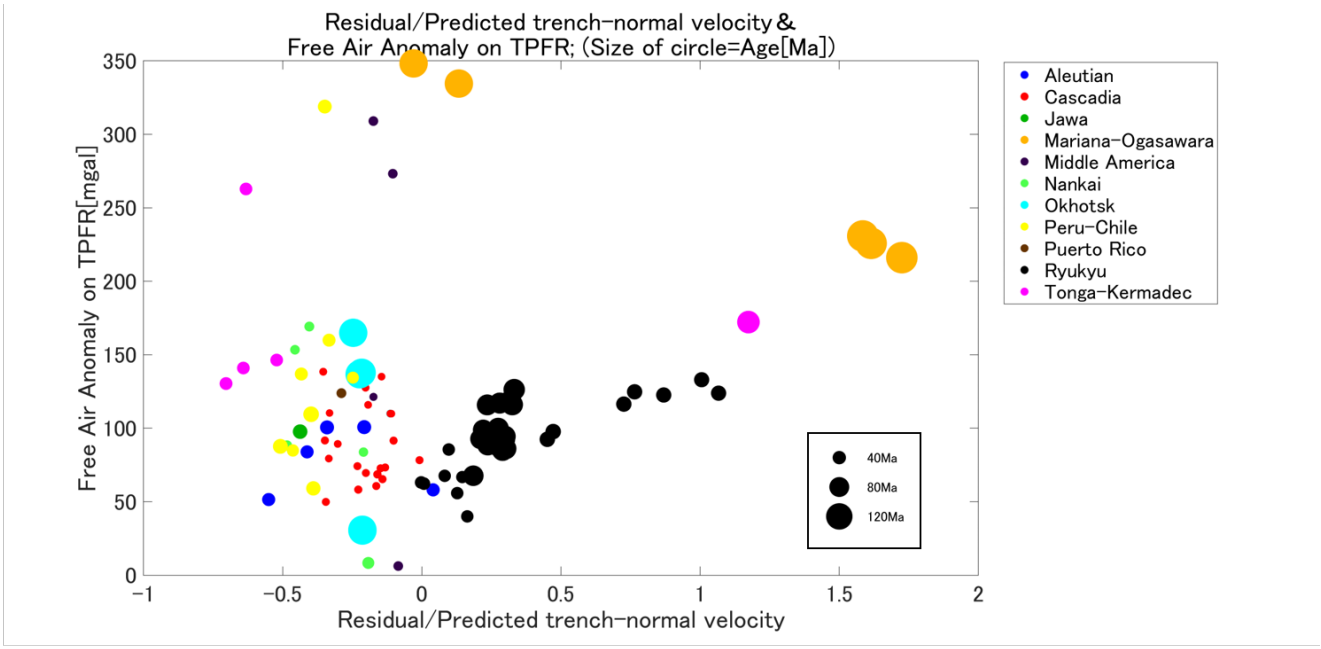
Mechanical consideration of gravity anomaly in fore-arc of subduction zones

*Shohei Iwama[1], Yuto Iwase[2], Ryoya Ikuta[3]

1. Graduate school of Integrated Science and Technology, 2. Graduate School of Environmental Studies, Nagoya University, 3. Faculty of Science, Shizuoka University

In this presentation, we will show a result of mechanical consideration of the cause of TPFRs from the view of inter-plate coupling using GNSS displacement velocity. We discuss the cause of trench-parallel fore-arc ridge (TPFR) considering the relationship between several subduction parameters including inter-plate coupling and the TPFR’s gravity anomaly. Bassett and Watts (2015) found that TPFR is universally found as positive free air gravity anomaly in fore-arc. They suggested that TPFR corresponds to the down dip limit of inter-plate earthquakes. Iwase (2017 JpGU) found a positive correlation between the TPFR’s free air anomaly and age of the subducting slab. They suggested that the TPFR is caused by inter-plate interaction which reflects the rigidity of the subducting slab. We make a mechanical consideration of the cause of TPFRs from the view of inter-plate coupling using GNSS displacement velocity. We study the circum-Pacific subduction zones and the Jawa, the Puerto-Rico trenches. Using the velocity vector of the fore-arc GNSS stations, we calculate the residual motion of the fore-arc stations with reference to the rigid plate motion to compare it with TPFR and age of slab. As a result, the trench-normal expansion rate of the fore-arc region shows positive correlation with the free air gravity anomaly. This result would be interpreted that stronger basal shear beneath extensional region compresses the fore-arc region more intensively to the subducting slab, which causes a growth of the TPFR. In contrast, in the compressive fore-arc regions, although the TPFR and the compression rate do not have clear coherency, the lower limit of TPFR shows positive correlation with the compression rate. In addition to the above considerations, we revisit the relationship between the free air anomaly and the slab age to find that the correlation between slab age and the TPFR does not necessarily exist. This suggests that the Iwase (2017)’s relationship would have included some artifacts due to a shortage of the data. We conclude that some other mechanisms cause the TPFR than inter-plate interaction including the inter-plate coupling although there is a weak correlation between TPFR and the inter-plate coupling.

Keywords: free-air anomaly, TPFRs, subduction zone



Scatter diagram between residual/predicted trench-normal velocity and free air anomaly on TPFR.

