Glossary of important terms for GW1876

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Parameters Variable input values for models, typically representing system properties and forcings. Values to be estimated in the history matching process. Typically identified as k, p, or x ($\mathbf{k}$, $\mathbf{p}$ or $\mathbf{x}$ for multiple parameters in a vector).

Observation Measured system state values. These values are used to compare with model outputs collocated in space and time. The term is often used to mean *both* field measurements and outputs from the model. When referring to a measured value, observations are typically identified by the variables y or o ($\mathbf{y}$ or $\mathbf{o}$ for multiple parameters in a vector)

Modeled Equivalent A modeled value collocated in time and space with an observation. There are various ways to identify a single or multiple modeled equivalent values (and, to make things confusing, they are often *also* called "observations"!)

Single values

1. $f(x)$
2. $X(\beta)$
3. $M(p)$

Multiple values

1. $\mathbf{X}\beta$
2. $\mathbf{Mp}$

Forecasts Model outputs for which field observations are not available. Typically these values are simulated under an uncertain future condition.

Phi Objective function, defined as the weighted sum of squares of residuals. Phi (aka $\mathbf{\Phi}$) is typically calculated as

$$\Phi = \sum_{i=1}^{n} \left(\frac{y_i - f(x_i)}{w_i} \right)^2 \quad or \quad \Phi = (\mathbf{y} - \mathbf{Jx})^T \mathbf{Q}^{-1} (\mathbf{y} - \mathbf{Jx}) \tag{1}$$

Residuals The difference between observation values and modeled equivalents $r_i = y_i - f(x_i)$

Sensitivity

Jacobian Matrix

FOSM

Gaussian (multivariate)

Weight

Weight Covariance matrix (correlation matrix)

Parametric uncertainty

Measurement noise

Structural (model) error

Monte Carlo Ensemble

Bayes' Theorem

Posterior (multivariate distribution)

Schur Complement

Prior (multivariate distribution)

Likelihood (multivariate distribution)