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Comparison of global synthetic seismograms calculated using the spherical 2.5-D finite-difference method with observed long-period waveforms including data from the intra-Antarctic region

Genti Toyokuni, Hiroshi Takenaka, Masaki Kanao, Douglas A. Wiens, Andrew Nyblade

We have been developing an accurate and efficient numerical scheme, which uses the finite-difference method (FDM) in spherical coordinates, for the computation of global seismic wave propagation through laterally heterogeneous realistic Earth models. In the field of global seismology, traditional axisymmetric modeling has been used widely as an efficient approach since it can solve the 3-D elastodynamic equation in spherical coordinates on a 2-D cross-section of the Earth, assuming structures to be invariant with respect to the axis through the seismic source. However, it has the severe disadvantages that asymmetric structures about the axis cannot be incorporated and the source mechanisms with arbitrary shear dislocation have not been attempted for a long time. Our scheme is based on the framework of axisymmetric modeling but has been extended to treat asymmetric structures, arbitrary moment-tensor point sources, anelastic attenuation, and the Earth center which is a singularity of wave equations in spherical coordinates. All these types of schemes which solve 3-D wavefields on a 2-D model cross-section are classified as 2.5-D modeling, so we have named our scheme the spherical 2.5-D FDM. In this study, we compare synthetic seismograms calculated using our FDM scheme with three-component observed long-period seismograms including data from stations newly installed in Antarctica in conjunction with the International Polar Year (IPY) 2007-2008. Seismic data from inland Antarctica are expected to reveal images of the Earth's deep interior with enhanced resolution because of the high signal-to-noise ratio and wide extent of this region, in addition to the rarity of sampling paths along the rotation axis of the Earth. We calculate synthetic seismograms through the preliminary reference earth model (PREM) including attenuation using a moment-tensor point source for the November 9, 2009 Fiji earthquake. Our results show quite good agreement between synthetic and observed seismograms, which indicates the accuracy of observations in the Antarctica, as well as the feasibility of the spherical 2.5-D modeling scheme.

Provenance and depositional environment of epi-shelf lake sediment from Schirmacher Oasis, East Antarctica, vis-à-vis scanning electron microscopy of quartz grain, size distribution and chemical parameters

Prakash K. Shrivastava, Rajesh Asthana, Sandip K. Roy, Ashit K. Swain, Amit Dharwadkar

The scientific study of quartz grains is a powerful tool in deciphering the depositional environment and mode of transportation of sediments, and ultimately the origin and classification of sediments. Surface microfeatures, angularity, chemical features, and grain-size analysis of quartz grains, collectively reveal the sedimentary and physicochemical processes that acted on the grains during different stages of their geological history. Here, we apply scanning electron microscopic (SEM) analysis to evaluating the sedimentary provenance, modes of transport, weathering characteristics, alteration, and sedimentary environment of selected detrital quartz grains from the peripheral part of two epi-shelf lakes (ESL-1 and ESL-2) of the Schirmacher Oasis of East Antarctica. Our study reveals that different styles of physical weathering, erosive signatures, and chemical precipitation variably affected these quartz grains before final deposition as lake sediments. Statistical analysis (central tendencies, sorting, skewness, and kurtosis) indicates that these quartz-bearing sediments are poorly sorted glaciofluvial sediments. Saltation and suspension seem to have been the two dominant modes of transportation, and chemical analysis of these sediments indicates a gneissic provenance.

Effect of radioactive pollution on the biodiversity of marine benthic ecosystems of the Russian Arctic shelf

Denis K. Alexeev, Valentina V. Galtsova

This study is the result of many years of research on the ecology of the marine benthos of Russian Arctic seas. We used samples collected at various locations from the Russian continental shelf during 1993-2009 as the basis of our study. Our main aim was to analyze the spatial distribution of taxonomic and quantitative characteristics of the meiobenthos (small bottom-dwelling animals, 0.1-3.0 mm in size). Statistical analysis of the data revealed that the factors determining the spatial distribution of meiobenthic organisms under natural conditions, and conditions impacted upon by human activity, were salinity, water depth, hydrocarbons, heavy metals and radiocaesium volumetric activity. The possible use of the meiobenthos as a tool for environmental impact assessment is proposed and discussed on the level of higher taxa.

Sphaeronectes pughi sp. nov., a new species of sphaeronectid calycophoran siphonophore from the subantarctic zone

Mary M. Grossmann, Dhugal J. Lindsay, Verónica Fuentes

A new species of sphaeronectid calycophoran siphonophore, Sphaeronectes pughi

sp. nov. is described from material collected in the subantarctic zone, south of Australia. An identification key for sphaeronectid nectophores is provided, with illustrations of the eleven recognized species.

Effects of neighboring vascular plants on the abundance of bryophytes in different vegetation types

Annika K. Jägerbrand, Gaku Kudo, Juha M. Alatalo, Ulf Molau

Due to the climate change, vegetation of tundra ecosystems is predicted to shift toward shrub and tree dominance, and this change may influence bryophytes. To estimate how changes in growing environment and the dominance of vascular plants influence bryophyte abundance, we compared the relationship of occurrence of bryophytes among other plant types in a five–year experiment of warming (T), fertilization (F) and T + F in two vegetation types, heath and meadow, in a subarctic–alpine ecosystem. We compared individual leaf area among shrub species to confirm that deciduous shrubs might cause severe shading effect. Effects of neighboring functional types on the performance of Hylocomium splendens was also analyzed. Results show that F and T + F treatments significantly influenced bryophyte abundance negatively. Under natural conditions, bryophytes in the heath site were negatively related to the abundance of shrubs and lichens and the relationship between lichens and bryophytes strengthened after the experimental period. After five years of experimental treatments in the meadow, a positive abundance relationship emerged between bryophytes and deciduous shrubs, evergreen shrubs and forbs. This relationship was not found in the heath site. Our study therefore shows that the abundance relationships between bryophytes and plants in two vegetation types within the same area can be different. Deciduous shrubs had larger leaf area than evergreen shrubs but did not show any shading effect on H. splendens.