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A new index quantifying the precipitation extremes

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Events of extreme precipitation have a great impact on society. They are associated with flooding, erosion and landslides.Various indices have been proposed to quantify these extreme events and they are mainly related to daily precipitation amount, which are usually available for long periods in many places over the world. The climate signal related to changes in the characteristics of precipitation extremes is different over various regions and it is dependent on the season and the index used to quantify the precipitation extremes. The climate model simulations and empirical evidence suggest that warmer climates, due to increased water vapour, lead to more intense precipitation events, even when the total annual precipitation is slightly reduced. It was suggested that there is a shift in the nature of precipitation events towards more intense and less frequent rains and increases in heavy rains are expected to occur in most places, even when the mean precipitation is not increasing. This conclusion was also proved for the Romanian territory in a recent study, showing a significant increasing trend of the rain shower frequency in the warm season over the entire country, despite no significant changes in the seasonal amount and the daily extremes. The shower events counted in that paper refer to all convective rains, including torrential ones giving high rainfall amount in very short time. The problem is to find an appropriate index to quantify such events in terms of their highest intensity in order to extract the maximum climate signal.
In the present paper, a new index is proposed to quantify the maximum precipitation intensity in an extreme precipitation event, which could be directly related to the torrential rain intensity. This index is tested at nine Romanian stations (representing various physical-geographical conditions) and it is based on the continuous rainfall records derived from the graphical registrations (pluviograms) available at National Meteorological Administration in Romania. These types of records contain the rainfall intensity (mm/minute) over various intervals for which it remains constant. The maximum intensity for each continuous rain over the May-August interval has been calculated for each year. The corresponding time series over the 1951-2008 period have been analysed in terms of their long term trends and shifts in the mean; the results have been compared to those resulted from other rainfall indices based on daily and hourly data, computed over the same interval such as: total rainfall amount, maximum daily amount, contribution of total hourly amounts exceeding 10mm/day, contribution of daily amounts exceeding the 90th percentile, the 90th, 99th and 99.9th percentiles of 1-hour data . The results show that the proposed index exhibit a coherent and stronger climate signal (significant increase) for all analysed stations compared to the other indices associated to precipitation extremes, which show either no significant change or weaker signal. This finding shows that the proposed index is most appropriate to quantify the climate change signal of the precipitation extremes. We consider that this index is more naturally connected to the maximum intensity of a real rainfall event.
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