Exercises – diagnostics in DA

Exercise 1: Spinup diagnostics

- The goal of this exercise is to diagnose spinup by observing the evolution of **mean surface pressure tendencies** in the forecast, depending on the initialization type.

- The sample environment is located on cca - go to $SCRATCH or $PERM and copy

  cp -r /perm/ms/spsehlam/hlam/daTraining/Day_5/sample_echkevo_alaro .

- The forecast can be run using the script forecast_echkevo.
- *cd scr_fc; qsub forecast_eckevo*
- After a successful execution, the file ICMSHe${LABEL}CHKOUT2 should appear data/output_fc/, along with the integration log file
- See the README file for explanation of the method.

Exercise 1: Spinup diagnostics

- The forecast should be repeated 4 times, with different values of LABEL parameter (script *echkevo_forecast*).

```
case $LABEL in
  SCC)
    # space consistency coupling (analysis = LBC0)
    cp $DIR/data/input_fc/${YYYY}${MM}${DD}${NT}_analysis ICMSHALADINIT
    rm -f ELSCFALADALBC000
    ln -s ICMSHALADINIT ELSCFALADALBC000
    NAMELIST=$DIR/namelist/morgane.namel
    ;;
  TCC)
    cp $DIR/data/input_fc/${YYYY}${MM}${DD}${NT}_analysis ICMSHALADINIT
    NAMELIST=$DIR/namelist/morgane.namel
    ;;
  DFI)
    NAMELIST=$DIR/namelist/morgane.namel.DFI
    ln -s ELSCFALADALBC000 ICMSHALADINIT
    ;;
  DYN)
    NAMELIST=$DIR/namelist/morgane.namel.NODFI
    ln -s ELSCFALADALBC000 ICMSHALADINIT
    ;;
```

Analysis: space-consistent coupling

Analysis: time-consistent coupling

Downscaling with DFI initialization

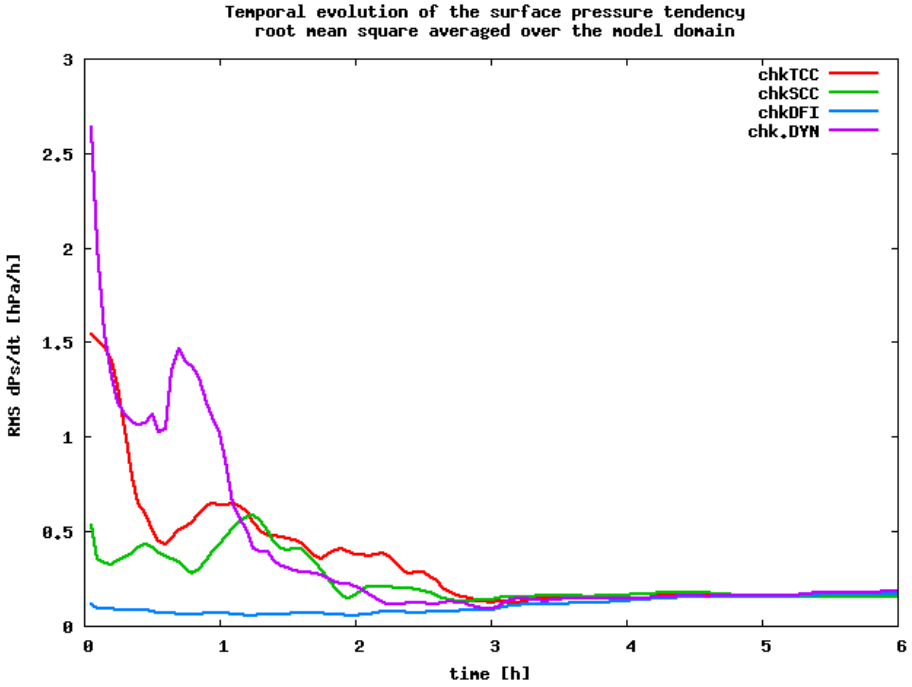
Downscaling without initialization

Exercise 1: Spinup diagnostics

- Plot the results by running the reading and plotting script located in bin directory.

  ./read_chkevo_pstend.pl ../data/output_fc/ICMSHeDFICHKOUT2 > DFI.dat

  ../plot_pstend.sh DYN.dat DFI.dat TCC.dat SCC.dat



Exercise 2: Perturbing observations

- The goal of this exercise is to learn how to perform offline **perturbation of observations** and diagnose the resulting ODB.
- On cca: go to $SCRATCH or $PERM and get the sample package

  cp -r /perm/ms/spsehlam/hlam/daTraining/Day_5/sample_dfs .
- See the README file.
- Run the script prep_perturbed_ccma.sh:

  cd scr; qsub prep_perturbed_ccma.sh

Exercise 2: Perturbing observations

- Exercise: Query the resulting perturbed CCMA ODB (located in ../data/output) for experiment OSE140CMOSE1

  cd data/output/OSE140CM/

  module load odb; *odbsql -q "select obsvalue, obs_error from hdr, body, errstat where varno=39 and obstype=1" -o ccma_perturbed.dat*

  and compare it to the original unperturbed CCMA, which is located in

  /perm/ms/spsehlam/hlam/daTraining/data/odb/OSE140CM/2018030100/odb_ccma/CCMA_unpert/

- Use

Exercise 3: DFS

- Purpose: To learn how to compute **DFS** and how to interprete results
- Execute the DFS computation by running:

  cd scr; ./run_dfs.sh

  This prepares the DFS for 2 experiments and 4 network times (the minimizations with perturbed observations were computed in advance).
- Execute the aggregation and plotting of DFS:

  module load R; Rscript visualize_dfs.R
- Check the plots dfs_plot_total.ps, dfs_evolution_${EXPNAME}.png by using e.g. using gv and eog.
- Questions: What is the main difference between the two experiments? Which obs. types and variables have the greatest impact on the analysis? Which obs. types are the most valuable for the analysis?

Exercise 4: DFS - Conventional vs. remote sensed obs.

- Modify the DFS computation program located in *src/dfscomp.F90* in order to compute the total DFS for conventional (SYNOP, AMDAR, TEMP) and remote-sensed observations (AMSU, IASI, SCATT, AMV,..).

  Hint: replace IF statements for different observations in a way that obstypes 1,2,4,5,6 get IIND=1 and the others get IIND=2.

- Compile the modified program:
  - module load gcc; gfortran *dfscomp.F90 -o dfstot.x*

  and rerun the dfs computation with this new executable. See and plot the output DFSs in *data/output/*. It now contains two columns, first for conventional, second for remote-sensed observation (labels on plot are wrong unless one modified the R script).

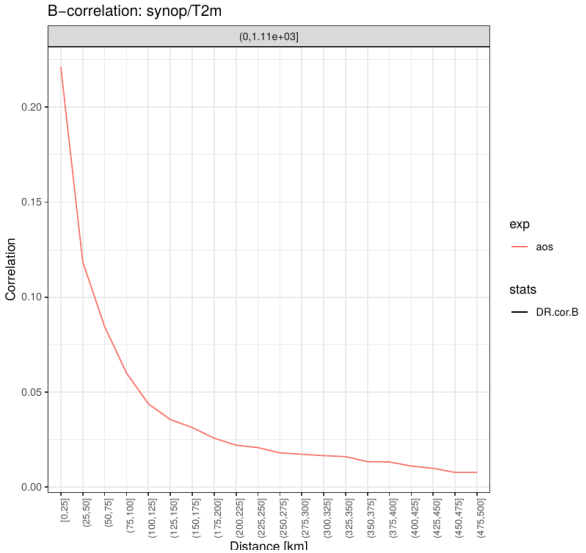
- Question: Which observations have larger impact and which are individually more valuable in the analysis?

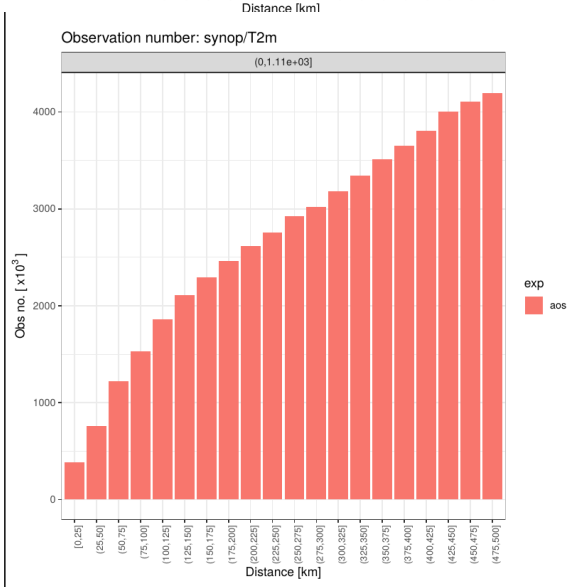
Exercise 5: ObsTool

- Purpose: To diagnose B and R correlations using **covariances of residuals**.
- On cca: go to $SCRATCH or $PERM and copy

  cp -r /perm/ms/spsehlam/hlam/daTraining/Day_5/sample_obstool .
- See and follow the two READMEs files.
- Check the setup file profile.h to check the dates.
- Run the diagnostics:

  ./start.sh





Exercise 5: ObsTool

- Run the obs. tool on experiment aos, period 2018080100 - 2018081006, analysis every 3 hour (no need to extract ODBs as this is done in advance). Try to shorten or extend the period of diagnostics (profile.h). Please keep LPREP=FALSE as the (re)computation of covariances is very demanding.
- Examine the generated pdf plots for SYNOP, AMDAR and TEMP, which show diagnosed R and B as a function of distance. See also the data counts to determine where the diagnosis is relevant. Determine the minimal thinning distance for AMDAR and SYNOP which needs to be applied if R is considered as spatially uncorrelated (usually we are safe at distance where correlation falls below 0.2).