

# How do weather systems shape the hydrological cycle?

## Three examples from different latitudes

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Understanding the variability and dynamics of the atmospheric branch of the hydrological cycle is important for two major reasons. First, because of its connection to the energy budget of the atmosphere through the transport of moisture and the formation of clouds. And secondly, because extreme events such as heavy precipitation are due to special configurations of its driving forces.

The three examples discussed in this presentation illustrate the importance of weather systems and their dynamics for shaping the hydrological cycle at different latitudes. In the first part, I focus on transient intense ocean evaporation events induced by cold air advection. This specific mid- to high latitude phenomenon is associated with distinctly measurable signals in the isotopic composition of the marine boundary layer water vapour, thus potentially serving as a proxy for such events at longer timescales. In the second part, I present first results from a recent campaign in the wintertime tropical trade-wind region of the North Atlantic. The connection between the low-level tropical cloud cover properties, intrusions of extratropical airmasses originating from the upper troposphere, and the isotopic composition of the boundary layer vapour are discussed. In the third part, three configurations of atmospheric precursor of heavy precipitation in Switzerland are discussed from a climatological analysis over the past 130 years.

The presented research offers a complementary view to thermodynamic steady state considerations of the hydrological cycle. It underlines the importance of the integral effect of transient weather systems in climate-related modulations of the hydrological cycle.

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