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The isotopic composition of present-day Antarctic snow in a Lagrangian atmospheric simulation

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The isotopic composition of present-day Antarctic snow is assessed for the period September 1980 to August 2002, using a Rayleigh-type isotope distillation model in combination with backward trajectory calculations with ERA-40 data as meteorological input. Observed spatial isotopic gradients are correctly reproduced, especially in West Antarctica and in the coastal areas. However, isotopic depletion of snow on the East Antarctic plateau is underestimated, a problem that also affects general circulation models equipped with isotope tracers. The spatial isotope-temperature relation varies strongly, which indicates that this widely used relation is not applicable to all sites and periods. Spatial differences in the seasonal amplitude are identified, with maximum values in the Antarctic interior and hardly any seasonal isotope signature in Marie Byrd Land, West Antarctica. The modeled signature of deuterium excess remains largely preserved during the last phase of transport, though the simulated relation of deuterium excess with $\delta^{18}O$ suggests that parameterizations of kinetic isotopic fractionation can be improved. These results can be used to identify general atmospheric patterns in modeled isotopic composition.