MOSAiC
The International Arctic Drift Expedition

IASC

The ***M**ultidisciplinary drifting **O**bservatory for the **S**tudy of **A**rcti**c** **C**limate* (MOSAiC) will be the first year-round expedition into the central Arctic exploring the Arctic climate system. The project with a total budget exceeding 60 Million Euros has been designed by an international consortium of leading polar research institutions, under the umbrella of the International Arctic Science Committee (IASC), led by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), Arctic and Antarctic Research Institute (AARI) and the University of Colorado, Cooperative Institute for Research in Environmental Sciences (CIRES).

The results of MOSAiC will contribute to enhance 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 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 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 sufficiently understood.
- **Understanding of Arctic climate processes is limited by a lack of year round observations** in the central Arctic.

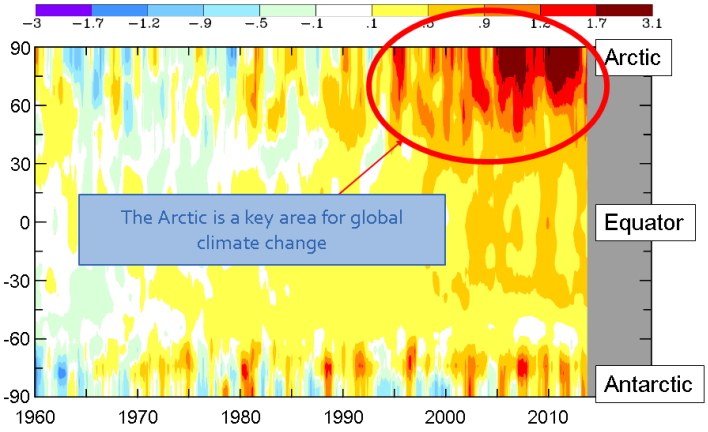

Fig. 1: Near surface temperature changes derived from observations (http://data.giss.nasa.gov/gistemp/time_series.html)

The dramatic changes in the Arctic climate system and the fast retreat of Arctic sea ice strongly affects global climate. **The inability of modern climate models to 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.

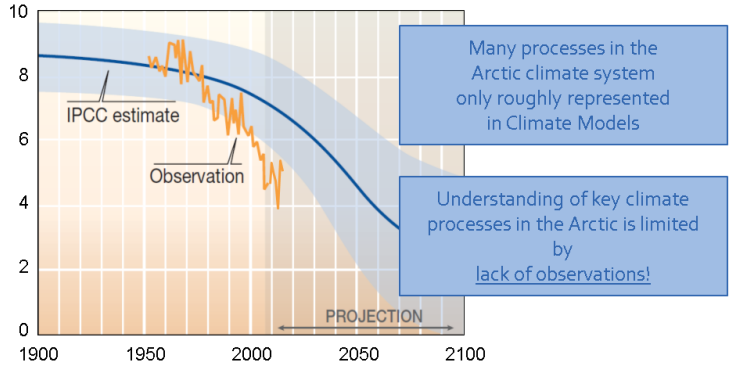

Fig. 2: Time series of observed (orange) and simulated (blue) minimum sea ice extent ($10^6\ km^3$) (Stroeve et al., 2007, updated)

MOSAiC has been designed in response to these research needs and will contribute to a quantum leap in our understanding of the coupled Arctic climate system and in 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**.

Innovative experimental design of the MOSAiC expedition

The heritage for MOSAiC is Fridtjof 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. While Nansen has demonstrated the basic concept of such an expedition, the scientific measurements at that time were extremely limited. **The backbone of MOSAiC will be the year round operation of 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 conditions in late summer. **A distributed regional network of observational sites will be set up on the sea ice in an area of up to ~50km 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 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 parametrizations for sub-grid-scale processes in climate models. The German **research aircrafts** Polar 5 and Polar 6, as well as the HALO research aircraft, will be operated to complement the measurements at the central MOSAiC site. **Research and supply 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**.

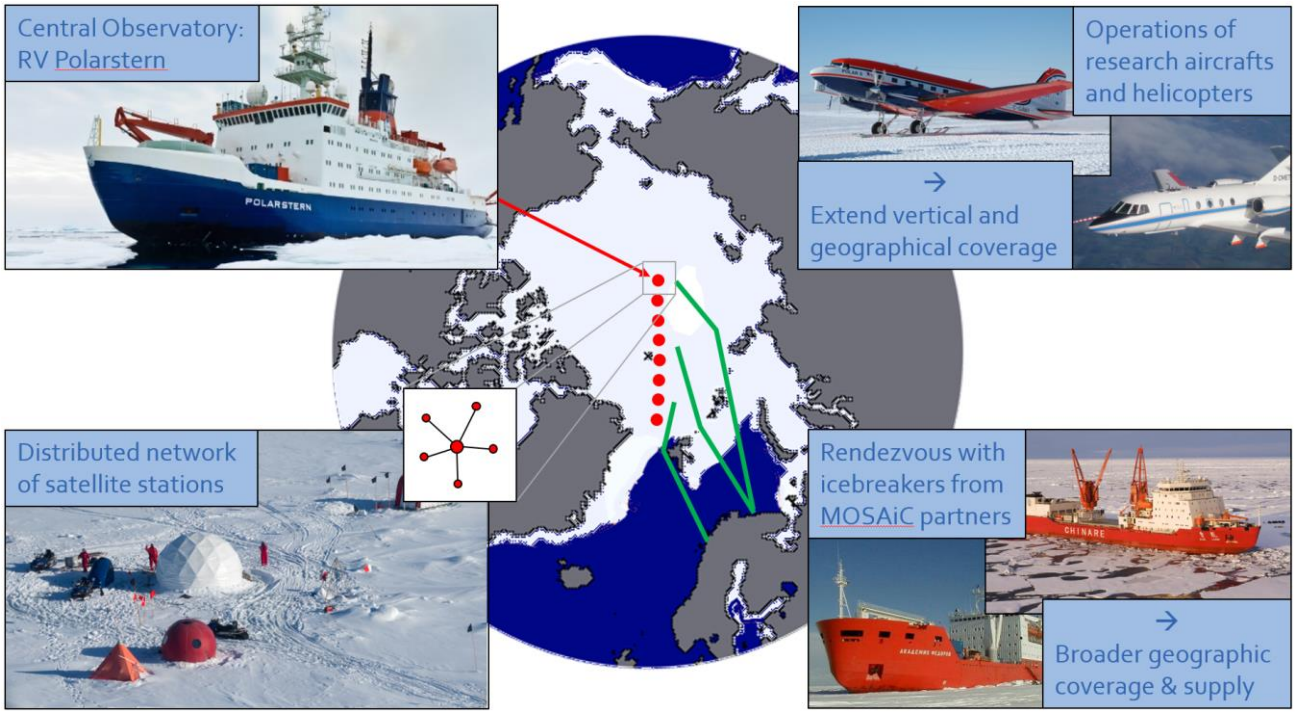

Fig. 3: Schematic overview of the basic components of the MOSAiC expedition

Contacts and more Information

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