

Project title: **Into the Blue – Resolving past Arctic greenhouse climate**

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Abstract

With this proposed DKRZ computing project we aim to perform climate and Earth System simulations within the framework of the ERC Synergy Grant project "Into the Blue" (i2B; Grant No. 101118519; <https://in2blue.eu/>). i2B is a 72-month ERC Synergy Grant (2024–2030) led by *UiT The Arctic University of Norway* (Dr. Jochen Knies), the *Alfred Wegener Institute – Helmholtz Centre for Polar and Marine Research* in Bremerhaven (Prof. Dr. Gerrit Lohmann), and *NORCE Norwegian Research Centre* in Bergen (Dr. Stijn De Schepper). i2B addresses a pressing challenge in climate science: understanding how a seasonally ice-free ("blue") Arctic Ocean has shaped Earth's climate in the past, and how it may affect the Earth system and society in the future.

The project is organized around three interconnected research thrusts: a) quantifying past and future environmental conditions of a blue Arctic; b) understanding the dynamics of a seasonally ice-free Arctic; c) assessing the impacts of such conditions on the biosphere and society. Central to this effort is the integration of high-resolution, multi-parameter paleoclimate records — preserving the geological fingerprint of past blue-Arctic episodes — with cutting-edge climate simulations that elucidate the underlying mechanisms and dynamics. Paleoclimate reconstructions draw partly on project-specific expeditions, most recently the [i2B Arctic Ocean Expedition 2025](#) aboard RV Kronprins Haakon. Climate and Earth System models additionally serve as tools to project Earth System conditions under future blue-Arctic scenarios. While i2B employs a multi-model approach — NorESM at the Norwegian partner institutes (NORCE/UiT) and AWI-ESM at AWI — this DKRZ proposal exclusively covers computations performed at AWI using different configurations of AWI-ESM. The modelling activities proposed here build on expertise and model developments established during previous work performed at the DKRZ, in particular within the PalMod project.

Over the lifetime of the i2B consortium, our proposed computing project will provide the modelling framework that is needed to better understand processes in a blue Arctic across timescales. It will support the interpretation of geological reconstructions and help elucidate mechanisms and dynamics in a warm(ing) Arctic, while also providing the means to transfer insights from past warm climates — spanning the Miocene, Pliocene, and Quaternary interglacials — to projections of future climate change.