Session: C4 Poster: TH208A

CLIVAR-SPAIN contributions: Streamflow variability and predictability in the Ebro river basin

Sonia Gamiz-Fortis[†]; Jose Hidalgo-MuÒoz; Daniel Arg,eso; MarÌa Esteban-Parra; Yolanda Castro-DÌez
[†] University of Granada, Spain
Leading author: srgamiz@ugr.es

The spatio-temporal variability and predictability of a very representative example of large Mediterranean rivers, the Ebro River Basin, is studied. The modes of spatial and temporal variation in 83 records of streamflow distributed across the whole basin are defined using the Principal Component Analysis for the period 1950-2006. Three significant components were selected revealing three regions with different temporal variability: the Basque-Cantabrian Mountains, the Pyrenees and the southern mediterranean region. For stations associated to the Basque-Cantabrian region winter-time river flow account for the majority of runoff, being followed by a relatively long and dry summer period. In the Pyrenees a nivo-pluvial flow type is presented, with streamflow peaking in June. Flows in the southern mediterranean region present low total annual streamflow and prolonged dry season, with streamflow peaking in May. Attending to this classification the main characteristic time scales of the maximum monthly streamflows are studied by Singular Spectral Analysis (SSA), revealing a similar structure for the three regions: 1) a nonlinear trend dominated by multidecadal variability; 2) modulated amplitude oscillations with periods longer than 7 years; 3) quasi-oscillatory modes in the bands 2-3, 4-5, and 6-7 yr, depending of the region; and 4) a red noise process. Decadal variations make particularly large contributions to year-to-year streamflow variance in the Cantabrian Mountains and southern mediterranean region, while for the Pyrenees flows the interannual contribution to the streamflow variations is more important. The predictability of the Ebro flow anomalies was investigated using a combined methodology: at decadal time scales SST anomalies from several regions provide a significant source of predictability, while at interannual time scales AutoRegressive-Moving-Average (ARMA) modelling is able to provide potential skill in forecasting. The results of this analysis demonstrated the existence of strong influences of ocean conditions at decadal time scales. For the Basque-Cantabrian region we find positive significant correlations between the streamflow anomalies in January and a tripolar-like pattern in the North Atlantic during the previous spring. This association is found maximum and stable for the tropical part of the pattern (0-20^{o}N). For the Pyrenees region the correlations between the June streamflow and global SST are weaker and only stable connections are found in the eastern Mediterranean Sea during the spring of the previous year and in the south-eastern Pacific Ocean during the previous summer. For the southeast of basin higher than average values of the Ebro river flow in May tend to be associated with a Pacific SST pattern that resemblance the negative phase of the Pacific Decadal Oscillation. Finally, the combination of SST_model and ARMA_model has been evaluated for each region. This methodology allows evaluating, independently, the decadal and interannual predictability of the streamflow series, which vary (for the period 1990-2003, used as validation period) between 20% and 44% for the Basque-Cantabrian region, between 6% and 62% for the Pyrenees region and between 36% and 52% for the mediterranean region, respectively. Acknowledgements: the Spanish Ministry of Science and Innovation, with additional support from the European Community Funds (FEDER), project CGL2010-21188/CLI has financed this study. Keywords: Poster cluster, CLIVAR-SPAIN, CLIMATE VARIABILITY AND CHANGE, SOUTHWESTERN EUROPE.