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Numerical modeling of the supercontinental cycle and the analysis of typical deep mantle structures arising at different stages

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The sequence of stages of a supercontinental cycle (Wilson cycle) is calculated on numerical two-dimensional model of assembling and dispersing continents, driven by mantle flows; in turn, the flows themselves are forming under thermal and mechanical influence of continents. The mantle forces acting on the end faces of a moving continent are taken into account. It may be shown that their disregard significantly distorts the course of the evolution and the structure of mantle streams. The comparison is fulfilled of the results for simple mantle model of heating from below only with the model with inner heat sources in the mantle. With the including of heat sources the lower boundary layer of the mantle becomes more weak, that is its temperature gradient (and the heat influx to the mantle) reduces. In a qualitative sense it results from the fact that the mantle heat sources retard the heat influx through the lower mantle boundary thus screening the upper boundary. The results also show that including the heat sources into the model changes the typical structures of whole-mantle flows as well as the calculated values of the maximum shear viscous stresses in the mantle. In the model with internal sources the regions of maximal shear stresses are located in the descending mantle flows near the upper surface. In the model without sources they are still located also at the places where the ascending flows arise near lower surface. The values of maximal stresses are almost the same in both models exceeding the mantle averages approximately by a factor of 10.