Making OOPS easier to use for new systems

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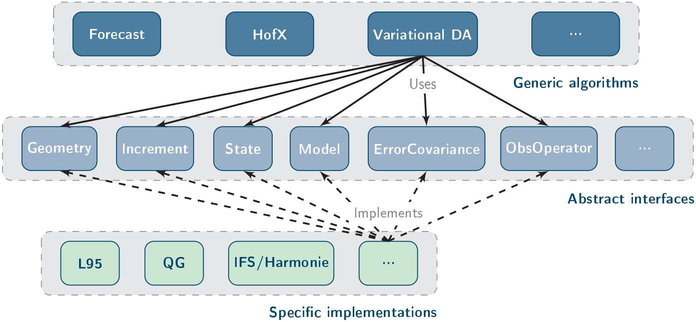
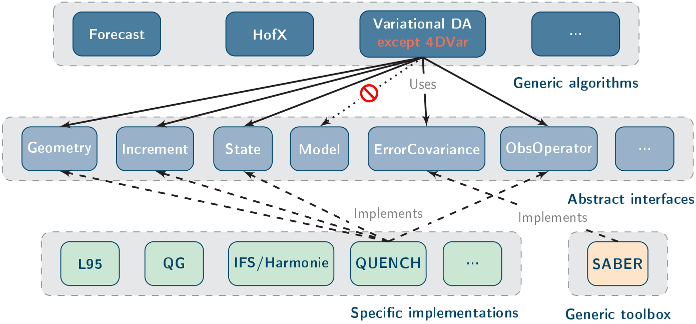
OOPS design: separation of concerns



- Main advantage: any new feature added at the generic algorithms level is immediately available for all the models.
- Main drawback: writing new specific implementations to interface an existing system with OOPS can take a lot of time, up to a decade (IFS/Harmonie).

The QUENCH model



- Generic geometry and fields based on ATLAS.
- Generic background error covariance with SABER.
- No time propagation: 3D-Var, 3D-EnVar and 4D-EnVar only.
- Main advantage: QUENCH is generic and can be used for many systems and various grids (e.g. land surface, ocean).
- Main drawback: 4DVar is not available.

More about QUENCH

QUENCH characteristics:

- Written in C++ ($\sim$ 5,700 lines), MPI parallelization.
- Based on ATLAS for geometry and fields (Fortran interface).
- Can handle masks, vertically staggered grids, orography, etc.
- Already available by default:
  - NetCDF I/O for background and observations files.
  - Bilinear interpolation for the observation operator.

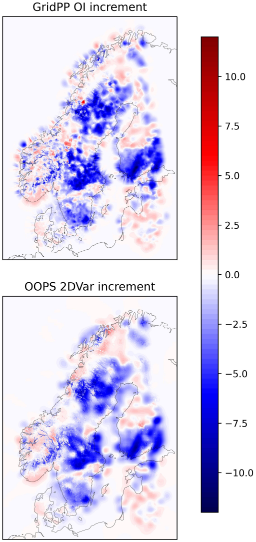
Newcomer TODO list:

- Optionally add your I/O class for background and observations.
- Optionally implement your observation operator (+TL/AD).
- Create a background error covariance matrix using the multiple options of the SABER library.
- Adapt the json configuration file for your geometry, your files paths, etc.

Test case: high-resolution surface temperature analysis

Preliminary comparison of the GridPP OI and OOPS 2DVar:

- Background: 2m temperature MEPS forecast downscaled at 1km resolution with GridPP.
- Observations: Netatmo surface network, 50 times denser than the usual networks.
- 2DVar background error covariance based on SABER (next slide).
- Local diagnostic of standard-deviation and horizontal length-scale based on the Hollingsworth-Lönnberg method.
- Similar analysis RMSE with respect to control observations.

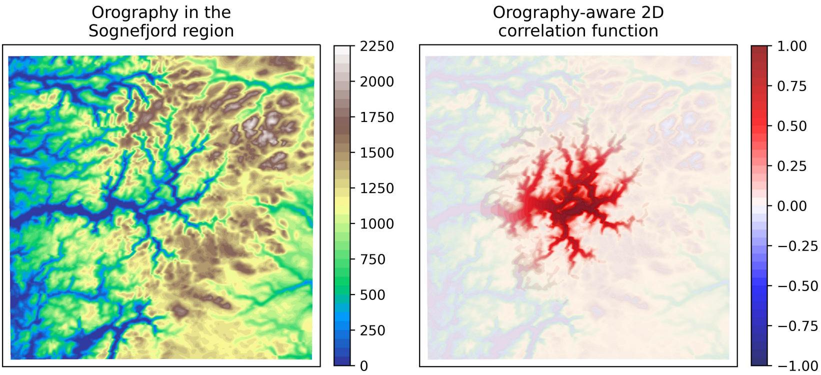


T increments (K)

Details about background error covariance

Background error covariance based on SABER:

- Locally varying standard-deviation.
- Orography-aware inhomogeneous 2D correlation.



Dirac test with the orography-aware 2D correlation function

Conclusions and future work

Conclusions:

- The QUENCH model enables a purely file-based use of OOPS for existing systems, without requiring a time-consuming development of interfaces.
- It can achieve good performances using the SABER library for background error covariance.

Future work:

- Testing 2DEnVar for surface T/q.
- Testing new systems.
- Including more complex observations.
- Exploring coupled DA, by combining IFS/Harmonie and QUENCH at the OOPS interface level.