SnowCast

Snow Contrasts Controlling the Fate of Sea Ice

Principal investigator

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Areas of contribution

Observations

Sea ice processes

Summary

The overall aim of the project SnowCast is to locate and quantify internal snowmelt, snow metamorphism, and snow-ice formation in the Antarctic snowpack on different spatial scales. Doing so, results will improve our understanding on processes and interactions in the snowpack as well as at the snow/ice interface associated with seasonal and inter-annual variations in the sea-ice mass budget of the Southern Ocean. In order to achieve this aim, in-situ observations of the Antarctic snow cover will be combined with a 1-D snow model (SNTHERM) to describe the temporal evolution of small-scale processes in the snowpack. Available remote sensing data will be utilized to quantify the mentioned variables on larger scales.

Description

Snow on sea ice alters the properties of the underlying ice cover as well as associated exchange processes at the interfaces between atmosphere, sea ice, and ocean. The Antarctic snow cover persists during most of the year and contributes significantly to the sea-ice mass budget due to comprehensive physical (transition) processes within the snowpack. It is therefore the overall aim of the proposed project SnowCast to locate and quantify internal snowmelt, snow metamorphism, and snow-ice formation in the Antarctic snowpack on different spatial scales. Doing so, results will improve our understanding on processes and interactions in the snowpack as well
as at the snow/ice interface associated with seasonal and inter-annual variations in the sea-ice mass budget of the Southern Ocean. In order to achieve this aim, in-situ observations of the Antarctic snow cover will be combined with a 1-D snow model (SNTHERM) to describe the temporal evolution of small-scale processes in the snowpack. Available remote sensing data on Antarctic-wide snowmelt onset (passive microwave observations), sea-ice type (satellite scatterometer), and sea-ice freeboard (CryoSat-2) will be utilized to quantify the mentioned variables on larger scales. Furthermore, the gained knowledge on the temporal evolution of internal snow structures and associated changes in the sea- and freshwater contents within the Antarctic snowpack can be used to increase the accuracy of various sea-ice data products based on satellite remote sensing. This knowledge gain contributes therefore essentially to YOPP in the Southern Ocean hemisphere. In order to bridge the gap between Arctic and Antarctic sea ice, the last part of the project is designed to identify similarities and differences regarding dominant processes and properties in the Arctic and Antarctic snowpack related to seasonal changes in the sea-ice mass budget, respectively. Doing so, the gained knowledge from the Southern Ocean related to the snow model and stratigraphy will be applied also on the Arctic snowpack. The project contributes therefore not only to the upcoming drift experiment MOSAiC but also to YOPP objectives related to the Arctic Ocean.

**Timeline**

2018-10-01 - 2021-09-30

**Regional emphasis**

Northern hemisphere: Yes

Southern hemisphere: Yes

**Key project deliverables**

- Investigate and quantify internal snowmelt, snow metamorphism, and snow-ice formation in the Antarctic snowpack from field measurements in the Weddell Sea (floe-size scale)

- Investigate and quantify internal snowmelt, snow metamorphism, and snow-ice formation in the Antarctic snowpack from autonomous measurements in the Weddell Sea (regional scale)

- Investigate and compare variations in the vertical structure of the Antarctic snowpack
  a. on floe-size scale,
  b. on regional scale in the Weddell Sea,
  c. on large scale by comparisons between the Weddell Sea and Eastern Antarctic, and
  d. in comparison with snow structures in the Arctic sea-ice area

- Investigate the temporal evolution of the snow stratigraphy with the 1-D-model SNTHERM for both, the Arctic and Antarctic snowpack
- Compare and combine results from the 1-D-model SNTHERM with model outputs from the 1-D-model SNOWPACK

- Upscaling of investigated snow structures and its temporal evolution to Antarctic-wide approach

- Investigate and quantify influence of studied internal snow structures/temporal evolution of liquid water content on retrieved data products from remote sensing applications (estimate of uncertainties)

**Data management**

PANGAEA

**Is data provided to WMO Global Telecommunication System**

No

**Timelines**

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<td>locate and quantify internal snowmelt, snow metamorphism, and snow-ice formation in the Antarctic snowpack on different spatial scales</td>
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