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Time-space variation of gravity anomaly associated with slab breakoff processes

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Subduction zones are characterized in general by a dual gravity anomaly, a negative anomaly associated with the trench and a large positive anomaly in the region of volcanic arc which represents the mass excess associated with a descending slab. A particular case of subduction is during continental collision when a process called breakoff often follows a decrease in subduction rate. In this study we combined numerical modeling of slab breakoff with gravity modeling in order to better quantify the time-space variation of gravity before, during and after a breakoff process. We show how gravity pattern changes during the slow process of downward and thermal relaxation of the slab, and also during the fast process of thermomechanical necking followed by slab detachment. Compared with normal subduction zones, the magnitude of gravity anomaly variations associated with slabs which exhibit breakoff is bigger due to the near vertical geometry of the slab.
Together with repetitive or continuous high-precision gravity measurements, our joint gravity-numerical modeling strategy will provide a step forward to validate slab breakoff hypothesis in regions where this process is thought to take place, as for example the Vrancea seismogenic zone in Romania.