Radiative Closure Studies Over the Arctic During Polarstern Expedition PS106

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1. Introduction

Motivation
- Earth radiation balance is dominated by clouds.
- In the Arctic these effects are closely linked with the ice albedo feedback.

Objectives
- The aim is to evaluate radiative closure, cloud radiative effect (CRE) at the bottom of the atmosphere (BOA) and cloud radiative heating rate forcing (CRHF) of selected cases of liquid, ice and mixed-phase single clouds running the 1D Rapid Radiative Transfer Model (RRTMG)

2. Instrumentation and Methods

Measurements
- The present results are based on remote sensing observations and radiative flux measurements performed onboard the research vessel POLASTERN during PS106 expedition (May 25th – July 21st, 2017).
- Liquid water content, liquid effective radius [1], ice water content [2], ice effective radius [3], and macro physical cloud properties were retrieved from Cloudnet [4] processed based on Lidar Polly XT, microwave radiometer HATPRO, Mira cloud radar 35GHz and Disdrometer.

Model
- Additionally forecast profiles of temperature were used as inputs to run the 1D RRTMG.

3. Results

4. Conclusions and Outlook

- The simulations for liquid clouds showed a very good agreement with the observations of upward, downward SW and downward LW radiative flux having the highest cooling CRE at the BOA of -92.5 [W/m²] and the highest influence of heating rates of -10 K/day in the cloud layer.
- The simulations of ice and mixed-phase clouds have relative good agreement with the observations. However the variance might be due to the ice effective radius retrieval [3] since it was computed neglecting the number, shape and size distribution of ice particles. Future simulations will be made considering a more suitable retrieval for the entire cruise.

5. References