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WGBIS

Geodetic inversion package

with **wrapped** satellite interferometric phase

in a **Bayesian** approach

to estimate fault and volcano model source parameters

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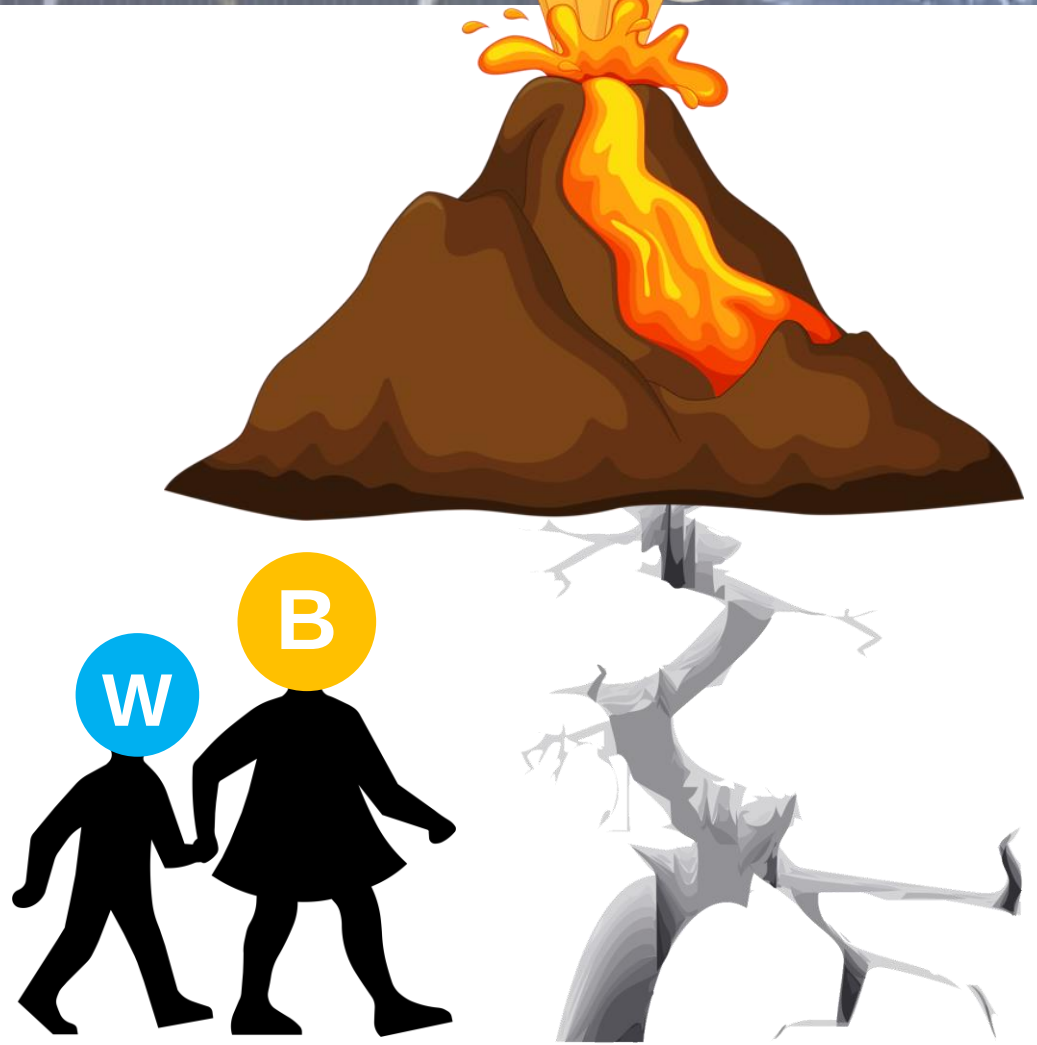

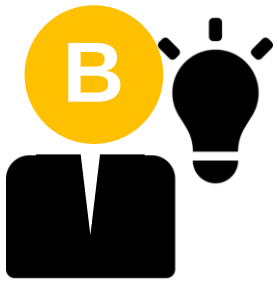

Using a **Bayesian approach**, WGBIS provides model estimation and **uncertainty assessment.**

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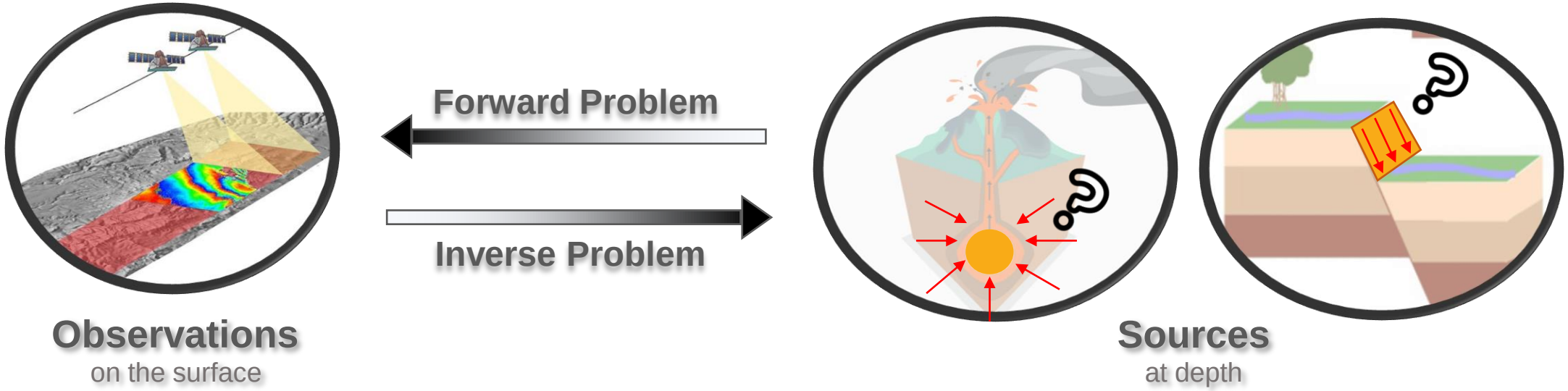
Extensive testing shows that, WGBIS has the capability to **escape local minima.**



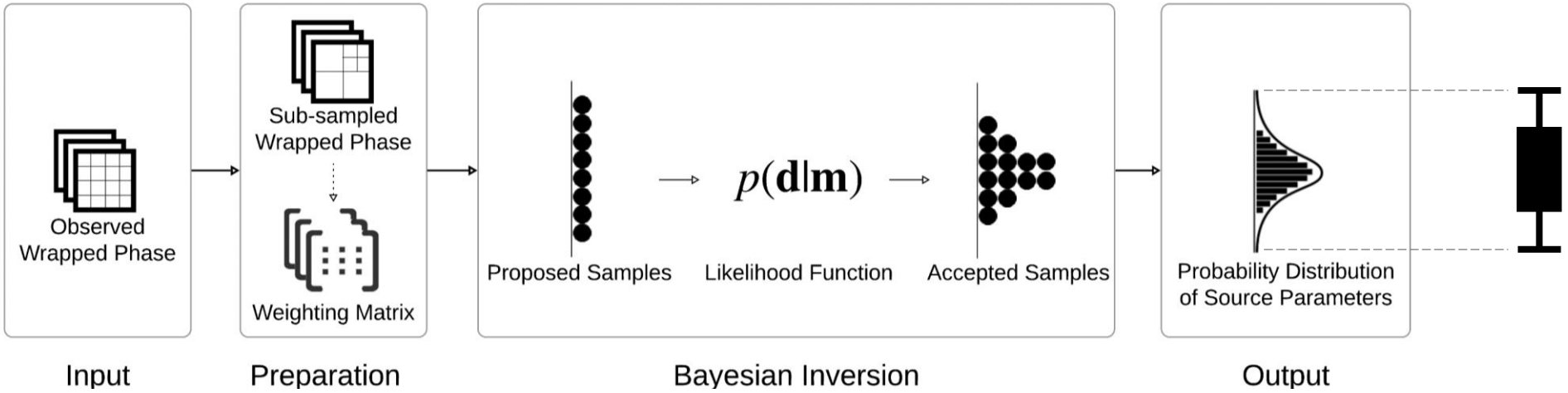


Figure: Schematic representation of WGBIS workflow. (Jiang Y. and Gonzalez P.J., 2020, JGR)

Directly using **wrapped phase**,

WGBIS avoids **phase unwrapping error**.

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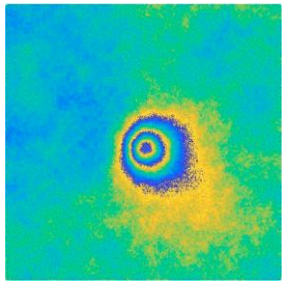
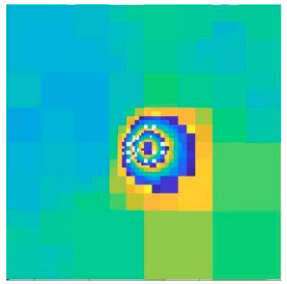
An improved data **down-sampling algorithm** for **wrapped interferometic phase** is proposed.

Wrapped observations are **weighted** by **appropriate data covariance**.

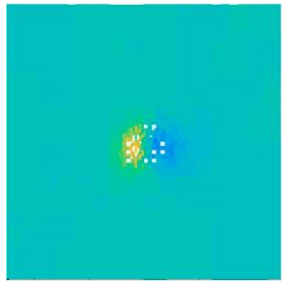
Phase Down-sampling



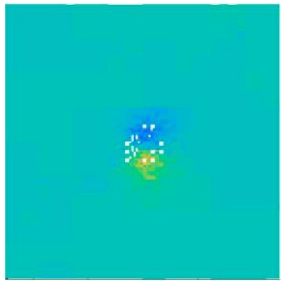
Observation



Mean Phase ϕ



X-direction Gradient ψ_x



Y-direction Gradient ψ_y

Likelihood Function

Weighted misfit function

$$p(\mathbf{d}|\mathbf{m}) = \mathbf{F}(f) \Longrightarrow \mathbf{F}(f) = f_1 + f_2 + f_3$$

For Mean Phase: $f_1 = \theta_1 C_1^{-1} \theta_1$, where $\theta_1 = \text{wrap}(\phi - \underline{\phi})$

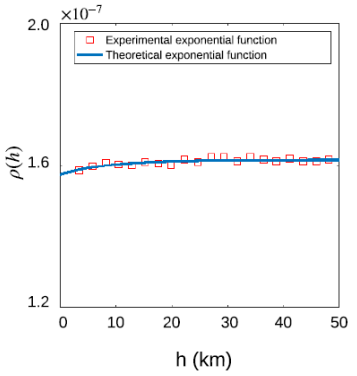
For Phase Gradient: $f_2 = \theta_2 C_2^{-1} \theta_2$, where $\theta_2 = \psi_x - \underline{\psi_x}$

$f_3 = \theta_3 C_3^{-1} \theta_3$, where $\theta_3 = \psi_y - \underline{\psi_y}$

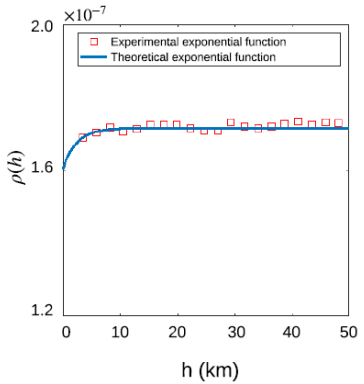
Phase Weighting

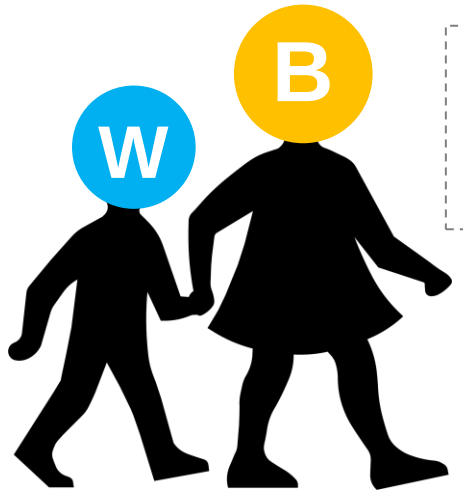
C_1 is estimated by circular mean deviation of de-ramped phase.

Semi-variogram for C_2



Semi-variogram for C_3





WGBIS is **validated** via a real earthquake, 2019 M5.7 Acipayam earthquake (Turkey).

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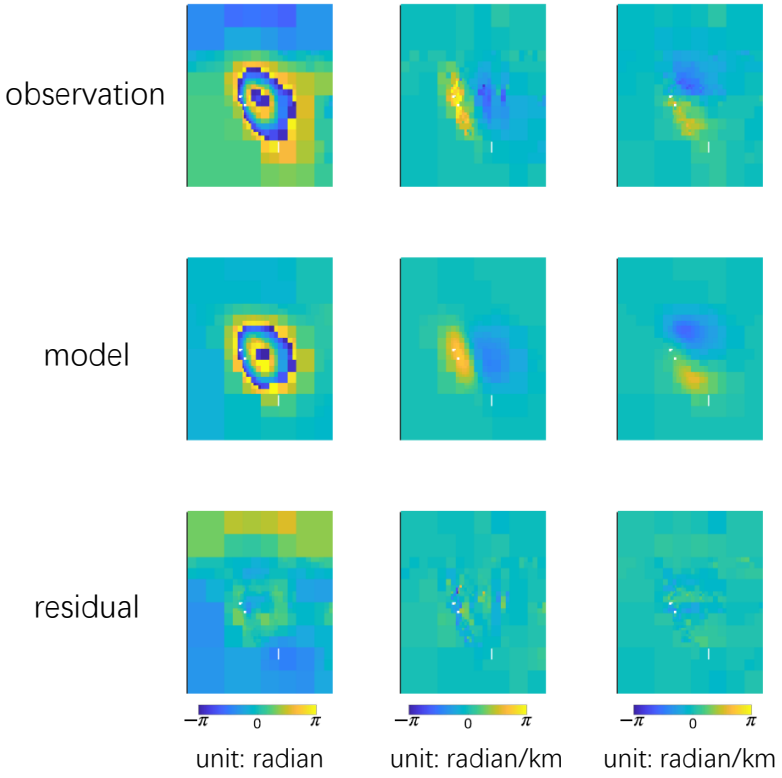
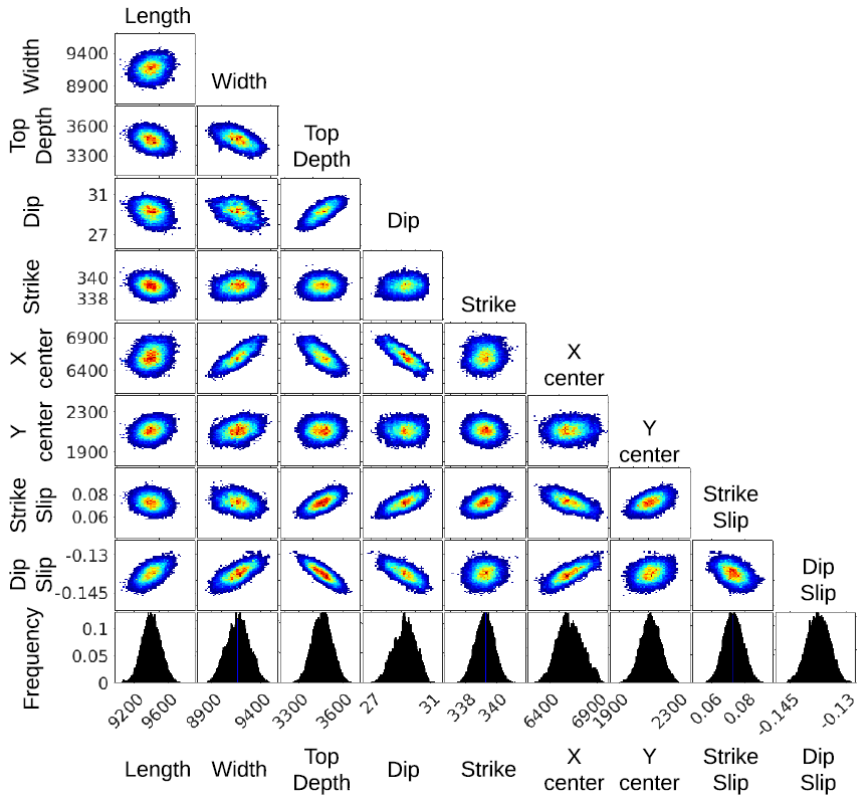
The estimated **geodetic moment** is **consistent** with the **seismic moment**.

The spatial distribution of **aftershocks** is **closely aligned** to the modelled **fault plane**.

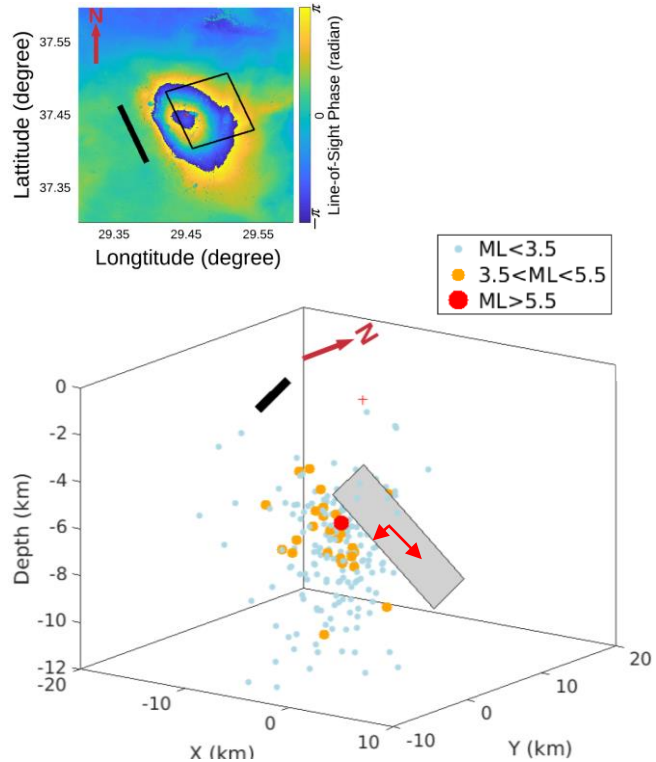
Observation vs Model



Joint Probabilities of Parameters



Seismicity Distribution



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