HyMeX - Eastern Adriatic trend and variability analysis in precipitation extremes

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The paper contributes to the knowledge of the eastern Adriatic extreme precipitation climatology that is a part of the HyMeX program LOP studies and working group WG3 Heavy rainfall, flash-floods and floods - topic 3.2a Quantitative precipitation estimation and it also comes under the objectives of MedCLIVAR. The fact that precipitation change is highly variable regionally increased the need for more accurate regional and local precipitation change analysis to improve the analysis of impacts. Many of these impacts will be felt through extreme events. These increase a demand for determining from the observational record whether there have been significant changes in amount, frequency and intensity of extreme precipitation. Spatial differences in precipitation extremes trends indicated in earlier study based on centennial scale analysis at three locations at the eastern Adriatic, initiated further analysis based on denser network for the second half of the 20th century and the first decade of the 21st century. The spatio-temporal change in seasonal and annual precipitation is analyzed for 23 Croatian rain gauge stations on the islands and the coast. Change in extreme precipitation conditions is investigated by trend analysis of seven indices of precipitation extremes proposed by World Meteorological Organization (CCI and CLIVAR). They are calculated using daily and multi-day precipitation data. The data series from the period 1953-2009 meet the criteria for calculating the indices. Trend for each station is estimated by means of Kendall's tau method and the statistical significance is tested using the non-parametric Mann-Kendall test. The overall significance is assessed by Monte Carlo method. In order to evaluate the intensity and frequency of more rare events, the Generalized Extreme Value (GEV) distribution is applied to the time series of annual maxima of 1-day and 5-day precipitation amounts. Since the middle of 20th century a general decrease in annual precipitation is found, becoming stronger from north to south. It is mainly forced by the summer and winter trends. Overall significant increase in the frequency of dry days in the southern Adriatic is accompanied by significant decrease in the frequency of wet days. According to the daily intensity index, heterogeneous sign in trend dominates over the analysed area. In spite the total precipitation decrease, part of annual precipitation amount coming from very wet days has increased. The 1-day and 5-day annual maxima showed large interannual variability. The estimates of 20-year return values calculated for 30-year moving periods indicate a strong influence of the upper outliers. An appearance of the upper outliers during the observed 57 years is discussed according to the 20year return value.