AURORA BOREALIS

SCIENTIFIC RELEVANCE

SINGLE-SHIP DRILLING EXPEDITIONS IN THE ARCTIC

Despite their significance, polar realms are not well understood. There is a substantial lack of temporal and areal coverage of sampling and observations. Though forecasts about changing climates in the high latitudes differ widely, both Polar regions will remain a challenge to operate in for the foreseeable future due to severe ice and weather conditions (see fig. 1). A sophisticated, winter-ice-going research vessel like the AURORA BOREALIS would enable scientists to gather invaluable information on global climate development.

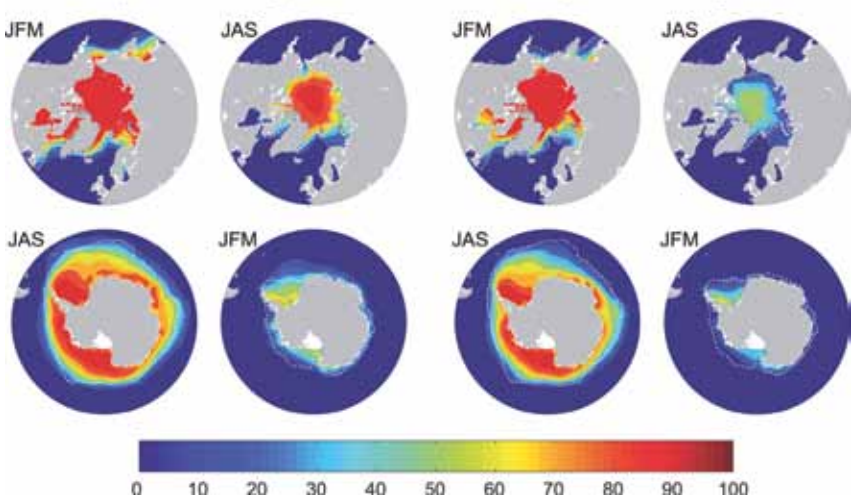


Fig. 1: Sea ice concentration. Polar Oceans are characterized by large areas that are permanently or seasonally covered by sea ice, very low temperatures, pronounced seasonal changes and bordering prominent continental ice sheets. The Polar Oceans are potentially most vulnerable to current and future global environmental changes, where small shifts may exceed thresholds, trigger unknown feedbacks and cause irreversible consequences.
JFM: Jan-Feb-Mar, JAS: Jul-Aug-Sep.
Upper panel: Artic, lower panel: Antarctic.
(IPCC AR 4: Arctic and Antarctic Summer/ Winter Sea ice concentration analysis/ forecast).

POLAR ALL-YEAR INVESTIGATIONS WITH AN ICE-GOING RESEARCH VESSELS

The scheduled polar research vessel will be classified as a heavy icebreaker, and single-ship expeditions are feasible even in the polar winter. Examples of research topics are:

Climate variability

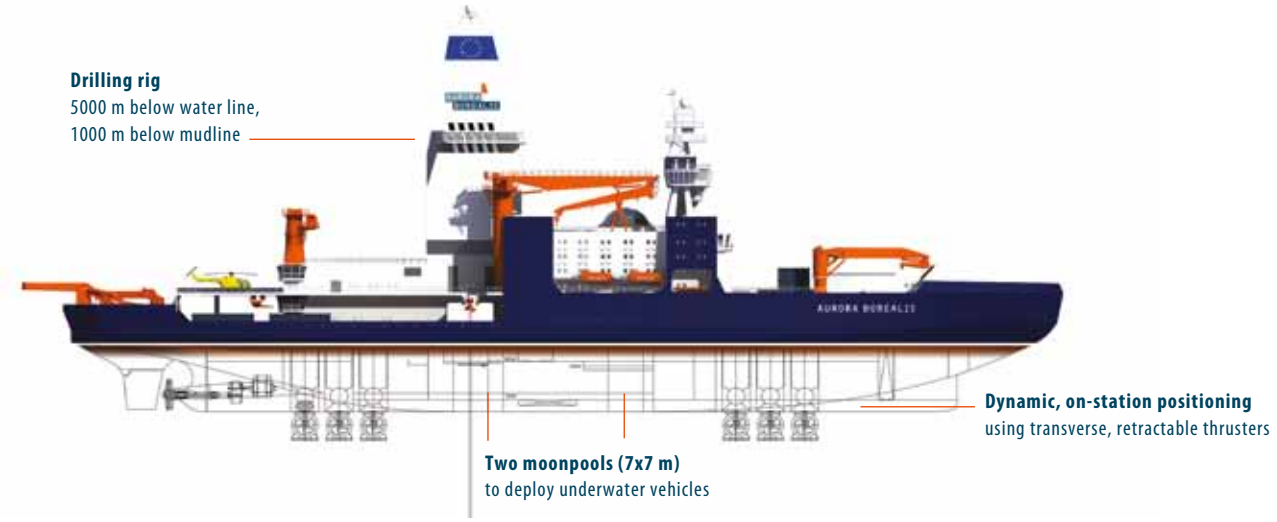
- Scales and indicators of polar climate change to forecast future climate situations

State and stability of cryosphere

- Changing biodiversity and ecosystems
- Integrated real-time observations and forecasting on ice–ocean–atmosphere–hydrosphere relationships in Polar regions

The advanced scientific drilling capability, including the dynamic, on-station positioning system, turns AURORA BOREALIS into a useful platform for **polar deep-sea drilling**. Thus, researchers will be able to, for example:

- Study past climatic variability, history and transition of Antarctic ice sheets. Assess nature and stability of submarine permafrost
- Unravel the tectonic and geodynamic history of Arctic and Antarctic ocean basins
- Evaluate the potential de-stabilisation of continental margins and releases of gas hydrates



DEEPENING OUR UNDERSTANDING OF CLIMATE

RESEARCH INFRASTRUCTURE THAT DEALS WITH −50°C

Polar oceans control global climate evolution on a broad range of time scales; they directly influence global ocean circulation, sea level change, atmospheric forcing and teleconnections. Complex interactions between ecosystems, ocean, atmosphere and sea ice determine the nature of these unique regions. Yet, they are likely to face drastic climatic changes, e.g. unprecedented temperature rises, surpassing in magnitude other regions of the world (fig. 2).

Up to now, there is a lack of information about natural physical or biological variability of the Polar oceans or long-term shifts in the cryosphere. The considerable technical and logistical efforts necessary to operate in −50 °C conditons have so far prevented the retrieval of natural paleoenvironmental archives, such as sediment cores from the deep seafloor. Now, a new type of polar research icebreaker-drilling vessel has been projected to enable a plethora of long-awaited research results.

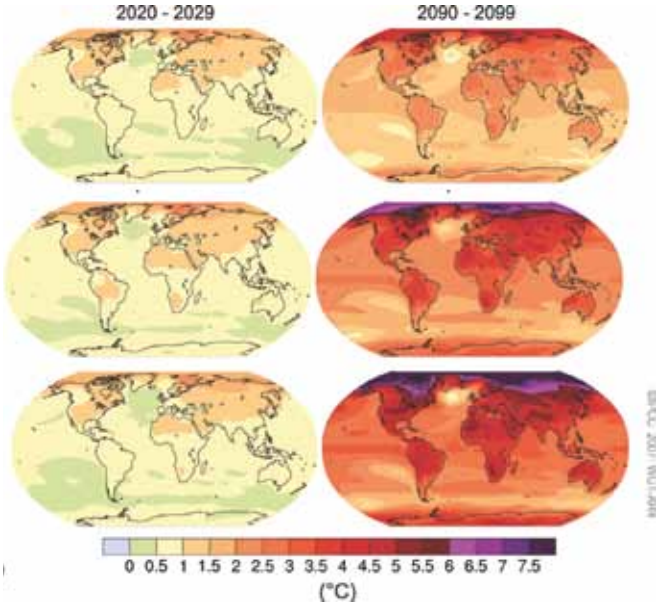


Fig. 2) Global estimated temperature rise. (IPCC 2007)

Picture of Antarctic sea ice in summer (Eastern Antarctic Peninsula 2006). Courtesy V.Willmott, AWI.

CHARACTERISTICS OF THE PLANNED AURORA BOREALIS

- **Icebreaker** of Polar Class 1, diesel-electric, 81 MW propulsion power
- **Deep-sea, riserless drilling rig**: more than 5000 m water depth, more than 1000 m below mudline
- **Dynamic positioning system** for on-station drilling in closed sea ice cover
- **Two moonpools, 7 x 7 m size each**, to deploy scientific underwater equipment sheltered from weather and ice conditions
- Operational temperature: fully functional at −50°C, working capacity +45°C to −30°C
- Modularized, mobile, mission-specific laboratory systems
- Max. operation time: 90 days | Crew and scientists: 120 persons
- Overall length: 199.85 m | Moulded breath: 49 m

The AURORA BOREALIS European Research Icebreaker Consortium is an EU-funded project to set up scientific, financial, legal and organistional frames for a new ship: a multi-disciplinary research icebreaker with a drilling tower. This unique research icebreaker is designed to gain sound climate-relevant data to support societal decision processes. Release of funds pending til Feb 2012.

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