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Estimation of probable maximum precipitation at the Kielce Upland (Poland) using meteorological method

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Probable Maximum Precipitation based upon the physical mechanisms of precipitation formation at the Kielce Upland. This estimation stems from meteorological analysis of extremely high precipitation events, which occurred in the area between 1961 and 2007 causing serious flooding from rivers that drain the entire Kielce Upland. Meteorological situation has been assessed drawing on the synoptic maps, baric topography charts, satellite and radar images as well as the results of meteorological observations derived from surface weather observation stations. Most significant elements of this research include the comparison between distinctive synoptic situations over Europe and subsequent determination of typical rainfall generating mechanism. This allows the author to identify the source areas of air masses responsible for extremely high precipitation at the Kielce Upland. Analysis of the meteorological situations showed, that the source areas for humid air masses which cause the largest rainfalls at the Kielce Upland are the area of northern Adriatic Sea and the north-eastern coast of the Black Sea. Flood hazard at the Kielce Upland catchments was triggered by daily precipitation of over 60 mm. The highest representative dew point temperature in source areas of warm air masses (these responsible for high precipitation at the Kielce Upland) exceeded 20 degrees Celsius with a maximum of 24.9 degrees Celsius while precipitable water amounted to 80 mm. The value of precipitable water is also used for computation of factors featuring the system, namely the mass transformation factor and the system effectiveness factor. The mass transformation factor is computed based on precipitable water in the feeding mass and precipitable water in the source area. The system effectiveness factor (as the indicator of the maximum inflow velocity and the maximum velocity in the zone of front or ascending currents, forced by orography) is computed from the quotient of precipitable water in the feeding mass and the mean areal depth of precipitation which occurred in the given time interval at the Kielce Upland.
The probable maximum precipitation at Kielce Upand defined as the combination of the following factors: maximum possible air humidity in the source area, minimum mass transformation and maximum effectiveness factor.