

Field Inversion & Machine learning (FIML)

Datasets $Y^1, Y^2 \dots Y^n$

Field
Inversion

$$\frac{DQ}{Dt} = R(Q) + \delta^j(x) : \min_{\delta^j(x)} \|Y^j - Y^j(Q)\|$$

Information Spatial discrepancy

$$\delta^1(x), \delta^2(x), \dots \delta^n(x)$$

Machine
Learning

Knowledge Functional discrepancy

$$\hat{\delta}(f(Q))$$

Embedding

$$\frac{DQ}{Dt} = R(Q) + \hat{\delta}(f(Q))$$

Prediction : Injection into solver

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Original system	$\frac{DQ}{Dt} = R(Q).$
Datasets	Y^1, Y^2, \dots, Y^n
Field inversion	$y^j \rightarrow \delta^j(x)$
Model corrections (spatial)	$\delta^1(x), \delta^2(x), \dots, \delta^n(x)$
Machine learning	$\delta^1(x), \delta^2(x), \dots, \delta^n(x), Q \rightarrow \hat{\delta}(f(Q))$
Model features	$f(Q)$
Model corrections (functional)	$\hat{\delta}(f(Q))$
Data-augmented system	$\frac{DQ}{Dt} = R(Q) + \hat{\delta}(f(Q))$