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Extreme hydrometeorological events in the Swiss Alps linked with air mass trajectories

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In the framework of rainfall forecasting by means of the Analogs method, air flow direction and air mass trajectories were linked to archives of observed rainfall in the Swiss Alps. Estimated air mass trajectories that correspond to observed extreme rainfall show a distribution that diverges from the wind climatology. The prevailing winds are the Westerlies while most of the critical situations linked to extreme rainfall are wind blowing from the south. This is true for orographic events, which are well defined by the flow orientation across the relief, and which are the most critical events in the Swiss Alps. The NCEP/NCAR Reanalysis data set allows for air flow direction determination and air mass trajectories estimation across the Alps at various pressure levels. Combination of information at high and low levels enables the identification of driving processes, like the jet forcing effect.

These trajectories alone cannot predict future extreme events, but show a certain potential in combination with other criteria that are able to represent the air masses physical properties.

These tools may offer an easy method for a first estimate of the risk of severe rainfall in regions where the orographic rainfall is the leading process in hydrological extremes.