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Post-treatments of the Climate Forecast System Reanalysis (CFSR) daily precipitations across Canada

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The most important challenge that many country faces, including Canada, is to characterize historical precipitation considering the low station density in many of their regions such as Northern Canada. Reanalysis, generated by Numerical Weather Prediction methods assimilating past observations, are an attractive alternative as they provide coherent, spatially and temporally continuous meteorological fields over a specific period and domain. However, reanalysis precipitations cannot be directly used as local estimates without post-treatments to correct bias and other errors. The Climate Forecast System Reanalysis, CFSR, produced by the National Centers for Environmental Prediction (NCEP), was chosen among the available reanalysis. The CFSR covers the period from 1979 to 2010 and includes hourly precipitation series at a 38 km resolution. The main objective was to post-treat the CFSR gridded daily precipitation over Canada to provide climatology and local estimates of precipitations series at sites without historical records. The Stochastic Model Output Statistical (SMOS) approach linking the CFSR grid-cell precipitation series to the corresponding station series was used. The SMOS approach proceeds in two steps: first, post-treatment of precipitation occurrence (Logistic regression) was made; second, a post-treatment of daily precipitation intensity for wet days was achieved (Vector generalized linear model in a Gamma distribution framework). These post-treatments permit to establish daily local precipitation distributions, characterized by six coefficients, for each day of the period. Post-treatments of CFSR precipitation series were first applied locally at each station/grid-point and site-specific post-treatment coefficients were estimated. Interpolated values of post-treatment coefficients (Kriging methods) were then estimated over Canada. Knowing CFSR precipitations and the SMOS interpolated coefficients at each grid-point, likely daily local precipitation series could be generated at any site. Three skill scores (Brier, continuous ranked probability, and quantile skill scores) showed that estimated SMOS distributions had a better predictive power than the climatology for both precipitation occurrence and intensity. Finally, comparison of post-treated precipitation series with validation series for different precipitation regimes across Canada was carried out.