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独立成分分析を用いた海底圧力観測記録からの鉛直地殻変動の抽出
Extraction of the vertical seafloor movement recorded on ocean bottom pressure data by applying ICA

徳永 旭将 [1*], 稲津 大祐 [2], 伊藤 喜宏 [2], 日野 亮太 [2], 中村 和幸 [3]
TOKUNAGA, Terumasa[1*], INAZU, Daisuke[2], ITO, Yoshihiro[2], HINO, Ryota[2], NAKAMURA, Kazuyuki[3]

[1] 明治大学研究・知財戦略機構 先端数理科学インスティテュート, [2] 東北大学大学院理学研究科附属地震・噴火予知研究観測センター, [3] 明治大学大学院先端数理科学研究科
[1]Meiji University, [2]Research Center for Prediction of Earthquakes and Volcanic Eruptions, Tohoku University, [3]Meiji University

In order to extract the vertical seafloor movement from ocean bottom pressure data obtained by the multi-point observation, we introduced Independent Component Analysis (ICA). The Ocean Bottom Pressure (OBP) change due to the predicted amount of seafloor vertical movement is comparable to or slightly less than that due to dynamic ocean processes. Therefore, it is needed some new methods that enable us to separate and/or extract the slow-slip component from oceanic components. ICA is one of the multivariable analysis techniques, which have been applied in the field of the speech processing and the electroencephalogram analysis [e.g., Common, 1994]. Since the spatio-temporal scale and the distribution of the slow-slip component is likely significantly different from those of oceanic components, ICA is expected to be a powerful method to separate them. In this study, we used FastICA algorithm developed by Apro Hyvarinen (see http://www.cs.helsinki.fi/u/ahyvarin/papers/fastica.shtml). To evaluate the practical performance of FastICA, we performed some experiments using the test data. The test data is a sum of the OBP data and the simulated slow slip event. The OBP data was obtained on 2009, which is a quite time in earthquakes, in Miyagi-Oki region [Hino et al., 2009]. The slow slip event was generated based on the result of numerical simulation shown in Hino et al. [2009]. Before ICA, tidal components were eliminated from OBP data by using BAYTAP-G. Also, sensor drifts were corrected by linear fitting function in advance. We applied FastICA to the test data on the assumption that the number of significant sources is 3. As a result, the artificial slow slip event was successfully extracted as the first independent component. The second and third independent component was likely corresponding to oceanic components. For comparison, we also applied Principal Component Analysis (PCA) to the test data described above. The result clearly showed the superior performance of FastICA for extracting the slow slip event from OBP data.

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