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Stable oxygen and hydrogen isotopes in precipitation comparison between an isotope- incorporated AGCM simulation and measured data for Europe

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The IsoGSM is a reanalysis-spectral nudged isotope- incorporated atmospheric general circulation model. IsoGSM simulations are available from 1979. In our work, we examined the reliability of the model, using the data of nearly 60 European stations of the Global Network of Isotopes in Precipitations (GNIP) as a reference data set. The model performance was tested on daily-, monthly-, seasonal-, and annual timescales. On the daily scale, the correlations ranged from $r = 0.36$ to $r = 0.79$, regression slopes (GNIP vs. IsoGSM) ranged from 0.26 to 0.91 for δ^{18}O (in case of δ^{2}H: $0.32 < r < 0.79$, slope from 0.33 to 0.89). On the monthly scale, the correlations ranged from $r = 0.22$ to $r = 0.99$, regression slope ranged from 0.12 to 1.27 for δ^{18}O (in case of δ^{2}H r from -0.12 to 0.91, slope from 0.18 to 0.99). The model results accurately reflected the actual observed precipitation stable isotope composition in continental areas regardless of the chosen temporal scale. The IsoGSM is contracted applying a constant δ^{18}O$= \delta^{2}$H$= 0‰$ parameterization for surface seawater, which can explain the much-reduced variance in the simulated precipitation stable isotope values at coastal locations. The regression slope of monthly δ^{18}O of 11 coastal GNIP stations ranged from 0.12 to 0.45. As general feature of all global models, IsoGSM also has a smooth topography producing insufficiently depleted compositions from model precipitation for high elevation GNIP stations. A constant bias correction using the elevation difference between the model surface and a high resolution continental elevation model significantly improved the correspondence with the GNIP records referring to mountainous localities of the reference data set.

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