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Inhomogeneities in bias-corrected precipitation time-series over Russia

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Inhomogeneities in climate time series of bias-corrected precipitation over Russia are analyzed.
During XX century in the USSR there was several changes in precipitation measurement procedures, which caused inhomogeneities in precipitation time-series. Two precipitation datasets are under investigation: the original one (without correction procedures and wetting correction), and the other - undergone the bias-correction procedure following the full empirical correction model of precipitation gauge data (The Voeikov Main Geophysical Observatory monthly datasets; Golubev, 2000; Bogdanova, 2008).
Three homogeneity tests were applied for annual sums to detect the breaks: the standard normal homogeneity test (Alexandersson, 1986), the Buishand range test (Buishand, 1982) and the Pettitt test (Pettitt, 1979).
The artifact inhomogeneities were detected not only in original dataset, where it was expected, especially after 1966, when the precipitation collecting method was modified, but also in bias-corrected time series. Most of breaks appear in 1950-s, when new gauges with Tretyakov wind shield were installed all over the observation hydrometeorological network of the USSR. Although all basic systematic measurement errors of precipitation gauges were excluded from bias-corrected dataset, homogeneity tests detect breaks. After 1966-1967, when wetting correction usage was started and the number of measurements was increased from 2 to 4 per day, and near 1986, when the number of measurements decreased from 4 to 2 per day, homogeneity tests also show biases. In the early 1970-s there were also changes in wind speed measurement procedure, which could cause breaks in corrected precipitation datasets (full model uses wind speed as a parameter).
The percent of determined breaks (5% significant level), detected at least by two tests, is near 50% for original dataset and near 30% for bias-corrected dataset. So, even bias-corrected precipitation dataset over Russia should be checked for homogeneity before usage. Filling gaps and careful extreme values correction procedures should improve dataset quality for climate change analysis.