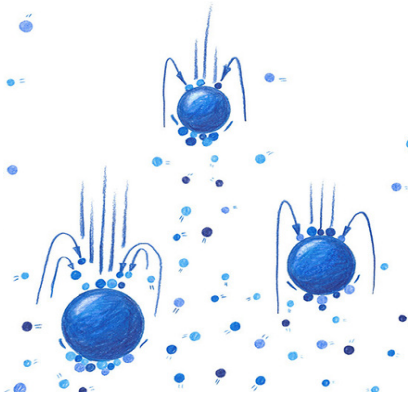
MSc topics 2023-2024

Microphysics of extreme rain:

What controls drop size distributions during heavy rain?

Context: Raindrop size distributions (DSDs) are crucial for understanding the microphysics of rain. The motivation for studying them is that most rainfall-related variables can be expressed as weighted moments of the DSD. In other words: if you know the DSD, you can calculate any rainfall variable of interest.

Challenge: How do rainfall extremes change with rising temperatures? To answer this very important question, detailed information about the DSD, its properties and dependence on temperature are needed. Some theories have been formulated for what happens in extreme rain. But so far, very little observational evidence has been collected to verify these predictions.



Raindrops grow in size by colliding with each other. When a drop becomes too large, it breaks up into smaller parts. The DSD contains the signature of this.

The goal of this project is to analyze in-situ DSD measurements in different countries to study drop sizes and number concentrations during heavy to extreme rain.

Disdrometers in Cabauw for measuring raindrop size distributions

The results will be used to understand the microphysics of sub-hourly rainfall extremes and their sensitivity to temperature.

The hypothesis is that moderate to heavy rain rates are predominantly controlled by natural variations in drop sizes while extreme rain rates are predominantly controlled by the number of raindrops per unit volume of air. The transition from size to number controlled regimes with increasing temperatures is what could explain the different scaling rates with temperature and temporal aggregation scales.

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