The following experiments were conducted:

- **Domain:**
  - System setup: (Harmonie-Arctic), which is a version of the operational regional NWP model at MET Norway.
  - Horizontal resolution: 2.5 km; Non-hydrostatic dynamic; Physical parametrisation: AROMEzoo-M; Assimilation strategy: 3-hourly cycling; Lateral boundary conditions: hourly ECMWF; Surface data assimilation: Optimum interpolation; Upper-air data assimilation: 3D-Var, Background error statistics computed as mean over 4 seasons.

- **Tested observations:**
  - Surface (SYNOP, DRIUS, Radiosondes, Aircraft, ATOVS (AMSU-A, AMSU-B/MHS) and IASI.

The experimental AROME-Arctic domain with all conventional observations in. This is a case of 12 UTC, December 2013.

### Observing System Experiments (OSE)

**System setup:** (Harmonie cycle 3841 P)
- Domain: 754990 grid points; Horizontal resolution: 2.5 km; Model level definition: 55-طعم
- Non-hydrostatic dynamic; Physical parametrisation: AROMEzoo-M; Assimilation strategy: 3-hourly cycling; Lateral boundary conditions: hourly ECMWF; Surface data assimilation: Optimum interpolation; Upper-air data assimilation: 3D-Var, Background error statistics computed as mean over 4 seasons.

**Tested observations:**
- Radiance assimilation:
  - AMSU-A: 13 channels; AMSU-B/MHS: Channels 3-5.
  - IASI: 65 active channels.
  - IASI: 65 active channels.
  - AMSU-A: Channels 5-10; AMSU-B/MHS: Channels 3-5.
  - AMSU-A: Channels 5-10; AMSU-B/MHS: Channels 3-5.
  - AMSU-B/MHS: Channels 3-5.

- Surface (SYNOP, DRIUS, Radiosondes, Aircraft, ATOVS (AMSU-A, AMSU-B/MHS) and IASI.

- Impact of adding DRIBU stations:
  - Comparing 4x vs 3x more
  - Comparing 3x vs 2x more
  - Impact of 2x more DRIBU

Sensitivity of the AROME-Arctic analyses to the observations using Degrees of Freedom for Signals (DFS) (Chapnik et al, 2006) (left) and the sensitivity of the forecast model to the observations (right) using modified total energy norm (MTEN) (Storto and Randriamampiana, 2010)

### Impact of radiances on the AROME-Arctic forecasts comparison against radiosonde observations

**Impact of 4 launches of radiosonde per day**
- Impact on geopotential, significant up to 9 hours
- Impact on humidity, significant up to 24 hours

**Impact of at least 2 launches of radiosonde per day**
- Impact on geopotential, but still significant impact on humidity (not shown)

**Concluding remarks – OSSE**
- Reducing by ~90% the simulated observational error, we could get comparable observations to the real data.
- Providing at least twice (x 2) or at least three times (x 3) measurements of the same point significantly improves the forecast of humidity; Providing at least 2 launches (16 RS more) per day at the existing radiosonde stations have significant impact on AROME forecasts.
- Using about 45 Buoys provides good coverage of studied domain with significant positive impact on the AROME forecasts; Overall roughly 24 (x3) Buoys seems to be optimal for the study domain.
- The impact of having more BUOYS is positive but less than that of three times more

**References**