The influence of model resolution on background correlations

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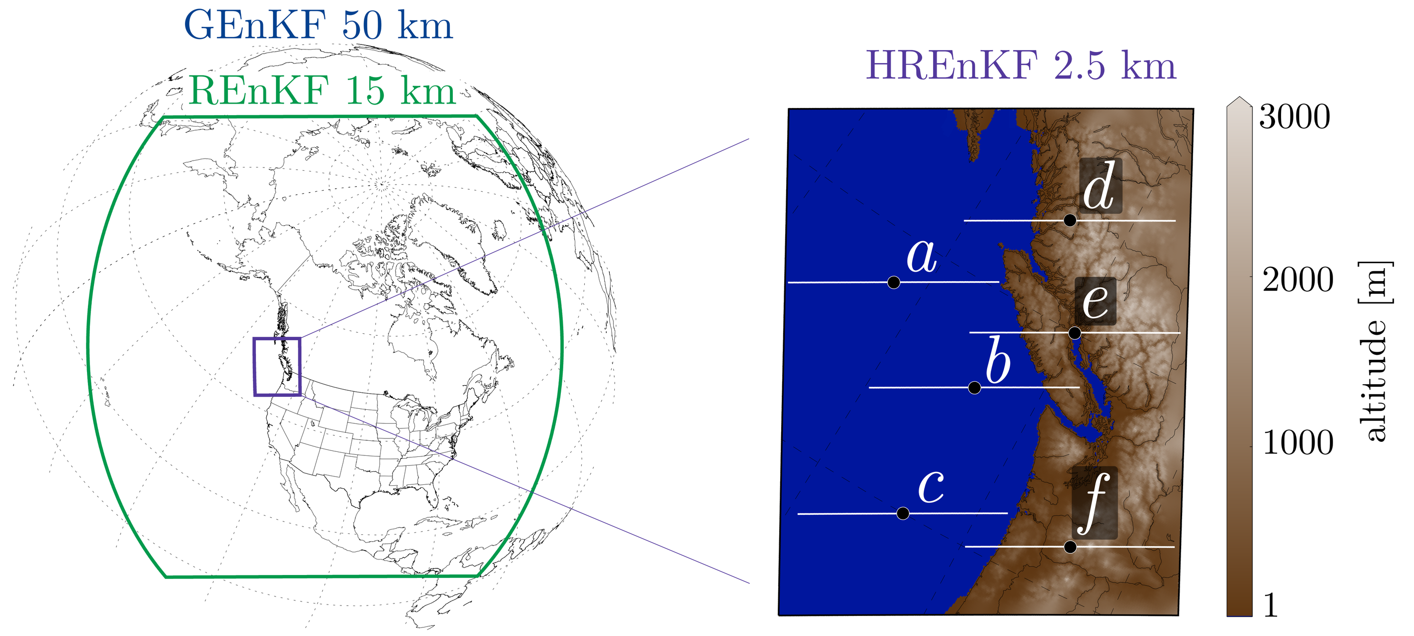
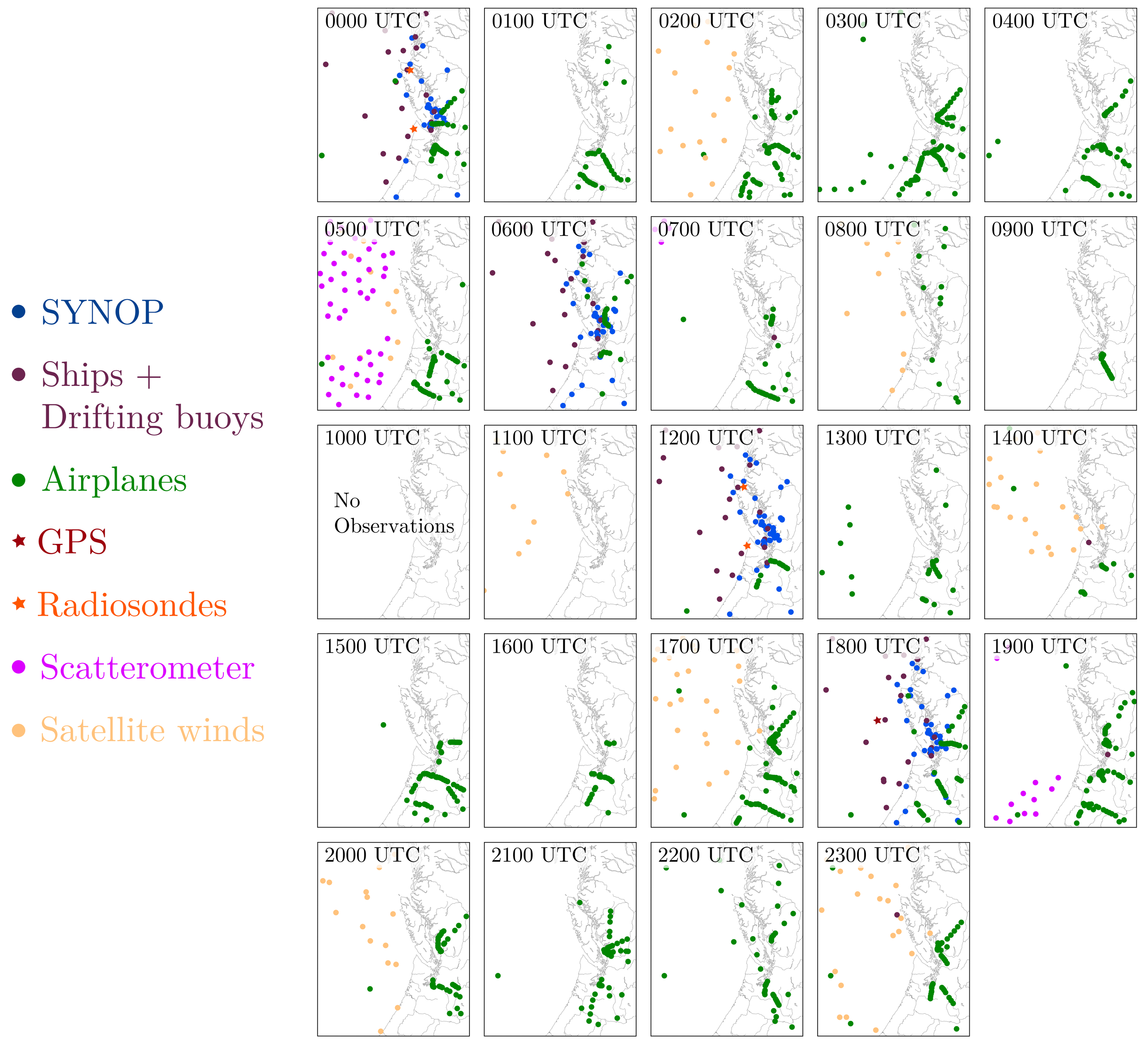
Three levels of nested EnKF

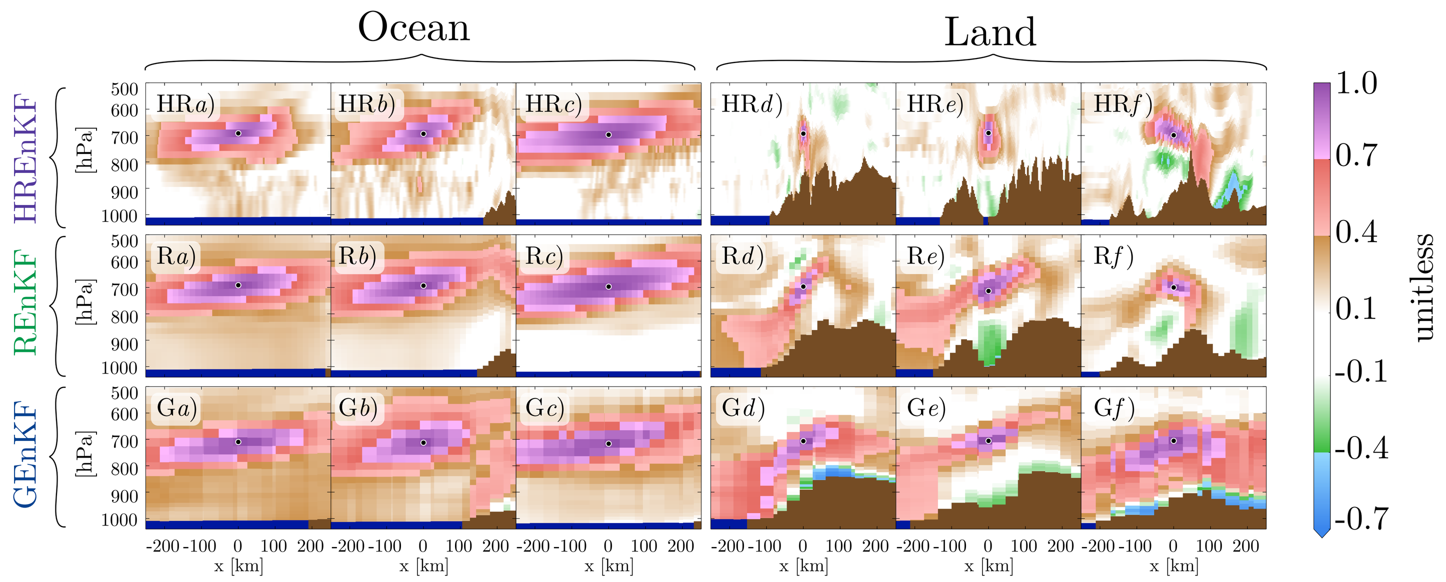


Observations in the HR system every hour of a day.

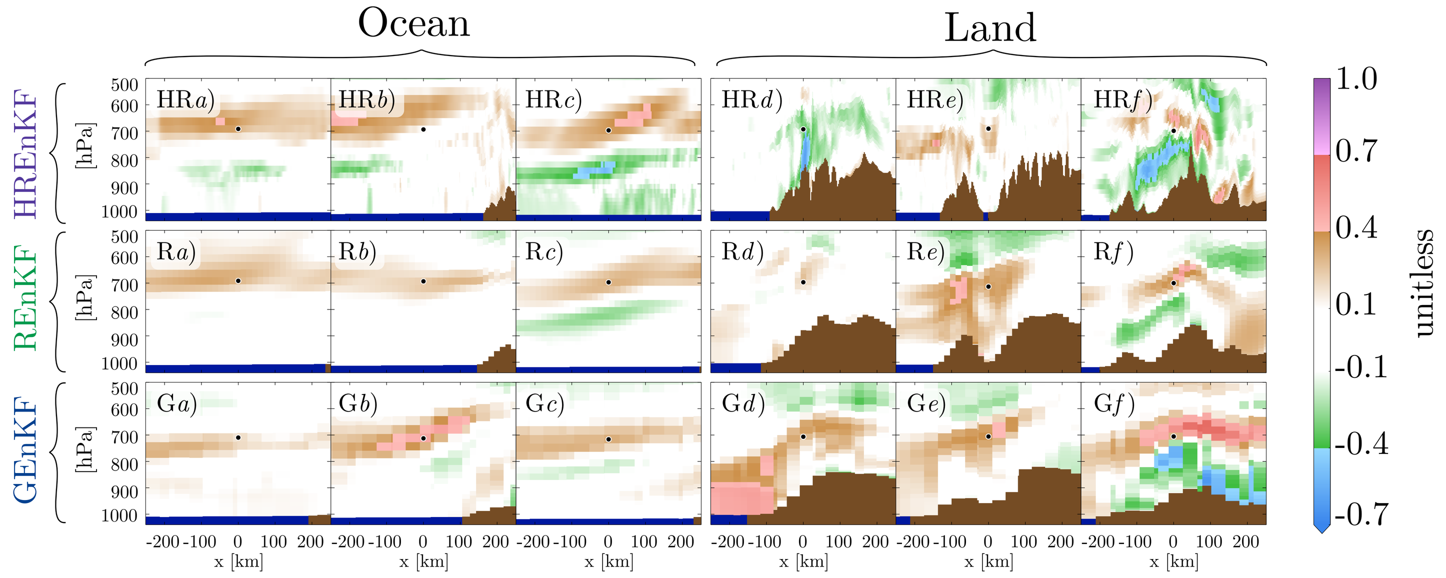


Correlations from the ensembles

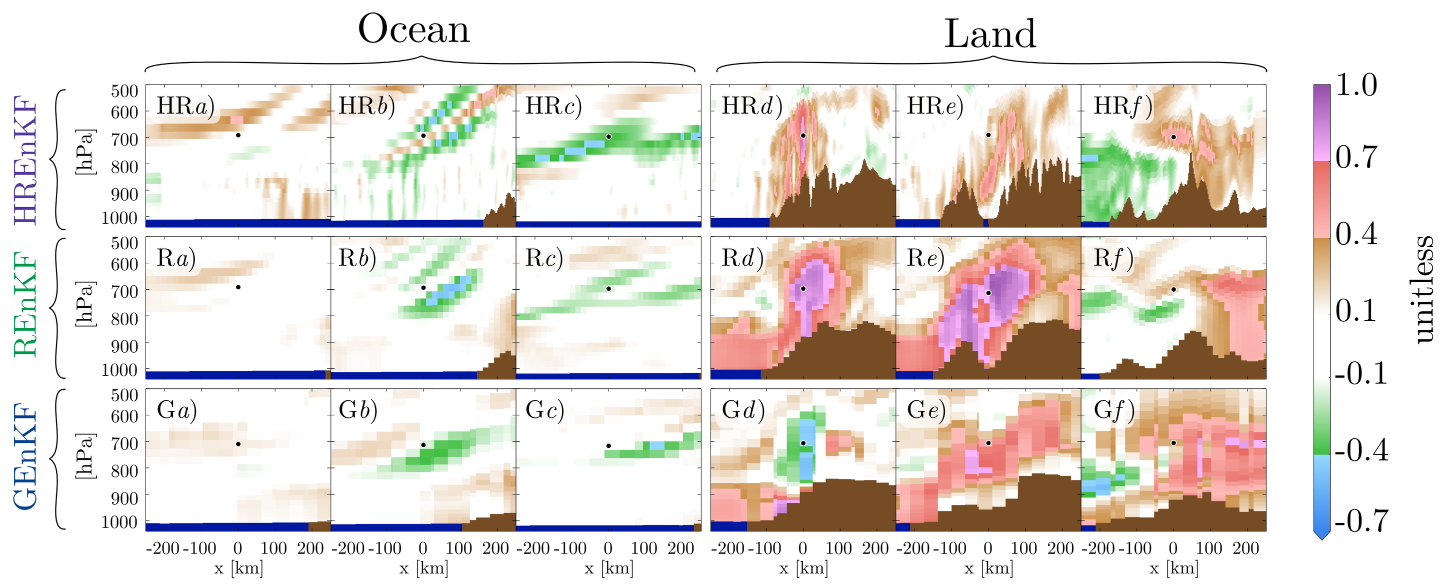
Autocorrelation of U-velocity



Correlation between U-velocity and Temperature

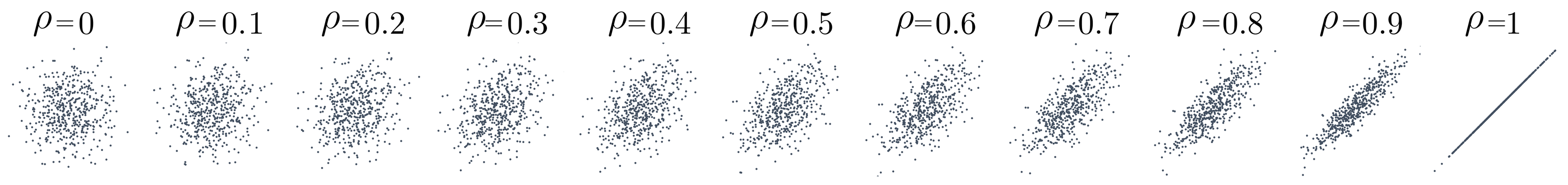


Correlation between Temperature and Water Vapor



Forecasting efficiency

A progression with constant intervals of ρ illustrates that correlation does not corresponds to our intuitive notion of an increasingly better fit.



Forecasting efficiency (Hull, 1927) provides a more intuitive metric for interpreting correlation.

Let

$$\mathbf{y} = \hat{\mathbf{y}} + \mathbf{e}$$

with

$\mathbf{y}$	an array of dependent variable
$\hat{\mathbf{y}}$	an array of estimates by a linear model
$\mathbf{e}$	the residual errors

Assuming no no correlation between $\hat{\mathbf{y}}$ and $\mathbf{e}$, we have

$$\mathrm{VAR}(\mathbf{y}) = \mathrm{VAR}(\hat{\mathbf{y}}) + \mathrm{VAR}(\mathbf{e})$$

$$\mathrm{TSS} = \mathrm{ESS} + \mathrm{SSR}$$

where

TSS	Total Sum Square
ESS	Explained Sum of Squares
SSR	Sum of Squared Residuals

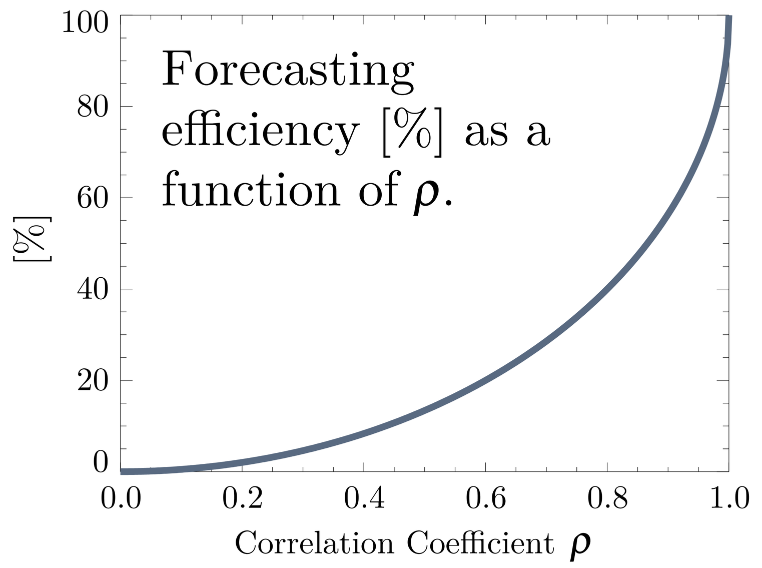
Using the "coefficient of determination",

$$R^2 = \rho^2 = \frac{\mathrm{ESS}}{\mathrm{TSS}} = 1 - \frac{\mathrm{SRR}}{\mathrm{TSS}}$$

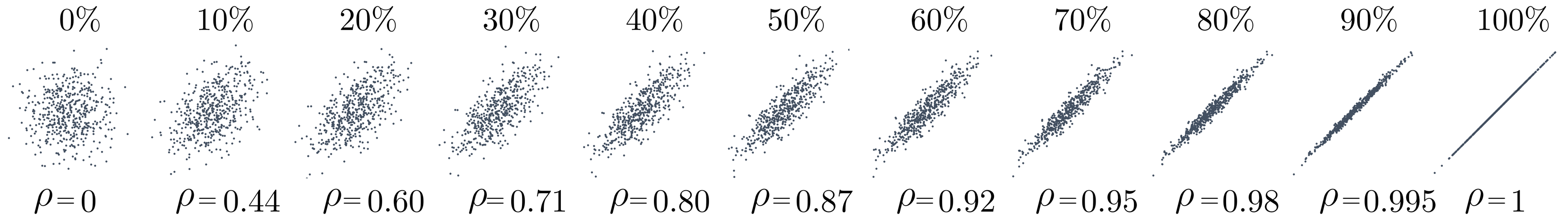
we can derive an expression for the "forecasting efficiency"; **the percentage reduction in forecast error** that is obtained by use of a linear model fitted to a cloud a points with a correlation ρ.

$$\mathrm{F.\ eff}[\%] = 100 \cdot \frac{\sqrt{\mathrm{TSS}} - \sqrt{\mathrm{SRR}}}{\sqrt{\mathrm{TSS}}}$$

$$= 100 \cdot \left(1 - \sqrt{1 - \rho^2}\right)$$

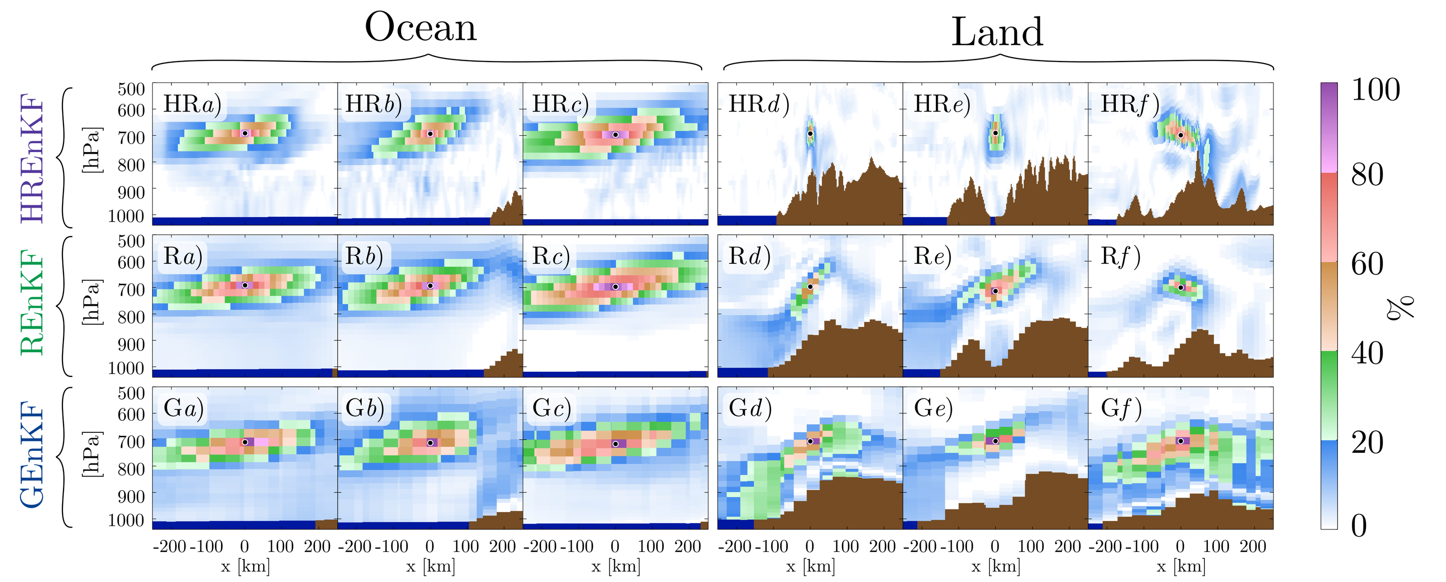


A progression with constant intervals of forecasting efficiency better corresponds to our intuitive notion of an increasingly better fit.

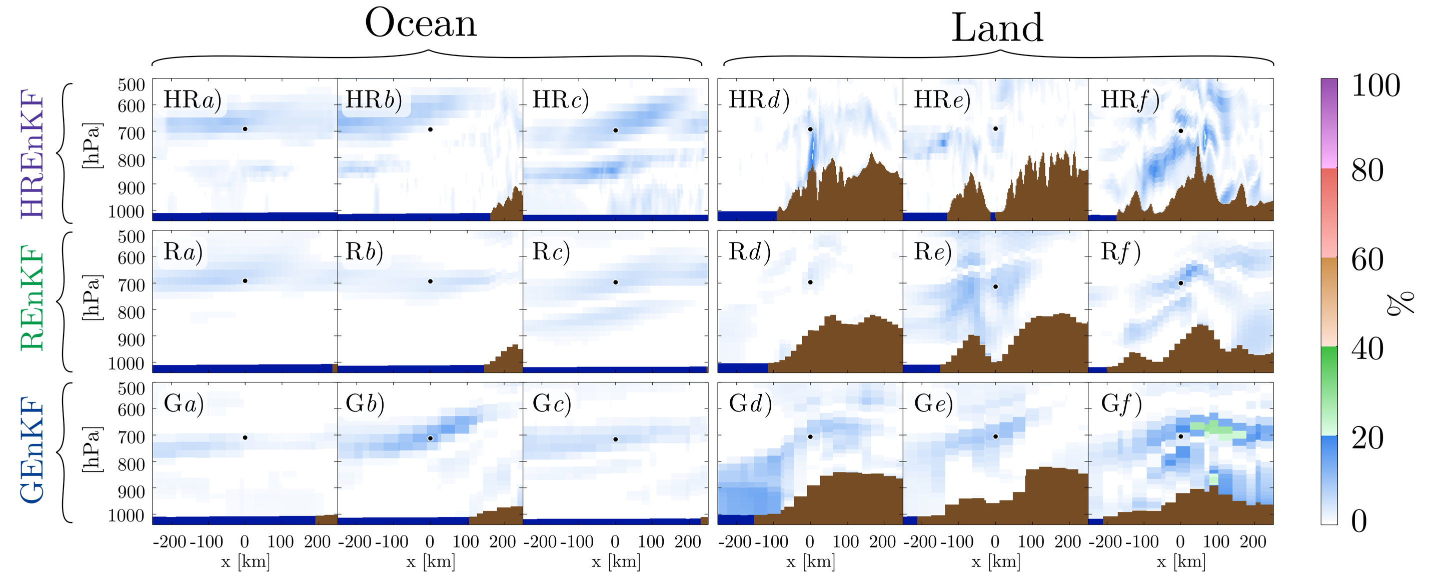


F. eff. from the ensembles

F. eff. from U-velocity autocorrelation



F. eff. between U-velocity and Temperature



F. eff. between Temperature and Water Vapor m/r