How much information does an observed data set include? (1): the importance of covariance for InSAR and other observed data

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Before the introduction of ABIC, we have not had a definitive way to determine the relative weight between the information from observed data and prior constraints. The point of ABIC is that we can objectively determine it based on statistics. That is to say, when we have an enough amount of accurate data, a model that well explains observed data is selected. Conversely, when the data are inaccurate and/or insufficient, the model comes to follow prior constraints. This is why, in the inversion analysis with ABIC, we have to be more careful in dealing with information included in observed data.

InSAR gives us spatially dense crustal displacement data, if the coherence is good. Here, we generally encounter the problem of sampling interval. For example, if we pick up InSAR data very densely, the information from observed data apparently increases. So, if we invert such a data set, a model that excessively fits observed data would be selected.

As mentioned above, InSAR data include spatially well correlated errors that mainly comes from atmospheric conditions. In other words, each data is not completely independent. So, taking the effect of data covariance into account, we can reasonably reduce the information from densely sampled observed data, which enables us to avoid a biased inversion.

If InSAR data should have no observation errors, could we neglect the effect of covariance? Even in this case the answer is no, because there are always modeling errors. For example, we never know the correct structure of the Earth, which leads to the errors of Green's functions and causes modeling errors. Modeling errors also have spatial and temporal correlation.

The situation is more complicated for seismic data because of the effect of seismic attenuation and filtering for data sampling. Yagi and Fukahata (2007, this meeting) discuss this case. In general, information of statistical nature for modeling errors is needed for appropriate inversion analyses, when the observation errors are quite small.