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A study of the evolution of the stable isotope signature of water vapour during the passage of synoptic low pressure systems over Sydney, Australia

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The stable isotopic composition of water vapour provides a tracer of atmospheric hydrological processes. Incorporation of stable water isotopes into weather and climate prediction models therefore has the potential to aid in their evaluation and improvement, but requires the availability of continuous high-resolution time series of quality isotope data. We present an analysis of an 18 month time series of hourly water vapour stable isotope measurements, collected using Fourier Transform Infrared spectroscopy at a site near Sydney, Australia. The analysis investigates the large variations in the time series of water vapour stable isotope values that are related to synoptic scale forcing. The inter-relationships between the 2H and 18O isotopes and meteorological conditions are explored. To help understand the variations in the observed signals, the stable isotope and meteorological data has been augmented with measurements of atmospheric radon concentrations, satellite-borne rainfall measurements (Tropical Rainfall Measuring Mission - TRMM) and back trajectory analyses. The combination of these different indicators provides an insight into the key processes that influence large changes in the stable isotopic composition of water vapour in the atmosphere.