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The Effectiveness of Blind Source Separation Using Independent Component Analysis for GNSS Time Series Analysis

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Due to the development of GNSS technology and the improvement of its positioning accuracy, observational data obtained by GNSS is widely used in Earth space geodesy and geodynamics research. Whereas the GNSS time series data of observation stations contains a plenty of information. This includes geographical space changes, deformation of the Earth, the migration of subsurface material, instantaneous deformation of the Earth, weak deformation and other blind signals. In order to decompose some instantaneous deformation underground, weak deformation and other blind signals hided in GNSS time series, we apply Independent Component Analysis (ICA) to daily station coordinate time series of the Southern California Integrated GPS Network. As ICA is based on the statistical characteristics of the observed signal. It uses non-Gaussian and independence character to process time series to obtain the source signal of the basic geophysical events. In term of the post-processing procedure of precise time-series data by GNSS, this paper examines GNSS time series using the principal component analysis (PCA) module of QOCA and ICA algorithm to separate the source signal. Then we focus on taking into account of these two signal separation technologies, PCA and ICA, for separating original signal that related geophysical disturbance changes from the observed signals. After analyzing these separation process approaches, we demonstrate that in the case of multiple factors, PCA exists ambiguity in the separation of source signals, that is the result related is not clear, and ICA will be better than PCA, which means that dealing with GNSS time series that the combination of signal source is unknown is suitable to use ICA.