU2017-5072, 2017
EGU General Assembly 2017

A Combined Atmospheric Rivers and Geopotential Height Analysis for the Detection of High Streamflow Event Probability Occurrence in UK and Germany

Federico Rosario Conticello (1), Francesco Cioffi (1), Upmanu Lall (2), and Bruno Merz (3)

(1) University of Rome "La Sapienza", DICEA, Roma, Italy (f.conticello@live.it), (2) Department of Earth and Environmental Engineering, Columbia University of New York, NY, USA, (3) Section Hydrology, GFZ German Research Centre for Geosciences, Potsdam, Germany

The role of atmospheric rivers (ARs) in inducing High Streamflow Events (HSEs) in Europe has been confirmed by numerous studies. Here, we assume as HSEs the streamflows exceeding the 99th percentile of daily flowrate time series measured at streamflow gauges.
Among the indicators of ARs are: the Integrated Water Vapor (IWV) and Integrated Water Vapor Transport (IVT). For both indicators the literature suggests thresholds in order to identify ARs. Furthermore, local thresholds of such indices are used to assess the occurrence of HSEs in a given region.
Recent research on ARs still leaves room for open issues: 1) The literature is not unanimous in defining which of the two indicators is better. 2) The selection of the thresholds is based on subjective assessments. 3) The predictability of HSEs at the local scale associated with these indices seems to be weak and to exist only in the winter months.
In order to address these issues, we propose an original methodology: (i) to choose between the two indicators which one is the most suitable for HSEs predictions; (ii) to select IWT and/or IVT (IVT/IWV) local thresholds in a more objective way; (iii) to implement an algorithm able to determine whether a IVT/IWV configuration is inducing HSEs, regardless of the season. In pursuing this goal, besides IWV and IVT fields, we introduce as further predictor the geopotential height at 850 hPa (GPH850) field, that implicitly contains information about the pattern of temperature, direction and intensity of the winds. In fact, the introduction of the GPH850 would help to improve the assessment of the occurrence of HSEs throughout the year. It is also plausible to hypothesize, that IVT/IWV local thresholds could vary in dependence of the GPH850 configuration.
In this study, we propose a model to statistically relate these predictors, IVT/IWV and GPH850, to the simultaneous occurrence of HSEs in one or more streamflow gauges in UK and Germany. Historical data from 57 streamflow gauges in UK and 61 streamflow gauges in Germany, as well as reanalysis data of the 850 hPa geopotential fields bounded from 90W to 70E and from 20N to 80N are used. The common period is 1960 to 2012. The link between GPH850 and HSEs, and more precisely, the identification of the GPH850 states potentially able to generate HSEs is performed by a combined Kohonen Networks (Self Organized Map, SOM) and Event Syncronization approach. Complex network and modularity methods are used to cluster streamflow gauges that share common GPH850 configurations. Then a model based on a conditional Poisson distribution is carried out, in which the parameter of the Poisson distribution is assumed to be a nonlinear function of GPH850 state and IVT/ IWV. This model allows for the identification of the threshold of IVT/IWV beyond which there is the HSE highest probability.