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Key controls of water vapour isotopes during oceanic evaporation and their global impact

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Stable water isotopes are employed as hydrological tracers to quantify the diverse implications of atmospheric moisture for climate. In a recent study based on several years of in-situ isotope measurements in water vapour of the marine boundary layer it was shown that the isotope signal during evaporation is not modulated by wind speed, contrary to the commonly used theory, but controlled by relative humidity and sea surface temperature, only (Bonne et al., 2019). In sea ice covered regions, the sublimation of deposited snow on sea ice was found as another key process controlling the local water vapour isotopic composition. Here, we evaluate how these new findings will impact the stable water isotope signal both in vapour and precipitation on a global scale. For this purpose, the newly suggested parametrisations are included in two versions of the isotope-enabled atmospheric model ECHAM-wiso (Werner et al., 2016; Cauquoin et al., 2019) and a set of simulations is performed to disentangle the effects of the various controlling factors. Model results are evaluated against a compilation of short-term measurements of the isotopic composition in the marine boundary layer (Benetti et al., 2017), as well as data sets from several coastal stations (Steen-Larsen et al., 2014; 2015; 2017). In addition, the implications of the suggested parameterization changes for the interpretation of various isotope records in paleo-records will be discussed.