CONTROL ID: 1472644
TITLE: Precipitation Intensity and Events Distribution Changes in the Extratropics

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ABSTRACT BODY: More than ten years ago, Groisman et al. (1999) first reported large-scale changes in spectra of precipitation distribution intensity. At the tails of this distribution the frequencies in heavy and very heavy precipitation events have increased over many parts of the extratropics. These increases were disproportionally high in the regions where the precipitation totals increased and were observed even in the regions where the mean rainfall remained unchanged or decreased. Thereafter, this peculiarity of the contemporary precipitation distribution change was substantiated in many regional studies summarized by Groisman and Knight (2013) and will be reported in our presentation.

Increases in the frequency of very heavy and extreme precipitation events (with return period of several years and decades respectively) are important for impact studies (assessment of soil erosion, potential of flood) but these events represent a small fraction in annual rainfall totals. Therefore, we analyzed the changes in the*mean* daily rainfall intensity over the northern extratropics in the regions well elucidated with dense gauge networks (southern Canada, contiguous U.S., Europe, Russia, and Japan). Nearly everywhere, we found systematic increases in daily rainfall totals per day with rain. While increases in very heavy and extreme rainfall intensity are an independent characteristic of the ongoing climatic change, the observed changes in mean precipitation intensity are in line with the ongoing global and regional warming.

Duration of the sequences of wet days (prolonged rain events) increased in Europe and Northern Asia, and the duration of the sequences of dry days (prolonged no-rain events) increased over large parts of Northern Eurasia and North America (Zolina et al. 2010; Groisman and Knight 2007; 2013). To describe this feature of the rain events distribution, Zolina et al. (2012) suggested a visual interpretation of wet days as beads on the necklace of the seasonal cycle time thread that can be (a) distributed more or less equidistantly or (b) grouped in clusters leaving large intervals (no-rain episodes) between themselves. Our findings show that in the northern extratropics a transition from **a-cases** to **b-cases** has occurred over most of the regions. There could be "the same number" of beads on the thread (i.e., leaving annual precipitation nearly intact) or there could be moderate increases/decreases in these numbers. However, the situations of clustered beads when unusually wet seasons are replaced with unusually dry seasons in the same regions (!) became more frequent in the last several decades. Eastern U.S., European Russia, southern Siberia, the Netherlands and Eastern Europe are among these regions.

Cited references:

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KEYWORDS: [1655] GLOBAL CHANGE / Water cycles, [1817] HYDROLOGY / Extreme events, [1854] HYDROLOGY / Precipitation.