3DA: Data-Driven Data Assimilation Applications to the Lorenz system and simulated sea surface heights
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Method[1]: Analog Forecast + EnKS

Given a huge historical dataset $\mathbf{C}$ (the catalog);

Given the current state estimate $\mathbf{x}_t$, search for the analogs of $\mathbf{x}_t$ within $\mathbf{C}$;

Build a local model based on the analogs and the corresponding successors;

Apply the local model on $\mathbf{x}_t$ to do the forecast.

OSSE of simulated sea surface height (SSH) in the Gulf of Mexico

Dataset: the OCCIPUT[2] simulated SSH, 50 members, 20 years

Truth: member #1 in year 20

Observations: simulated along-tracks from the real altimetry in 2004

(AnDA) catalog: member #2-#50, in year 1 - year 19

(AnDA) ensemble size: 1000

(OI) $B = B_{\text{clim}} \otimes \exp(\frac{d^2}{2L_i^2})$ where $B_{\text{clim}}$ is the spatial climatology calculated from the OCCIPUT dataset

(OI) $L_i = 20$ (days)

(OI) radius of influence = 1.5 (degrees)

Summary:

- AnDA captures more small scale flows
- AnDA produces more informative variance maps
- AnDA relies on catalog

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References:
[1] R. Lguensat et al., The analog data assimilation, MWR, 2017
[2] L. Bessières et al., Development of a probabilistic ocean modelling system based on NEMO 3.5: application at eddying resolution, GRL, 2017