Summary from discussion (end of DA session during ASW 2021)

1) Large scale information in deterministic DA. With approaches like LSMIX we are already including large scale information in the sampled B, so the resulting B is more like B~ as introduced by Ole (Roel). There is a need that for the B computation we provide as much as possible the inner model information as a proxy for true forecast error (Ole). In his first simple proposal a covariance matrix was modelled as a fraction of B, but one still needs a C matrix information to be more sophistically included in the proposed B~, for instance its vertical variation. Carlos arguments that VC addresses the same problem and invites others to try it.
2) The sub-hourly assimilation. There are plans at several places with rather defined time frame for its technical implementation (scripting system), but there are also still scientific concerns related to spin up and not using observation twice in case of overlapping windows. For instance, Carlos argues that the DA algorithms are not ready to cope with this short DA cycling and proposes to make use of VC he developed. Later on, the discussion touched the use of spectral nudging as a way to control the high-res DA system with larger scale information.
3) Roger plans to organize a dedicated working group to discuss this.
4) Experience with single precision in 4D-Var: Filip Vana explains that double precision was introduced to help with matrix inversions AD which need to be diagonally-dominant. It is doable but dangerous and was shown (for some part of code) that it provides additional noise and has detrimental impact on TL/AD identity accuracy which could hide other issues. SP will be used for trajectory runs and observation handling in ODB. There is currently no speed-up on Cray because of hacked Lapack library which uses double precision internally.
5) Need for non-hydrostatic DA: Filip asked Pierre about the non-hydrostatic increments in his presentation. Pierre answers that importance of it was studied only in one case with severe convection. EnVar is a good environment to evaluate different variables in the control vector.
6) Surface pressure vs. geopotential assimilation. So far little effect was shown (with Netatmo), but it is preferable to use pressure in combination with bias correction. The development is available but not yet in the common/export codes.

Other items that were tackled during presentations (but not specifically or substantially discussed)

1) Use of ensemble information in high-res DA? What are the recommendations for including flow dependent B (now in 3D-Var or later in EnVar). If operational ensemble systems can not be coupled with this as they contain too much large scales (Ulf's talk), how the EDA systems for assimilation should be

designed. What is the experience from MF with EnVar (e.g. resolution and setup of the EDA used with EnVar and ensemble size).

2) Bayesian inversion was proposed to be used for many observations (while for radar there are proposals to go beyond it). For applications including any type of derived precipitation (observed or radar-based rain rate, rain rate from microlinks), the currently anticipated solution is to use a standalone physics package (obs. operator) from P. Lopez (as done in Morocco and suggested by Claude) as observation operator (note that linear/adjoint is needed), which means a deviation from the model physics applied in the forecast step (much like in the current 4D-Var). What would be a long term solution for successful assimilation of “rain observations”?
3) Satellite DA: new ideas emerge on how to more optimally cycle VarBC and how to deal with biases in obs/model. One of the proposals was to fix the VarBC update time to network times which show a stable and good coverage for the given instrument.
4) At several occasions, the Desrozier's tuning was mentioned and applied. Do we need a better approach fort his, also knowing we have technical issues like SIGMAO_COEF obs. error tuning parameter differently applied to different obs. types, which can cause difficulty in interpretation and application of the tunings.
5) Correlated observations errors: it was shown through a single assimilation test that, at some extend, changing the thinning distance and inflation of the observation error provide similar results. This idea was suggested to be explored further when working with other high resolution observations like, for example, Netatmo or smartphone observations.