

Localization in ensemble data assimilation

Paul Kirchgessner¹ Lars Nerger¹
Angelika Bunse-Gerstner²

¹Alfred-Wegener-Institute, Bremerhaven

²University of Bremen

27.11.12

Local Analysis

The quality of the local analysis depends on different parameters

- Ensemble size
- Inflation factor
- Localization method
- Localization radius

Relationship is not sufficiently understood.

Local Analysis

The quality of the local analysis depends on different parameters

- Ensemble size
- Inflation factor
- Localization method
- Localization radius

Relationship is not sufficiently understood.

Local Analysis

Research questions:

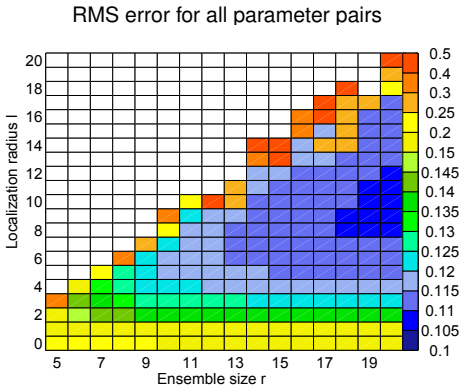
- Filter divergence?
- Optimal localization radius?
- Relation between different localization techniques?

Numerical experiments

- Twin experiments with the Lorenz-96 model
- LEKTF as implemented in PDAF
- Domain localization (D_{loc}) and observation localization (O_{loc})
- Variation of ensemble size r and localization radius l

Quality of analysis D_{loc}

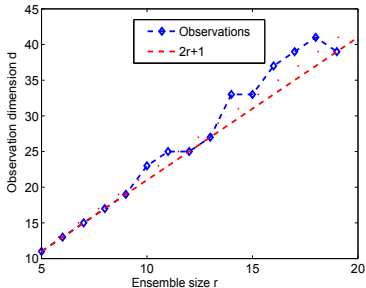
- Much improvement at optimal loc. radius
- Clear divergence boundary.
- Similar results for O_{loc}



Boundary of divergence

- Linear relationship between r and d
- More stable for big r

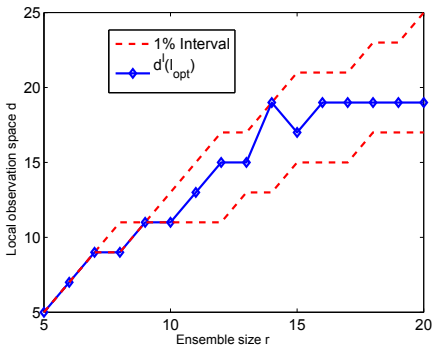
Dimension of observation space



Optimal localization radius

- Linear for small r
- Very narrow interval if $r \ll n$
- More freedom for bigger ensemble

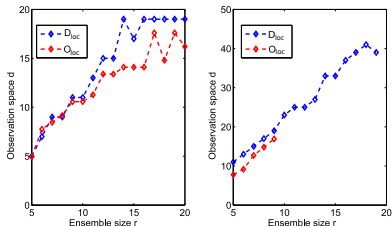
Local observations space



Comparison domain loc. and observation loc.

- Very similar for $r < 10$
- D_{loc} and O_{loc} comparable
- Difference if $r > 10$

Optimal observation space (left) and boundary of divergence (right)



Summary

- Boundary of divergence nearly linear to ensemble size
- Optimal localization radius linear to r if $r \ll n$.
- Similar results for domain- and observation localization

Current and future work

- Model independence?
- Adaption to a shallow water model (Krysta et. al. 2011)
- Nonlinear data assimilation algorithms (Particle filter, ...)
- Adaption to realistic models (NEMO, FESOM)