INTRODUCTION

Western Anatolia is stretching in the north-south direction and its hot crust (Tezcan & Turgay, 1991) is thinning. On the other hand, high Bouguer gravity values (Özêçli, 1973), marine and river terraces, and positive residual and dynamic topography suggest that the area is rising (despite the stretching).

According to seismic tomographic inversions (e.g., van Hinsbergen et al., 2010), the subducted slab beneath the south of Western Anatolia seems to be detached from the African plate and hence may not generate a strong southward slab-pull force. Thus, it can not pull Western Anatolia to stretch in N-S direction.

EXTENSION IS N-S

It can be postulated that pull of the attached part (western) of the subducting African slab (van Hinsbergen et al., 2010) can generate SW-NE extensional deformation in Western Anatolia due to the flexure in a coherent crust. The residual topography map (Komit et al., 2012) was generated using data from Trim et al. (2013) and CRUST 1.0 model based on lateral changes (continental / oceanic) for crust and sea water load. The model is notable also because it uses temperature values (Gökțürk et al., 2003) converted from heat flow data for the crust of Western Anatolia (see Figure B.1), which is characterized by high heat flow.

Model Set-Up & Selected Experiments

Mantle flow models are based on the thermal structure derived from a P-wave seismic tomography section (see van Hinsbergen et al., 2010; Amara, 2007). Using various combinations of rheological and mechanical parameters, we systematically designed and carried out more than a thousand experiments. The modeling is notable also because it uses temperature values (Gökctürk et al., 2003) converted from heat flow data for the crust of Western Anatolia (see Figure B.1), which is characterized by high heat flow.

CRUSTAL DEFORMATION OF WESTERN ANATOLIA BASED ON UPPER MANTLE CONVECTION

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We model mantle flow in conjunction with active crustal deformation to explain the tectonics in the region. There is a good correlation between residual topography and dynamic topography plots. The numerical experiments suggest:

- 2012 is the first of the observed topography anomaly is related to dynamic support of underlying mantle in Western Anatolia.
- Dynamic topography anisotropy has a plateau pattern if we use temperature data (AT) rather than normal geotherm for the base of the lithospheric layer (Exps. B).

- Comparison of plate type dynamic topography anomaly of plots B-1 and B-2 suggests that crustal geotherm is driven by asthenospheric hot temperature beneath Anatolia. No similar pattern in plots A type experiments because of their isolated crust (793 K constant temperature for base of the crust).
- Generated surface velocity field eminently supply velocities measured by GPS (see Akgün et al., 2009) along the profile that is parallel to the stretching direction (N-S).
- C-1 experiment which assumes stronger mantle (weaker mantle lithosphere) provide a good fit for surface velocities.

CONCLUSION

N-S extension (~20 mm/yr) of the crust in the models was driven by mantle circulation based on a thermal structure derived from seismic tomography profiles for the region. In general, instead of using assumptions using observed data, such as converted temperature structure of crust from heat flow and reliable crustal and geotherm structures, for model inputs causes better results. We compare the dynamic topography results with residual topography based on crustal models interpreted from recent receiver function studies. A good correlation suggests that the diffuse lateral N-S extensional deformation of the crust in Western Anatolia has been generated by convection of the asthenosphere, which also results in considerable uprising of the surface topology of the crust.

REFERENCES


