MSc Thesis > CE/AES **Date of publication:** 20 Januari 2019

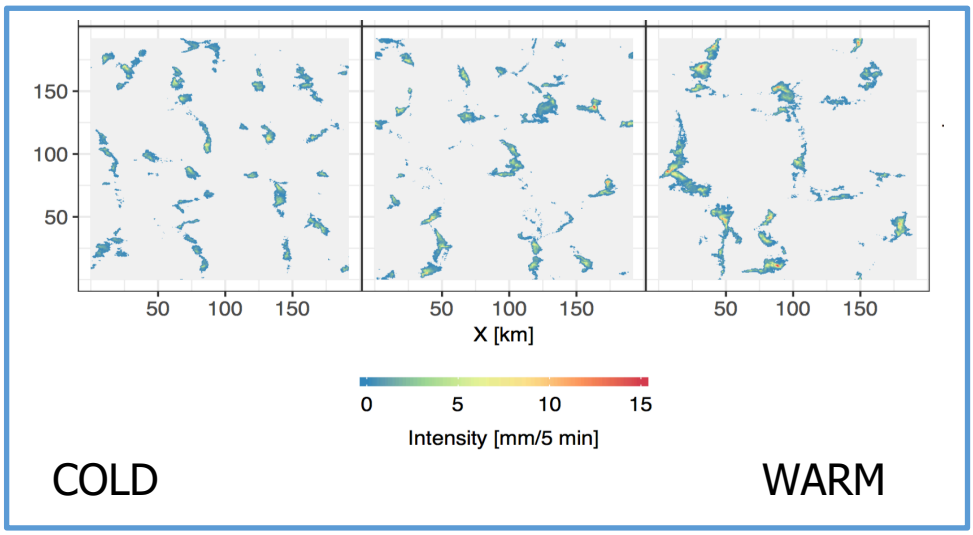
Geosciences and Remote Sensing

Dynamics of extreme precipitation events in a warming climate

Researchgroup: Atmospheric Physics

Introduction

It is well understood that precipitation extremes will increase in a warming climate. This is primarily based on the Clausius-Clapeyron (CC) relation which states that warmer air can contain more water vapour at a rate of 6-7 % per degree. In fact, at larger spatial and temporal scales changes are often found to be close to the CC rate, both in model projections of the future as well as in observed trends. However, it has been found that local (sub)hourly precipitation extremes – important for instance for urban flood management – could be much more sensitive to warming with rate up to 2 times the CC rate. This so-called super CC scaling has received considerable attention in the scientific literature in the last 10 years. Despite this, its cause is still unsettled. Here, we focus on a common hypothesis which states that feedbacks from the local dynamics of clouds are responsible.



Goals

In order to study the intensification of convective rain, very detailed model simulations with a Large Eddy Simulation model have been performed for typical conditions with heavy rain in the Netherlands. By systematically perturbing the atmospheric temperature, a large response of cloud dynamics to warming has been found. These lead to a much more rapid growth to larger and more vigorous cloud structures in the warmer runs. In this this project you will study these dynamics further by considering the vertical velocity, which plays a key role in rain formation by transporting moisture upward in the clouds. You will focus on how these vertical velocities respond to warming, how they depend on cloud size and to which degree they contribute to the intensification of extreme precipitation.

Interested?

We are looking for an enthusiastic student with an interest in physics of the atmosphere in relation to climate change. For the analysis you will need to write some analysis code in your own preferred data language (i.e. Python, Matlab etc). This project will be done in collaboration with The Royal Netherlands Meteorological Institute (KNMI)

Supervisors:

Dr. Geert Lenderink (Thursdays at TUD)
Prof. dr. Pier Siebesma

Additional information:

Geert Lenderink
Room: 2.12.1
E: glenderink@tudelft.nl
lenderin@knmi.nl

Pier Siebesma
Room: 2.15
E: a.p.siebesma@tudelft.nl