Supplement 1

SEP and OIA used in this study

In this study, we use "SEP" defined as Eq. (1). The SEP is short for "steric effect on pressure on the seafloor." The SEP is intrinsically the same as the "steric height" and "geopotential distance anomaly," which are widely used in physical oceanography. To calculate the steric height, the integration range of the specific volume anomaly is often set to be from a consdtant pressure value (e.g., 2000 dbar) to the sea surface (0 dbar) at each grid point in physical oceanography. However, in this study, SEP is vertically integrated from the pressure close to the seafloor to the sea surface, to focus on the effect of the integrated density change of the seawater from the sea floor to the sea surface on pressure on the seafloor. In addition, the sign of the SEP is opposite to that of the steric height, thus highlighting its canceling effect on SSH anomalies concerning the pressure on the seafloor. To distinguish between this and "traditional" steric height in physical oceanography, we used SEP in this study.

The OIA is defined as the sum of the SSH and SEP anomalies, as shown in Eq. (2). The OIA represents the component of the SSH anomaly associated with the vertically uniform fluid motion with the same velocity as the ocean bottom current, called the "barotropic component", which is also widely used in physical oceanography. In this study, we used OIA instead of the barotropic component of SSH anomalies in order to highlight the effect of the oceanic isostasy on pressure on the seafloor.