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Future changes in precipitation intensity over the Arctic projected by a global atmospheric model with a 60-km grid size

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Future changes in precipitation intensity over the Arctic were calculated based on three-member ensemble simulations using a global atmospheric model with a high horizontal resolution (60-km grid) for the period 1872–2099 (228 years). During 1872–2005, the model was forced with observed historical sea surface temperature (SST) data, while during 2006–2099, boundary SST data were estimated using the multi-model ensemble (MME) of the Coupled Model Intercomparison Project, Phase 3 (CMIP3) model, assuming the A1B emission scenario. The annual mean precipitation (PAVE), the simple daily precipitation intensity index (SDII), and the maximum 5-day precipitation total (R5d) averaged over the Arctic increased monotonically towards the end of the 21st century. Over the Arctic, the conversion rate from water vapor to precipitation per one degree temperature increase is larger for PAVE than for R5d, which is opposite to the tropics and mid-latitudes. The increases in PAVE, SDII, and R5d can be partly attributed to an increase in water vapor associated with increasing temperatures, and to an increase in the horizontal transport of water vapor from low to high latitudes associated with transient eddies.

Vp/Vs-ratios and anisotropy on the northern Jan Mayen Ridge, North Atlantic, determined from ocean bottom seismic data

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In order to gain insight into the lithology and crustal evolution of the northern Jan Mayen Ridge, North Atlantic, the horizontal components of an Ocean Bottom Seismometer (OBS) dataset were analyzed with regard to Vp/Vs-modelling and seismic anisotropy. The modelling suggests that the northernmost part of the ridge consists of Icelandic type oceanic crust, bordered to the north by anomalously thick oceanic crust formed at the Mohns spreading ridge. The modelled Vp/Vs-ratios suggest variations in gabbroic composition and present-day temperatures in the area. Anisotropy analysis reveals a fast S-wave component along the Jan Mayen Ridge. This pattern of anisotropy is most readily interpreted as dikes intruded along the ridge, suggesting that the magmatism can be related to the development of a

leaky transform since Early Oligocene

Contrasting patterns in lichen diversity in the continental and maritime Antarctic

Shiv Mohan Singh, Maria Olech, Nicoletta Cannone, Peter Convey

Systematic surveys of the lichen floras of Schirmacher Oasis (Queen Maud Land, continental Antarctic), Victoria Land (Ross Sector, continental Antarctic) and Admiralty Bay (South Shetland Islands, maritime Antarctic) were compared to help infer the major factors influencing patterns of diversity and biogeography in the three areas. Biogeographic patterns were determined using a variety of multivariate statistical tools. A total of 54 lichen species were documented from Schirmacher Oasis (SO), 48 from Victoria Land (VL) and 244 from Admiralty Bay (AB). Of these, 21 species were common to all areas. Most lichens from the SO and VL areas were microlichens, the dominant genus being Buellia. In AB, in contrast, many macrolichens were also present and the dominant genus was Caloplaca. In SO and VL large areas lacked any visible lichen cover, even where the ground was snow-free in summer. Small-scale diversity patterns were present in AB, where the number of species and genera was greater close to the coast. Most species recorded were rare in the study areas in which they were present and endemic to Antarctica.

Spatial distribution of micro- and meso-zooplankton in the seasonal ice zone of East Antarctica during 1983-1995

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Historically, most studies about the geographic distribution of zooplankton in the Southern Ocean have been focused on the macro-sized zooplankton (2-20 mm), such as the Antarctic krill and larger-sized copepods. On the other hand, despite the high abundance and biomass, the distribution patterns of micro- (20-200 μm) and meso-sized (200 μm-2 mm) zooplankton communities are little understood. In this study, we investigated the distribution patterns of larger micro-zooplankton (100-200 μm) and meso-zooplankton communities in the seasonal ice zone in the Cosmonaut Sea near Syowa Station and examined the effects of environmental factors and water properties on these communities. The investigation was based on samples collected with 100 μm mesh nets, which are appropriate to estimate the quantitative abundance and community structure of micro- and meso-zooplankton species between 1983 and 1995. Cluster analysis of the samples revealed that the distribution of macro-zooplankton species was influenced by the temperature and salinity of ocean fronts. Among the meso-zooplankton, cyclopoid and small calanoid copepods tended to be ubiquitously distributed. However, among the micro-zooplankton, the distributions of foraminiferans and tintinnids were associated with sea ice extent. The distribution of micro- and meso-zooplankton communities could be used to estimate the impact of environmental changes on the marine ecosystem in the Southern Ocean.

Methane excess production in oxygen-rich polar water and a model of cellular conditions for this paradox

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Summer sea ice cover in the Arctic Ocean has undergone a reduction in the last decade exposing the sea surface to unforeseen environmental changes. Melting sea ice increases water stratification and induces nutrient limitation, which is also known to play a crucial role in methane formation in oxygenated surface water. We report on an excess of methane in the marginal ice zone in the western Fram Strait. Our study is based on measurements of oxygen, methane, DMSP, nitrate and phosphate concentrations as well as on phytoplankton composition and light transmission, conducted along the 79° N oceanographic transect, in the western part of the Fram Strait and in Northeast Water Polynya region off Greenland. Between the eastern Fram Strait, where Atlantic water enters from the south and the western Fram Strait, where Polar water enters from the north, different nutrient limitations occurred and consequently different bloom conditions were established. Ongoing sea ice melting enhances the environmental differences between both water masses and initiates regenerated production in the western Fram Strait. We show that in this region methane is in situ produced while DMSP (dimethylsulfoniopropionate) released from sea ice may serve as a precursor for the methane formation. The methane production occurs despite high oxygen concentrations in this water masses. As the metabolic activity (respiration) of unicellular organisms explains the presence of anaerobic conditions in the cellular environment we present a theoretical model which explains the maintenance of anaerobic conditions for methane formation inside bacterial cells, despite enhanced oxygen concentrations in the environment.