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Multi-source quantification of precipitation in the global water cycle

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The knowledge of global precipitation is of crucial importance to the study of climate dynamics and the global water cycle in general. Although global precipitation climatologies have existed for some time, and their understanding has improved dramatically due to the vast amount of different data sources, their information has not been comprehensive enough due to precipitation spatial-temporal variability. Thus, ground station reports are, in some cases, not representative of the surrounding areas. Remote sensing data and model simulations complemented the traditional surface measurements and offered unprecedented coverage on a global scale. It is important to note that satellite data records are now of sufficient time frame lengths and with methods "mature" enough to develop meaningful precipitation climatologies that are able to provide information on precipitation patterns and intensities on a global scale. While data (and in some cases exploration/visualization tools as well) are widely available, each dataset comes with different spatial resolution, temporal resolution, and biases.

Consequently, this unique opportunity to obtain a robust quantification of global precipitation has been hindered by the uncertainty, already revealed in the first attempts of the unification of different data products. Herein, we present a multi-source quantification of global precipitation, focusing on the description of the underlying uncertainties. Our approach combines station (CRU, GHCN-M, PRECL, UDEL, and CPC Global), remote sensing (PERSIANN, PERSIANN-CCS, PERSIANN-CDR, GPCP, GPCP_PEN_v2.2, CMAP, and CPC-Global) and reanalysis (NCEP1, NCEP2, and 20CRv2) data products, providing an updated overview of the role of precipitation in global water cycle.