



Environment
Canada

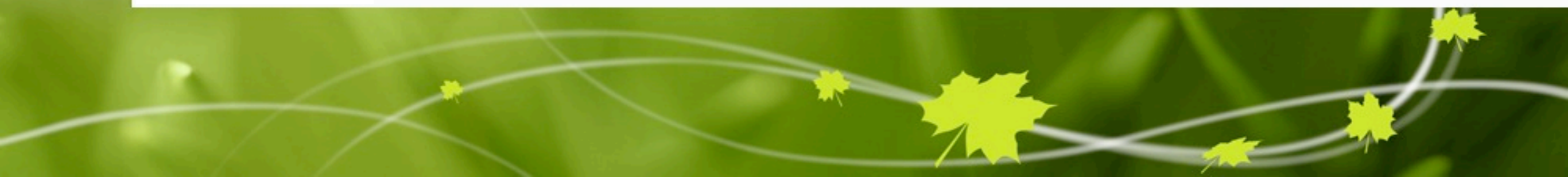
Environnement
Canada

Canada

Environment Canada's Regional Ensemble Kalman Filter: Some preliminary results

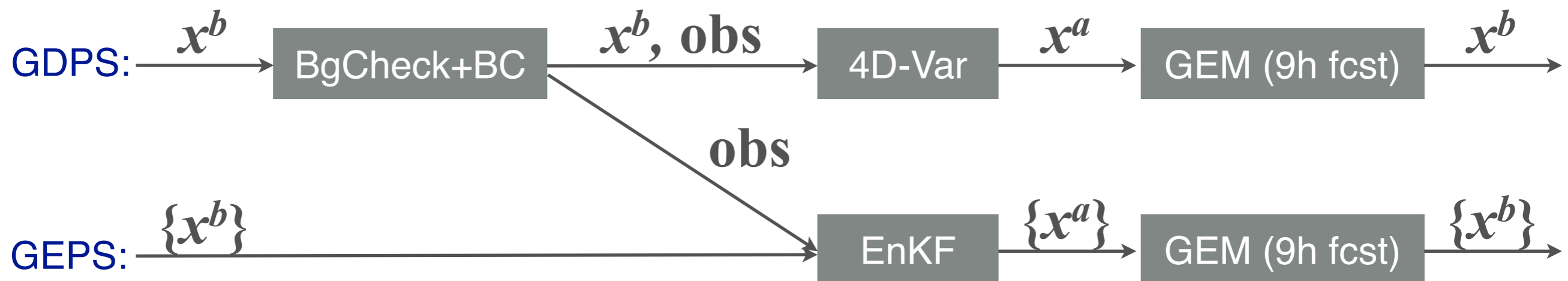
EnKF Workshop 2012

*Seung-Jong Baek, Luc Fillion, Peter Houtekamer
Meteorological Research Division, Environment Canada, Dorval, Quebec
Atmospheric & Oceanic Sciences, McGill University, Montreal, Quebec*

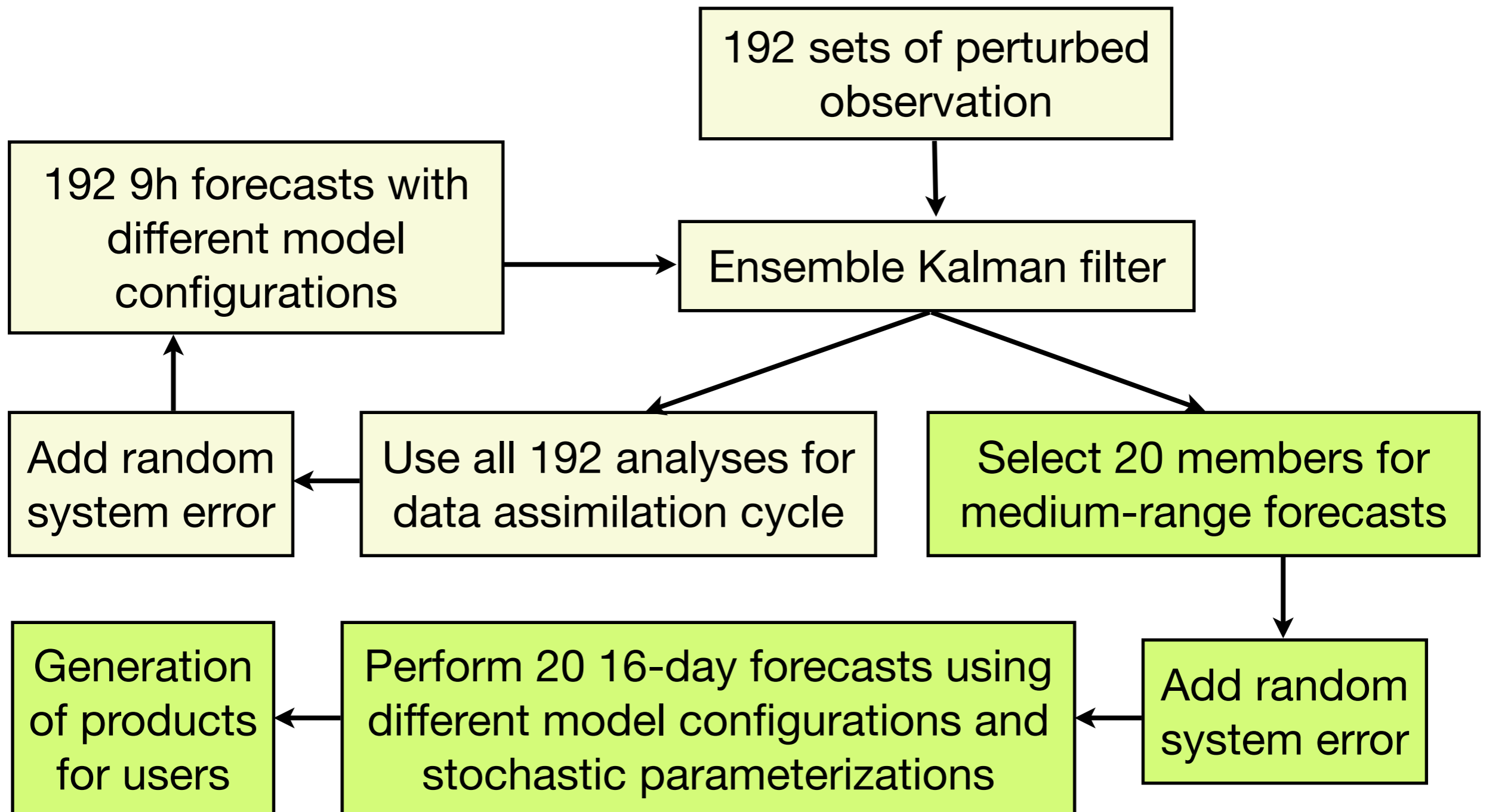


Global EnKF at the Environment Canada

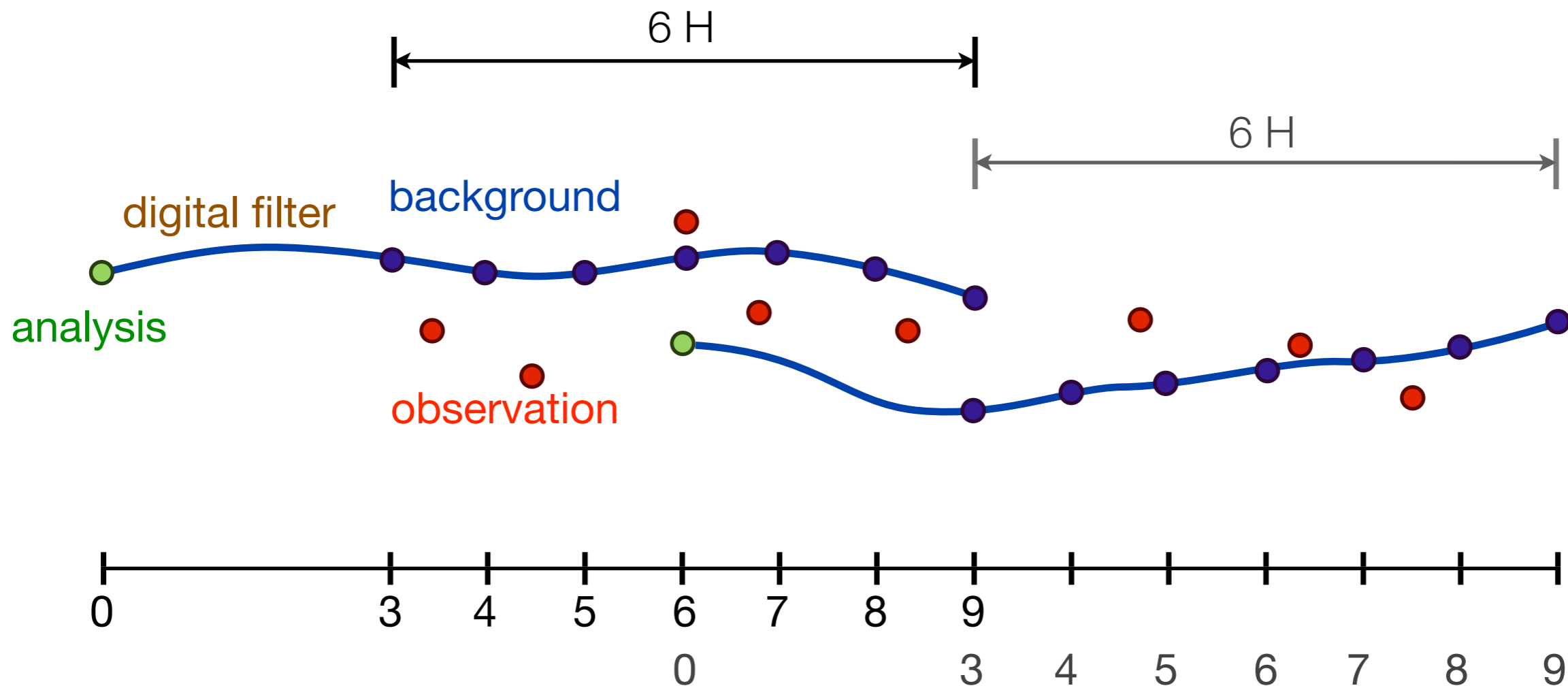
- Operational since 2005
- Maintain reasonable meteorological quality.
- Weak components of the algorithm need to be improved. (e.g., localization, bias correction,



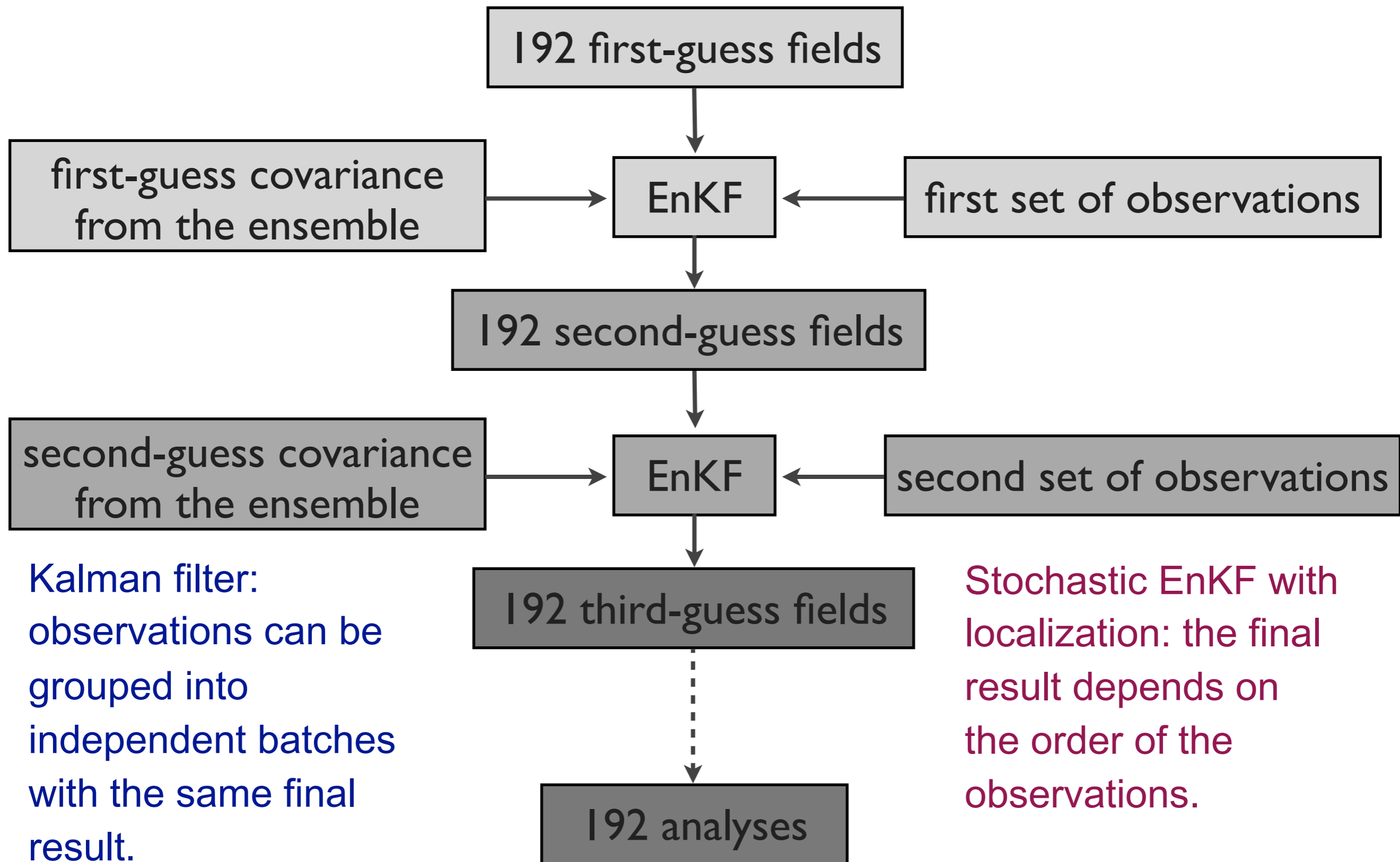
Monte Carlo methods in the global ensemble



Assimilation window



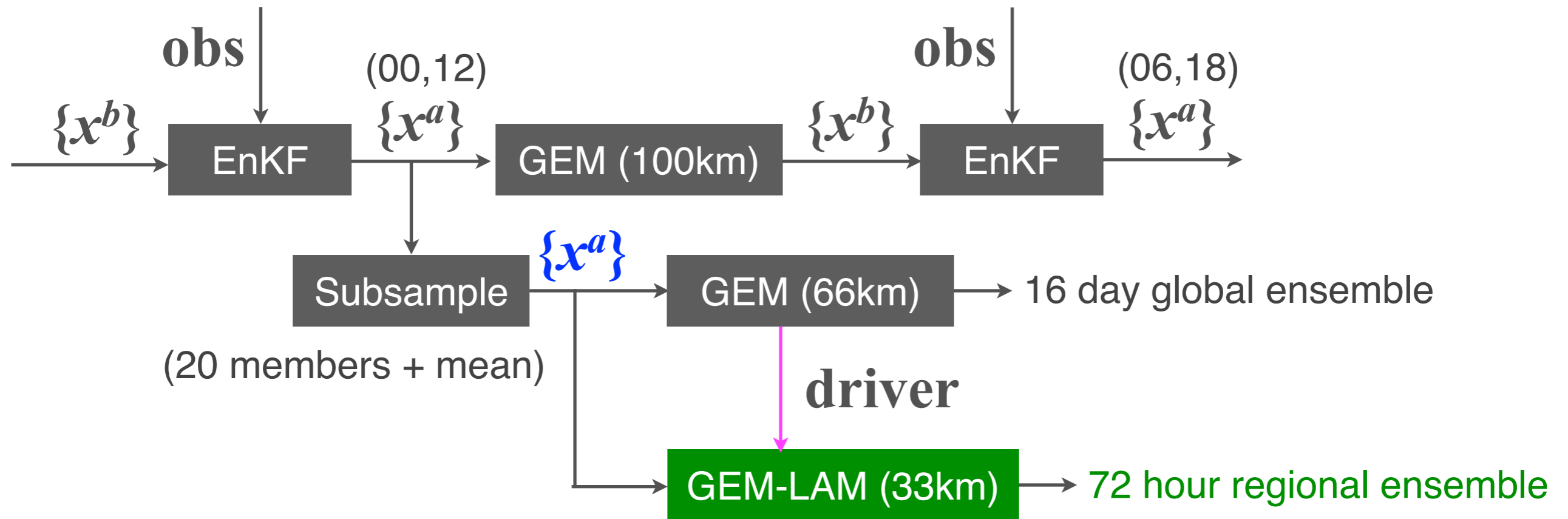
Sequential ensemble Kalman filter



Kalman filter:
observations can be
grouped into
independent batches
with the same final
result.

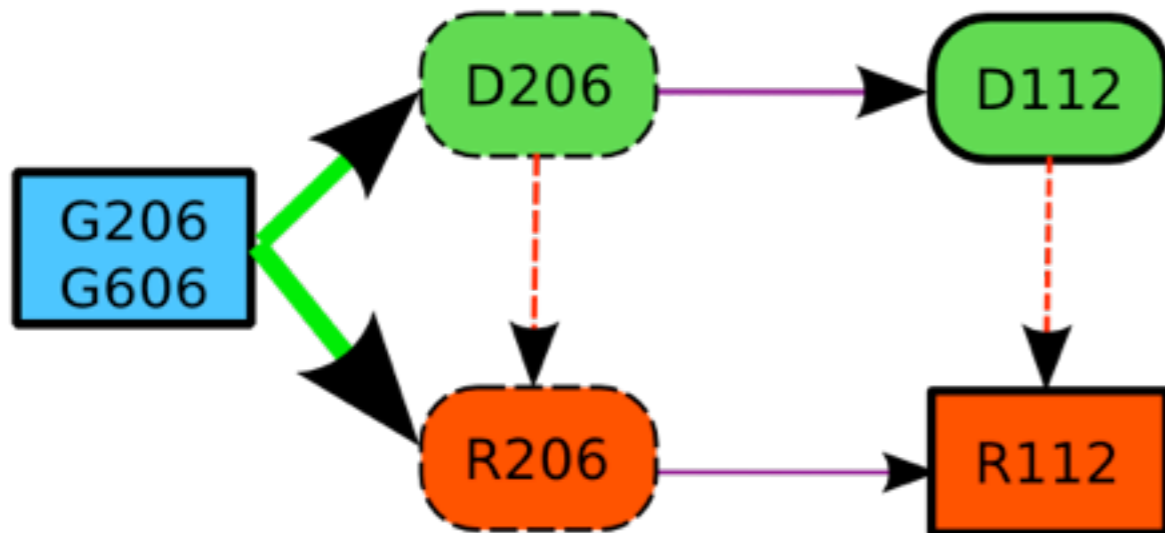
Stochastic EnKF with
localization: the final
result depends on
the order of the
observations.

Regional Ensemble Prediction System (REPS)









- Main purpose of EnKF is to generate the 20 initial conditions for the global ensemble forecast for every 12 hours.
- REPS has the same initial conditions as the GEPS.
 - Initial states: 100 km, 2 hPa top
 - GEPS: 66km, 2hPa top
 - REPS: 33km, 10hPa top

Regional Deterministic Prediction System (RDPS)



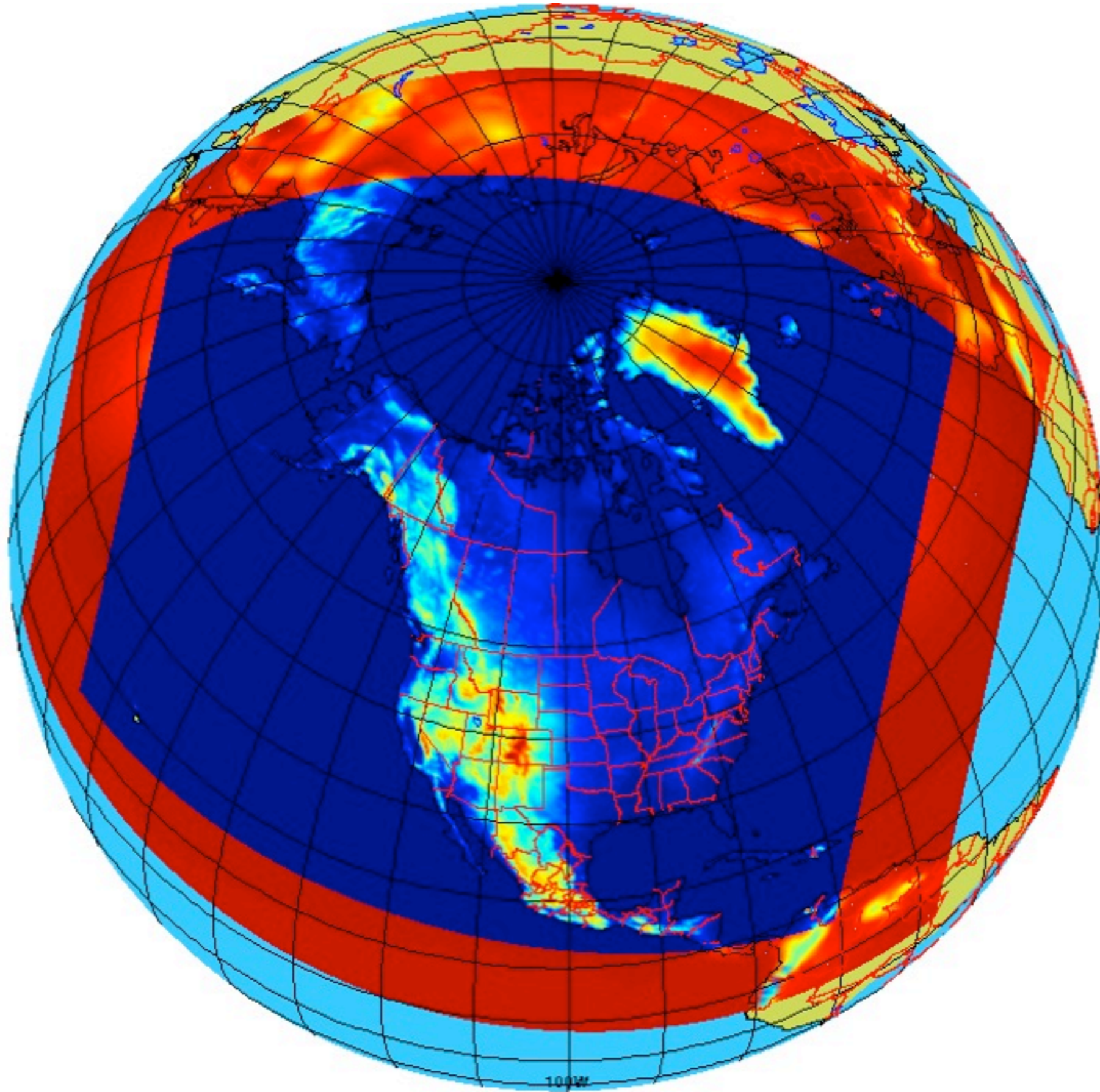
G : Global Model (33 km)
D : Driver Model (33 km)
R : Regional Model (15 km)

 Driving
 Trial field
 Global analysis used

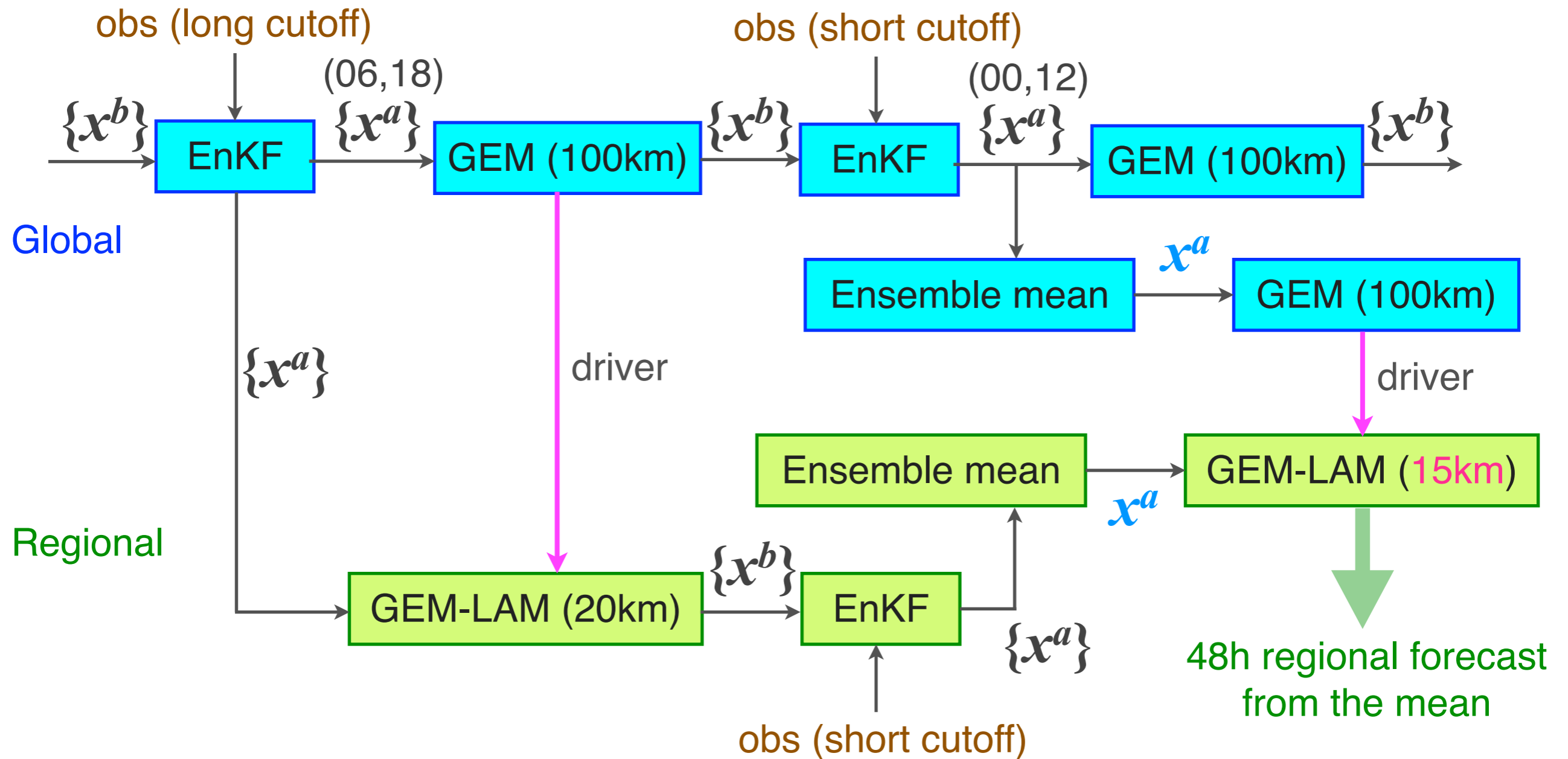
 Trial field
 3D-VAR FGAT Analysis
 4D-VAR Analysis

NL-High 15-km grid (649x672)
NL-High 10-km grid (996x1028)

NL-Low/TL/AD 100-km grid (141x141)



Experimental setup

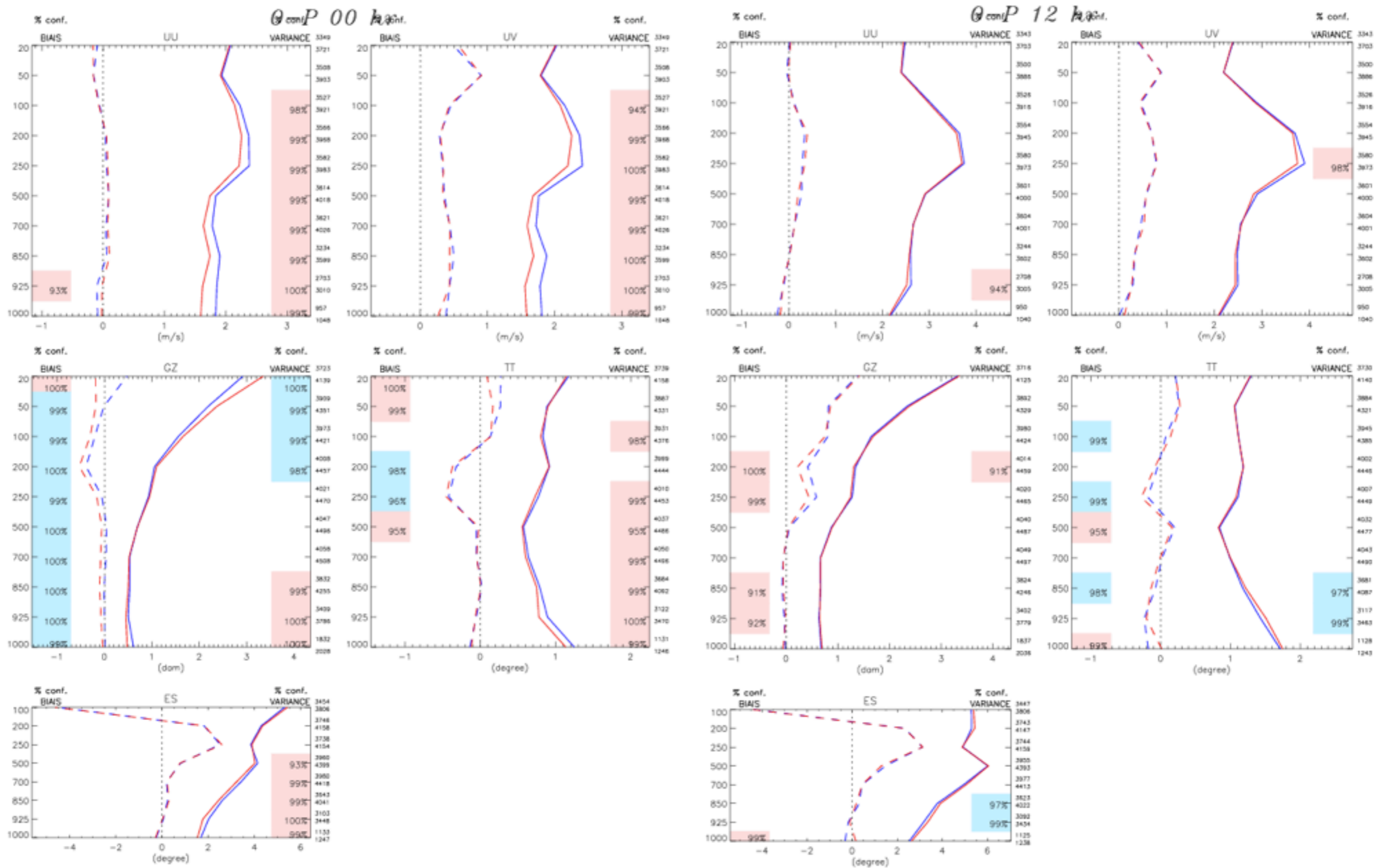


- Following the regional 4D-Var, no cycling is performed.
- Data assimilation for every 36 hours.
- No model parameter perturbation.

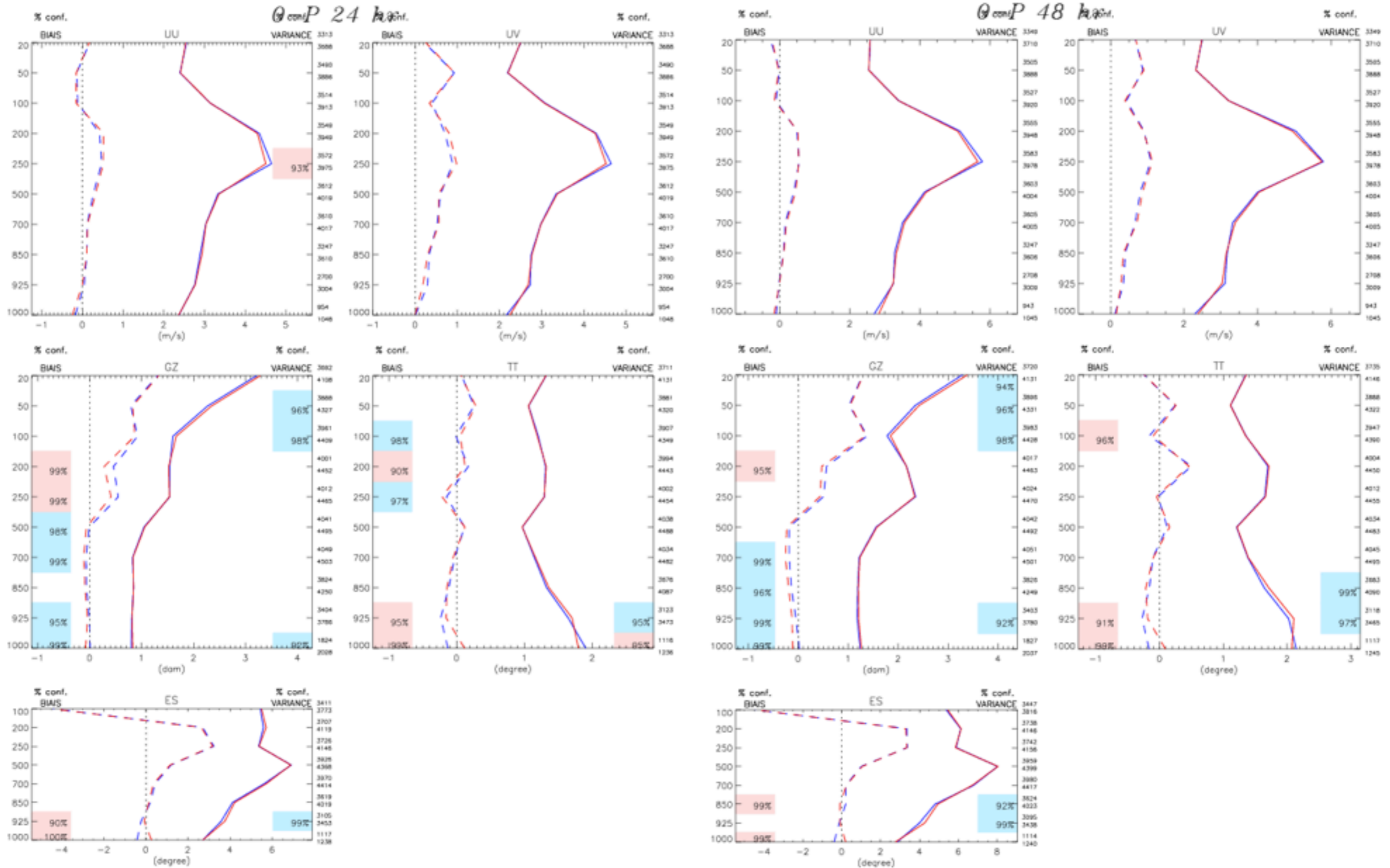
Comparison of 48 hour forecasts

- Perform the regional deterministic forecasts (GEM-15km) from two initial conditions for every 36 hours.
 1. Mean analysis from the regional ensemble Kalman filter.
 2. Mean analysis from the global ensemble Kalman filter.
- Verify against radiosonde observations every 12 hours.

Global EnKF .vs. Regional EnKF (0H, 12H)



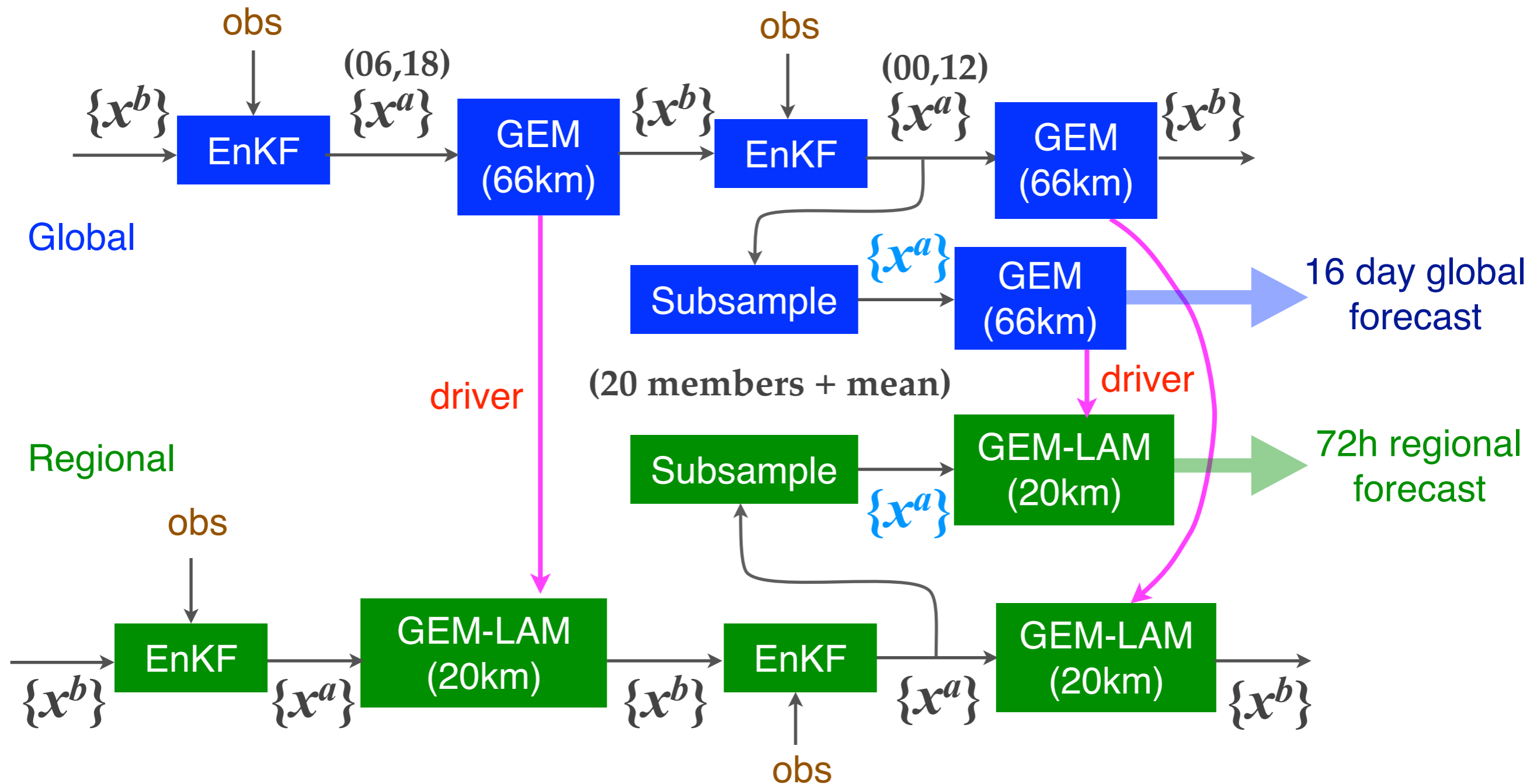
Global EnKF .vs. Regional EnKF (24H, 48H)



Experiment summary

- The global EnKF is ported to the regional EnKF with little efforts.
- Regional ensemble mean produces 48 hour deterministic forecast as comparable as the global mean.
- Computational cost of the regional EnKF is acceptable for the operational use.

Synchronous coupled EnKF: Global and Regional



- Bias correction from global 4D-Var.
- Background check from global and regional 4D-Var.

Future work

- Localization distance adjustment.
 - Flow dependent covariance localization.
- Observation density: reduced data thinning.
- Higher vertical resolution.
- Perturbations from the regional covariance.
- Model parameter perturbation.
- Background check and bias correction.
- It can be beneficial to share the main algorithm between the global and regional EnKF.