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Moving from Principal Component Analysis-based Inversion Method (PCAIM) to Independent Component Analysis-based Inversion Method (ICAIM)

Abstract:
Geodetic time series data are usually studied through classical statistical techniques, that is decomposing them into different deterministic signals. Recently, new techniques have been developed and applied to geodetic data, in order to extract as much information as possible from them. An example is the Principal Component Analysis (PCA), used both to detect network errors in GPS data (such as the Common Mode Error, CME, see Dong et al., 2006), and to identify geophysical signals common to a certain region. The latter approach is particularly useful for understanding geophysical processes, and the PCA-based Inversion Method (PCAIM, see Kositsky and Avouac, 2010) is a good realization of this concept. I used this method to analyze the GPS data of the 2009 L'Aquila earthquake (central Italy). A strong limitation of the PCA is that it is not able to separate multiple mixed sources. In other words, the PCA technique is not effective in treating the so-called Blind Source Separation (BSS) problem. For this goal, it reveals to be an efficient technique the Independent Component Analysis (ICA). The objective of my project is to modify the decomposition step of the PCAIM code. In particular, I want to introduce the possibility to perform an ICA decomposition, with the goal to detect and separate multiple sources of signal.