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From atmospheric water isotopes measurement to firn core interpretation in coastal sites: A method for isotope-enabled atmospheric models in East Antarctica

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In a context of global warming, it is key to estimate the evolution of the atmospheric hydrological cycle and temperature in the polar regions. Since records are only available from satellite data for the last 40 years, one of the best ways to access longer records is to use climate proxies in firn cores. The water isotopic composition of firn cores is widely used to reconstruct past temperature variations. However, both temperature and atmospheric water cycle (origin of the precipitation, deposition and post-deposition effects) influence the isotopic composition of snow. We present a 2-year long time series of vapor and precipitation isotopic composition measurement at Dumont D'Urville (DDU), a coastal station in Adélie Land. This unique data set is first used to study the link between hydrological cycle and weather regimes at DDU. It is found that both continental and oceanic air masses impact the signal. Then, this record is used to evaluate the Global Climate Model ECHAM6-wiso equipped with water stable isotopes which is able to reproduce the observed isotopic signal. This result permits further use of ECHAM6-wiso to interpret water isotopic profiles on short firn cores. Using this methodology, we evaluate ECHAM6-wiso atmospheric outputs at two other East Antarctic coastal sites: Davis and Neumayer stations.