The Bayesian Hierarchical model and glossary

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1 The Bayesian hierarchical model

In this section, we introduce the Bayesian hierarchical model using the GIA process as an example.

We assume that the true GIA process is a real-valued spatial process continues on the sphere and denote it by $Y : \mathbb{S}^2 \mapsto \mathbb{R}$. We use one of the GIA solution, say from one of the *ice6g* models, as the prior mean of the true process and denote it by $\mu : \mathbb{S}^2 \mapsto \mathbb{R}$. Then the residuals $X := Y - \mu$ can be modelled as a stationary Gaussian process on the phere $X \sim \mathcal{GP}(0, \kappa(\theta))$, where $\kappa(\theta)$ defines the covariance function with hyper parameters θ.

In order to assess the bias and uncertainties in the *ice6g* solution, we use the GPS observations to update the GIA process. The GPS data are the yearly trend of vertical movement in millimeter at the observed locations and it can be regard as the GIA process with measurement errors; therefore we model the GPS data as $X_i = A_i Y_i + \varepsilon_i$