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Water Cycle Changes in Reanalyses

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Remote sensing data and reanalyses complement traditional surface-based measurements and offer unprecedented coverage over previously inaccessible or unmonitored regions. Even though these have improved the quantification of the global water cycle, their varying performances and uncertainties limit their applicability. Herein, we discuss how a framework encompassing precipitation, evaporation, their difference, and their sum could further constrain uncertainty by unveiling discrepancies otherwise overlooked. Ahead, we physically define precipitation plus evaporation to sustain its appropriateness to describe reanalyses. We investigated how well the global water cycle fluxes are represented in four reanalysis data sets (20CR v3, ERA-20C, ERA5, and NCEP1). Among them, we observe four different responses to the temperature increase between 1950-2010, with ERA5 showing the best agreement with the water cycle acceleration hypothesis. Our results show that implementing the framework proposed can improve the evaluation of reanalyses' performance and enhance our understanding of the water cycle changes on a global scale.