**Title**

Moisture transportation for extreme precipitation: On how dynamics enhances precipitation intensification in a warmer climate in the Netherlands

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**Abstract**

It is well understood that precipitation extremes will increase in a warming climate. On (sub-)hourly timescales, the apparent scaling of precipitation extremes is stronger than expected from the Clausius-Clapeyron relation. Here, we focus on a common hypothesis which states that feedbacks from the local dynamics of clouds are responsible.

The effects of climate change on intensification of extreme precipitation in the Netherlands are modeled using the Dutch Atmospheric Large Eddy Simulation (Lochbihler et al. 2019). The objective is to understand more about extreme precipitation events in a warming climate in the Netherlands. A feedback loop is proposed in which cold-pools increase precipitation intensification with super-CC scaling.

Atmospheric conditions from a composite of days with extreme precipitation are perturbed.The entire atmospheric temperature column is warmed and cooled by 4 degrees Kelvin under constant relative humidity. The convective precipitation is described with a 10 minute timescale. A period of organized convection in the simulations is selected for comparison between the simulations. In this timeframe of extreme precipitation, the yield increases 8.5\% per degree Kelvin.

Convection grows deeper and updrafts in the clouds become stronger with warming. The updrafts that are the most representative of precipitation yield increase in velocity by 4.7\% per degree Kelvin. At 7 km height, updraft speeds increase up to 20.7 \% per degree Kelvin.

Moisture transport occurs predominantly low in the clouds, near cloud base.
With warming, more moisture is transported higher up in the clouds. Moisture transport near the surface increases along organized gustfront lines. On average the increase in transport by updrafts in the sub-cloud layer is dominated by increased moisture rather than due to strong updrafts becoming stronger. The moisture that is concentrated into convective cores coincides with intenser precipitation cores. With warming the subsiding motions accelerate and a stronger drying effect is present around precipitation cores. Cold-pools become stronger, forming bigger gustfront structures.