

Changes in precipitation intensity and duration distributions over Northern extratropics related to extreme rainfall and droughts: New tendencies emerging during the last decades

Pavel Groisman[†]; Olga Zolina; Sergey Gulev; Richard Knight; Thomas Karl

[†] UCAR at NOAA National Climatic Data Center, USA

Leading author: pasha.groisman@noaa.gov

We quantify an observational evidence of changes in precipitation intensity and duration distributions over Northern Extratropics for the past 40 to 50 years with focus on extremes on both sides of daily (for the United States, daily and hourly) and multi-day rainfall distribution in the warm season. These analyses could be and have been completed only for the areas with sufficiently dense meteorological networks. We found a notable change in rainfall rate distribution (increase in heavy rainfall frequencies while mean precipitation grows slower or decreases) is accompanied with increased frequencies of no-rain periods over most of North America south of 55°N and Northern Eurasia south of 60°N. These changes are a new phenomenon and were observed only for the past several decades. Northern Eurasia became wetter west of The Ural Mountains and drier further to the east. During the past five decades over Russia south of the Arctic Circle the duration of prolonged 1-month-or-longer dry episodes has significantly increased. Over North Asia, this increase corroborates with an increase in the potential forest fire danger over Siberia, the Russian Far East, and Northwestern China and a century-long increase of the agricultural drought indices in the major crop producing region of Western Siberia and Northern Kazakhstan. Over the European Russia, the duration of prolonged dry periods has also increased but this increase occurred on the background of substantial increase in total precipitation and runoff leaving the indices of potential forest fire danger and agricultural drought to vary widely without apparent tendencies (this last statement was made prior to the data for year 2010 were accounted for). Over Europe during the period 1950-onwards there has been a clear tendency of the increasing duration of wet periods by 15 to 20%. Furthermore, longer wet periods were clearly associated with the increase in the intensity of heavy rainfalls. Interestingly, the duration of European dry spells has also increased in the Central and Eastern Europe. This implies that during the last several decades the structure of European precipitation has been considerably changed due to re-grouping of wet and dry days into prolonged wet and dry spells. Generally, over North America, the recent changes in precipitation intensity distribution are observed on the background of the relatively "wet" period when very heavy and extreme precipitation have increased (particularly, in the central U.S.). However, during the past four decades, the duration of prolonged dry episodes has significantly increased over the Eastern and Southwestern U.S. This increase has expanded to neighboring regions of Mexico and Canada and potential fire danger in the Southwestern U.S. has increased.