Surface data assimilation development divided into three main points:

- **Main scientific directions**
- **Main challenges**
- **Organisation ideas for discussion**

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… already shared with/commented by some colleagues in HIRLAM/ALADIN/LACE/SURFEX

Main scientific directions

Core:

Go for EKF/STAEKF to utilize observations beyond SYNOP (e.g. satellite products for soil moisture and SnowWaterEq, LAI) but also to allow utilisation of physics beyond force-restore and 1-layer snow. This development should be done in the SURFEX/ SODA framework. Activities already are ongoing within HIRLAM/ ALADIN/ LACE/ SURFEX.

Optional now but core on long term:

Go for EnKF! Two main reasons why it should be better than EKF:

- Easier because one avoids the assumption that the system is required to behave linearly and one avoids the sensitive choice of size of perturbations.
- Fits better with ENS activities. With EKF for the surface all atmospheric members are forced to relate to one single surface representation which is limiting the near-surface spread. Exactly where our high-resolution impact should be largest.

Long term optional:

Include the hydrological time scale by coupling to river discharge and hydrodynamic models. Hydrologist have shown that assimilation of observed river discharge can improve snow pack description. Requires EnKF!

Main challenges

New assimilation methods:

EKF/STAEKF methods are on its way but we still need to understand how they talk to new physics (SURFEXv8 explicit snow scheme and diffusion soil). EnKF methods are studied and looks promising but are still not well understood among most surface people. Particle filters...

Observation operators:

To utilize the full potential of satellite products we should apply observation operators. However, each observation operator is in principle unique to the representation of processes in the specific model setup and the adaptation of the operator requires quite some work. E.g. how are soil moisture and SnowWaterEq represented (layers, which prognostic variables, patches, vegetation).

Coupled model systems:

Coupling to river discharge/hydrodynamic models involves time scales on the order of days. How to find the initial condition for a NWP forecast? Combination of offline systems including the long term time scales (snow, deep soil, vegetation, river discharge, lake/river levels) with short term NWP system.

Organisation ideas for discussion

… to find well defined sub-groups with a suitable number of people connected to each group.

One consortia-wide coordinator each for

- surface physics development on NWP time scale including parameter optimisation and identification/elimination of systematic biases. Coordinated in tight collaboration with the offline SURFEX community, especially the SURFEX team at Météo-France and the SURFEX Steering Committee. Coordination with the climate modelling community would be beneficial.

- physiography development: coordination of (i) solving errors/issues in currently used physiography and (ii) national high-resolution data sets.

- for surface data assimilation where satellite products and development of observation operators is coordinated in collaboration with surface physics and atmospheric assimilation teams.

One consortia-wide coordinator for optional collaboration

- development of hydrometeorological system including processes and assimilation methods on time scales of several days. Requires collaboration with the hydrological community.