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Configuration of sub-km Harmonie-nowcasting ensemble

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National weather services need to develop forecast capability for warning of rapidly developing, extreme weather events, latter are often with short life cycle and of small scales, such as cloud burst and thunderstorms. hence of limited predictability. From long term perspectives, an ensemble nowcasting with NWP-based high resolution forecast system maybe ideal due to many attractive potentials in modelling of weather features and assimilation of observation data. On the other hand, NWP-based nowcasting itself still faces many challenges, such as the contradiction between need to run nowcasting setup with sufficiently high resolution, rapid update for assimilation of high frequency observation, and the need for rapid and frequent delivery while keep computation cost affordable. Moisture spin up in connection with frequent assimilation of humidity-related observation is another important constraint, which affect the usefulness of fresh forecast with short lead-time. Further, the need to account for uncertainty in nowcasting range poses severe challenge due to expensive nature with usual ensemble forecast system.

At Danish Meteorological Institute, in connection with operationalisation of the COntinuous Mesoscale Ensemble Prediction System (COMEPS) during recent years, an operationally feasible ensemble generation method with use of overlapping assimilation window has been developed with success. With COMEPS approach, ensemble control and perturbation members are configured along consecutively shifted, partially overlapped time windows and launched continuously around clock, forming a sizable number of forecast ensembles by time lagging. Recently, in developing NWP-nowcasting for Denmark, a prototype type Harmonie-arome ensemble nowcasting system has been set up, with an aim to extend the basic COMEPS approach to a more frequent launch (e.g., from each half-hour to every 10 min), with 3DVAR assimilation of rapidly delivered radar, aircraft and surface data. Through time lagging, forecasts in the last 2 to 3 hours are put together to form nowcasting ensembles. With a target for a computationally efficient and feasible operational nowcasting system in Denmark, the Harmonie-arome model with grid resolution of 750 m has been selected, covering a limited domain centered around Denmark with forecast lead time up to 9h. In order to utilise more observations and benefit from frequent assimilation while limiting moisture spin-up, the assimilation window is set to be 1 to 2 hour, with use of shorter lead time forecast from adjacent suite as first guess in assimilation. Preliminary real time suites have shown some promising results. Presently, the ensemble nowcasting system are in development and evaluation, with a view for operational use in the future.