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北海道・東北日本沈み込み帯における温度構造：スラブの形状と斜め沈み込みの影響
Thermal structure of the NE Japan-Hokkaido subduction system: The effects of 3-D slab geometry and oblique subduction

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In this study, we first examine the effects of along-strike variation in slab geometry and oblique subduction on subduction zone thermal structures by comparing 3-D numerical thermal models with a range of generic subduction geometries and parameters with a 2-D reference model. We found that changes in slab dip along a straight margin have modest effects on the mantle flow pattern and thus the thermal field. However, concave and convex ocean-ward margins result in cooler and warmer mantle wedges, respectively, and oblique subduction results in a warmer mantle wedge, compared to the 2-D reference model. We developed a 3-D thermal model for the NE Japan-Hokkaido margin, using a well-constrained 3-D slab geometry model. In general, there is little 3-D effect on the thermal structure of the shallow part (<70 km depth) of the subduction system, where the mantle does not participate in the slab-driven wedge flow. We also found that the 3-D effect is small in the deeper part of the southern half of the system, where the margin is relatively straight and the slab dip does not vary significantly along the margin. These results indicate that 2-D models provide excellent approximations for the thermal structures of the shallow part and the southern part of the subduction system. However, from the northern part of NE Japan to Hokkaido, the mantle flow pattern is affected by the concave ocean-ward margin and oblique subduction, and the wedge is cooler near the NE Japan-Hokkaido junction and warmer in Hokkaido than the 2-D thermal models for the respective regions. We compare the 3-D thermal modeling results with along-strike variations in surface heat flow, arc magma geochemistry, and earthquake distribution in NE Japan and Hokkaido.

キーワード: Tohoku-Hokkaido subduction system, 3-D thermal model, slab geometry, oblique subduction, mantle wedge flow, earthquakes and volcanism
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