BACKGROUND

- **The Arctic is a key area of global climate change**, with warming rates exceeding twice the global average (Figure 1).
- **The observed rate of climate change in the Arctic is not well reproduced in climate models** (e. g. they largely underestimate sea ice retreat, Figure 2).
- **Many processes in the Arctic climate system are poorly represented** in climate models because they are not suffiently understood.
- **Understanding of Arctic climate processes is limited by a lack of year round observations** in the central Arctic.

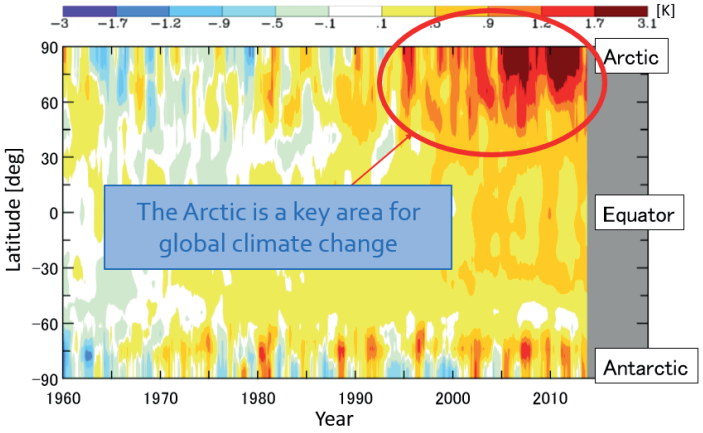

Fig. 1: Near surface temperature changes derived from observations (http://data.giss.nasa.gov/gistemp/time_series.html)

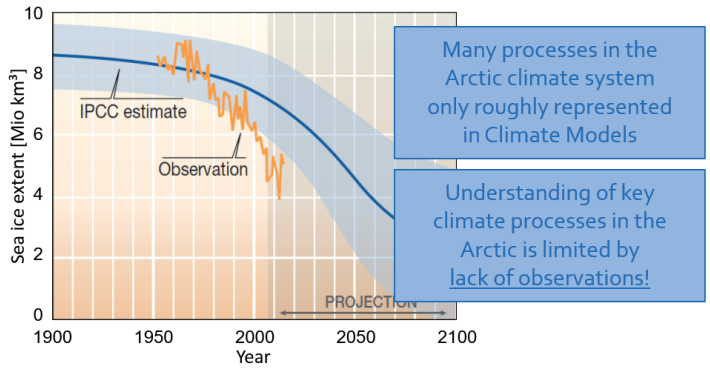

Fig. 2: Time series of observed (orange) and simulated (blue) minimum sea ice extent (10^6 km³) (Stroeve et al., 2007, updated)

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MOSAiC

The International Arctic Drift Expedition

Multidisciplinary drifting Observatory for the Study of Arctic Climate

IASC

MOSAiC is a complex, collaborative project that will rely on international coordination of science, infrastructure, and funding. The project highly welcomes new partners and is open to additional engagement and contributions from different nations and institutions that help to support MOSAiC science objectives.

RV Polarstern in sea ice, installation work (Photo: Jens Klimmeck/realTV group)

First year-round expedition exploring the coupled climate system in the central Arctic

MOSAiC

MOSAiC has been designed by an international consortium of leading polar reserach institutes, led by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), under the umbrella of the International Arctic Science Committee (IASC).

MOSAiC will contribute to a quantum leap in our understanding of the coupled Arctic climate system and its representation in global climate models. The focus of MOSAiC lies on direct in-situ observations of the climate processes that couple the **atmosphere, ocean, sea ice, bio-geochemistry and ecosystem**.

The results of MOSAiC will enhance the understanding of the regional and global consequences of Arctic climate change and sea-ice loss and improve weather and climate predictions. As such it will support safer maritime and offshore operations, contribute to an improved scientific basis for future fishery and traffic along the northern sea routes, increase coastal community resilience, and support science-informed decision-making and policy development. Improved understanding of the impact of Arctic climate change on conditions world-wide will provide stakeholders and decision-makers with improved knowledge for adapting to climate change and develop target oriented mitigation strategies.

The heritage for MOSAiC is Fridjof Nansen's famous Fram expedition during 1893 - 1896, which demonstrated the feasibility of letting a research vessel drift across the polar cap, driven by the natural drift of the sea ice.

Scanned from Nansen, Fridtjof: Farthest North, Constable, London 1897, Gemeinfrei, https://commons.wikimedia.org/w/index.php?curid=8088261

EXPERIMENTAL DESIGN

The dramatic changes in the Arctic climate system and the fast retreat of the Arctic sea ice strongly affects the global climate. **The inability of modern climate models to fully reproduce Arctic climate change is one of the most pressing problems in understanding and predicting global climate change.** As a result the urgency of year-round observations of key climate processes in the central Arctic has been highlighted by all major research initiatives including the IPCC.

The backbone of MOSAiC will be the year-round operation of the RV Polarstern, drifting with the sea ice across the central Arctic during the years 2019 to 2020. During the set-up phase RV Polarstern will enter the Siberian sector of the Arctic in thin sea ice condition in late summer. **A distributed regional network of observational sites will be set up on the sea ice in an area of up to ~50 km distance from RV Polarstern.** The ship and the surrounding network will drift with the natural ice drift across the polar cap towards the Atlantic, while the sea ice thickens during the winter (red dotted line in Figure 3).

Large scale research facilities addressing key aspects of the coupled Arctic climate system will be set up on board of RV Polarstern and on the sea ice next to it. The distributed regional network further around the central observatory will be comprised of autonomous and remotely-operated sensors, characterizing the heterogeneity of key processes in an area representing a typical grid box of modern climate models and providing invaluable data for the development of parameterizations for sub-grid-scale processes in climate models. The German **research aircrafts** Polar 5 and 6, and HALO will be operated to complement the measurements at the central MOSAiC site. **Cruises by icebreakers from MOSAiC partners** will further extend the geographical coverage of the observations and will link the measurements to the larger scales of the Arctic climate system and explore global feedbacks.

Access to the central MOSAiC site, for exchanging scientific staff and for emergency operations, will be guaranteed by **operations of long-distance helicopters via a fuel depot on Bolshevik Island.**

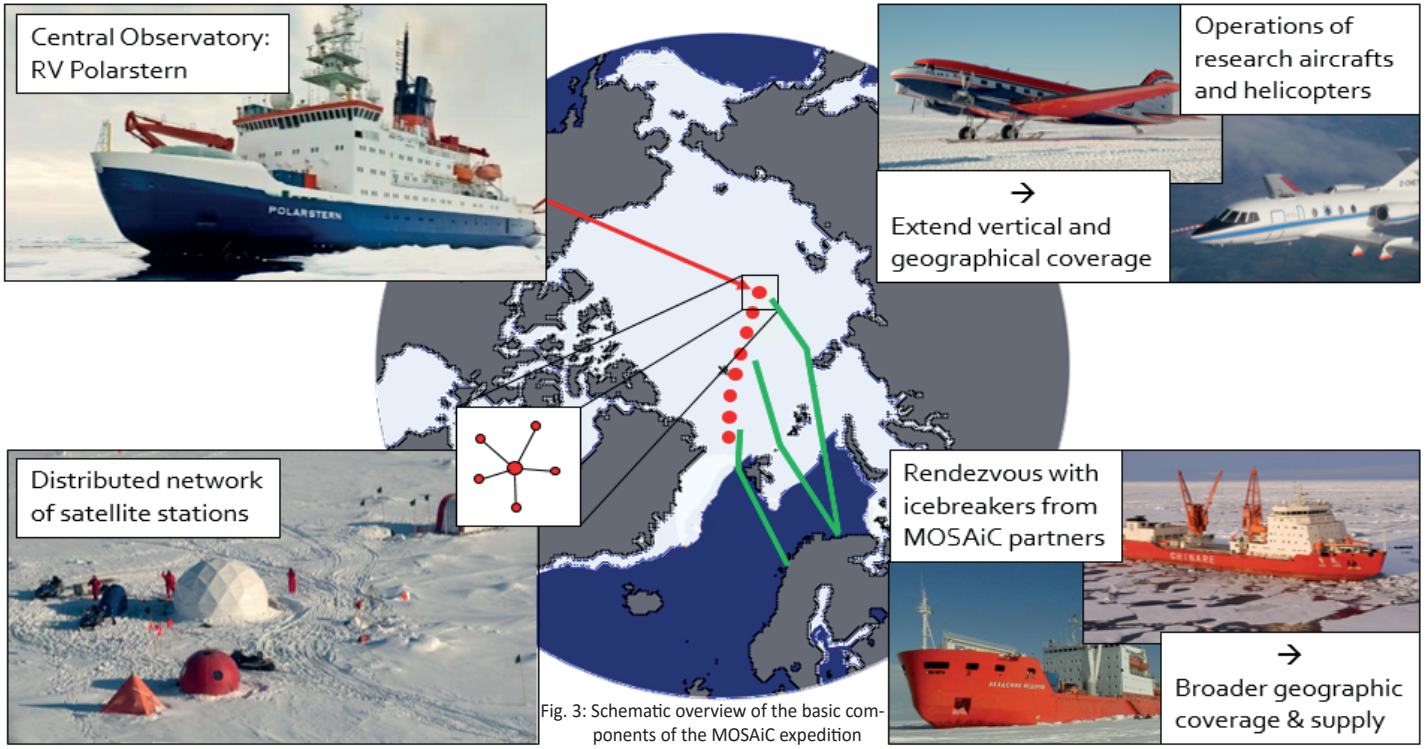

Fig. 3: Schematic overview of the basic components of the MOSAiC expedition