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Bias correcting isotope-equipped GCMs to quantify the contribution of oceanic moisture to summer precipitation in eastern China

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As an important component of the global climate systems, ocean-continent interaction influences hydrological cycles at regional and local scales. Eastern China is a typical region where oceanic moisture (OM) has significant influences on summer precipitation. Due to its simplicity and accuracy, physical water vapor tracer method based on the stable isotope has been widely employed to estimate the contributions of different sources to precipitation. However, dense and long-term isotopic observations are limited by technical and economic reasons. Isotope-equipped global climate models (iGCMs) provide potential solutions to to improve our knowledge of hydrological processes. Accordingly, this study investigates the potential of using iGCMs to quantify the contributions of the OM to precipitation, which aim at better understanding of the hydrologic cycle processes. A new bias correction method is proposed to correct biases of precipitation isotopes simulated by five iGCMs (i.e. CAM2, GISS-modelE, LMDZ4, MIROC32, and HadAM3). A modified two-component mixing model taking 18O as a tracer is employed to assess the spatiotemporal contributions of summer OM for eastern China. Results show that iGCMs are biased in simulating preciptiation isotopes at local and regional scales. The bias correction method performs reasonable well in terms of reducing the biases. Based on biased-corrected precipitation isoscapes, the influence of OM on summer precipitation is investigated and found that OM plays an important role in summer precipitation, and spatially decreases along the transport route and the passage of time in summer. In addition, the OM contribution to precipitation contain a considerable uncertainty associated with the choice of a given iGCM for each sub-region and sub-period. Overall, bias correction is necessay before applying iGCMs to study hydrological cycles at the regional scale and the application of multi-iGCMs is critical to delineate uncertainty in studying oecanic-land interaction.