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曲面スラブの沈み込みに伴う温度場・流れ場・地殻熱流量の３次元数値モデリング
Three-dimensional numerical modeling of temperature, fluid flow and heat flow associated with subduction of curved slabs

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In order to simulate distributions of temperature and fluid flow associated with subduction of a curved slab, we constructed a three-dimensional thermal convection model. We assumed that slab extends with time in a given shape with velocity of 6cm/year, dip angle of 10 deg. for 10 million years. We investigated the relation concerning shape of slab upper surface, subduction direction, distributions of temperature and fluid flow, and surface heat flow for various types of curved slabs. The results revealed a very likely relation between temperature distribution and upper surface shape of a slab, and composite subduction angle which is a compound of a dip angle and slab gradient slope angle along subduction direction. Not only thermal field, but also flow velocity differed greatly on each side of a curved slab. A bent slab leads to a complex fluid flow around it. The results also exhibited how oblique subduction performs in such a curved slab. Although symmetric slab shape models are constructed, oblique subduction resulted in some asymmetric patterns of interplate temperature and heat flow distributions. Isotherm on the plate interface appears to be dragged to the direction of oblique subduction, and low heat flow anomaly appeared on the descent slope of the subducting slab. Most of these simulated results are related to the composite subduction angle. The slab surface shallower than a depth of 60 km has a corresponding relation with surface heat flow distribution above it, whereas the effect gradually disappears when it is deeper than 60 km. Cooling effect associated with subduction is generally related to slab length from the model surface and the composite subduction angle. Large bent slab shape also has a negative effect on cooling down as compared with a flat one .
Keywords: curved slab, temperature, fluid flow, heat flow, numerical simulation