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Improved in-situ observations and usage for ERA6

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References

<https://doi.org/10.5281/zenodo.13747457>

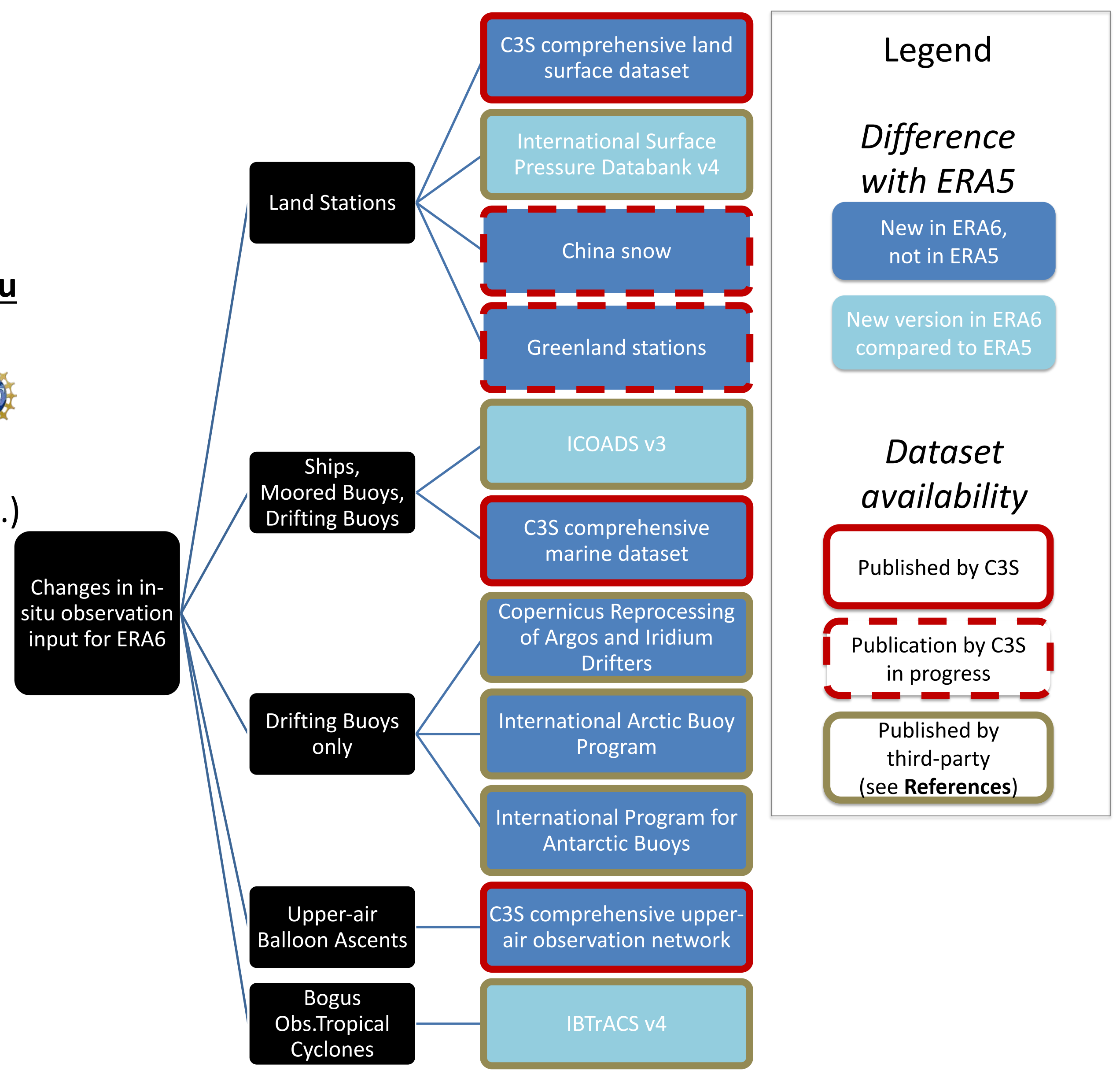
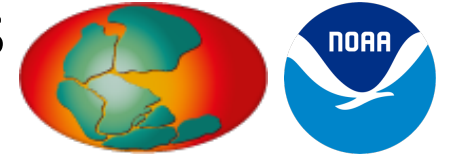


Motivation

Improve the quality and quantity of observations available to ERA6 and others for climate activities

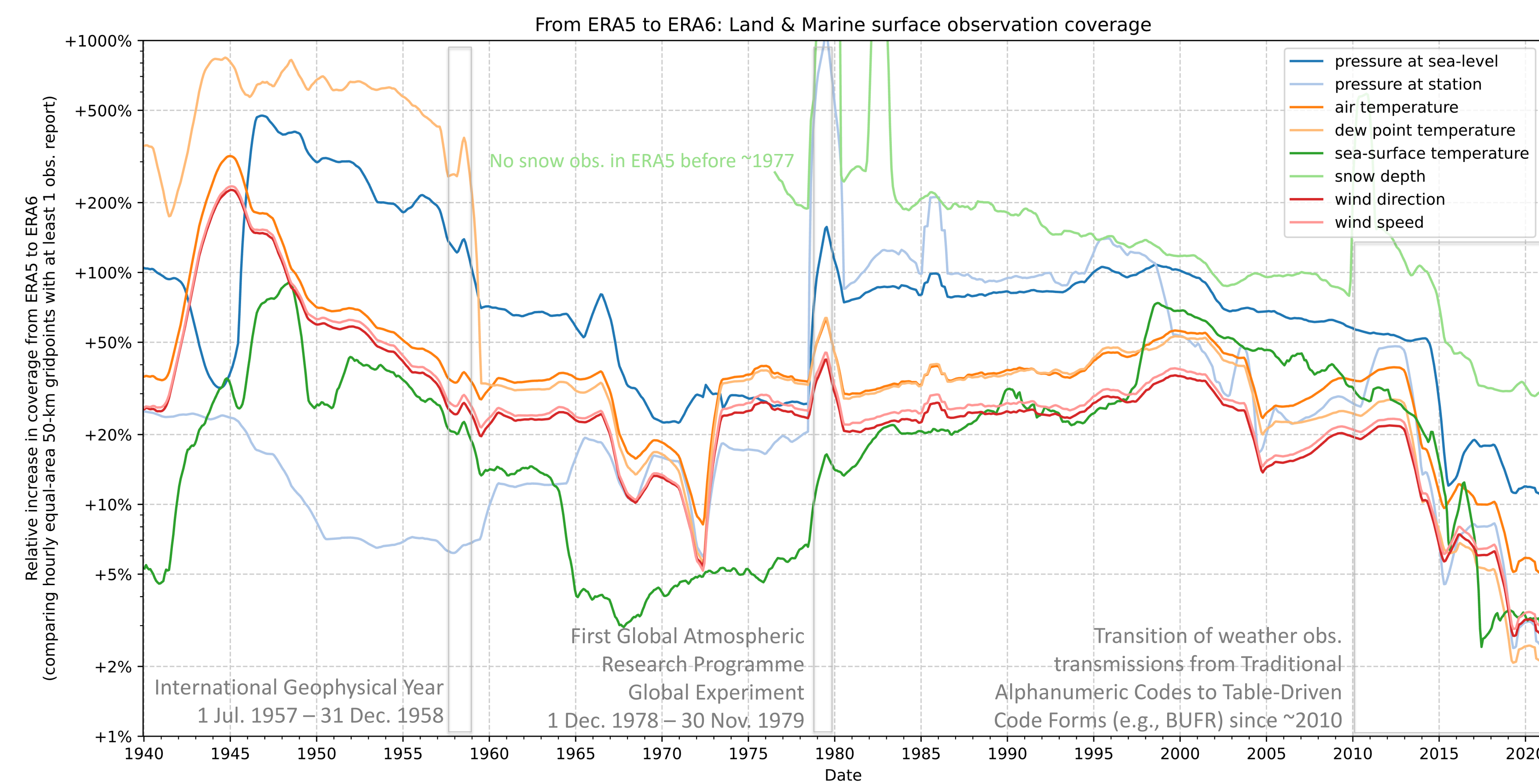
Approach

- Contract out in situ data rescue & reprocessing activities
 - Target components of the observing system that have a large impact on reanalysis quality and require the most attention: **upper-air** and **surface land & marine**
 - Tag each record with provenance, data policy, and quality control flag
 - Publish resulting datasets on Climate Data Store: <https://cds.climate.copernicus.eu>
- Advocate assistance for 3rd-party data rescue & reprocessing activities
- Acquire already-published 3rd-party observation datasets
- Merge observation datasets for climate reanalysis
 - Apply dataset-provided quality controls
 - Reconcile station data records with metadata when possible (anemometer height...)
 - Verify land station/moored buoy positions for gross errors or coordinate sign error
 - Identify duplicates and form/retain 'best available' profile (upper-air balloon ascents) or monthly trajectory (drifting buoys) or single record within the assimilation (duplicate check)
 - Encode observations into state-of-the-art format required by ECMWF Integrated Forecasting System (IFS): WMO BUFR, with special provisions to allow for tracing provenance and balloon drift trajectory plus provider-suggested bias corrections
 - Carry out data assimilation experiments, archive the observation feedback
 - Report issues found to datasets providers (1) to (3), iterating with (1)-(2)
 - Measure quantity improvement using simple coverage metrics
 - Measure quality improvement using standard data assimilation metrics
 - Document procedures and findings



Surface observations coverage

Metrics: Relative change from ERA5 to ERA6 in the number of gridpoints with at least one report, for a given observable, at hourly 50-km resolution (equal-area grid).



Observing System Experiment

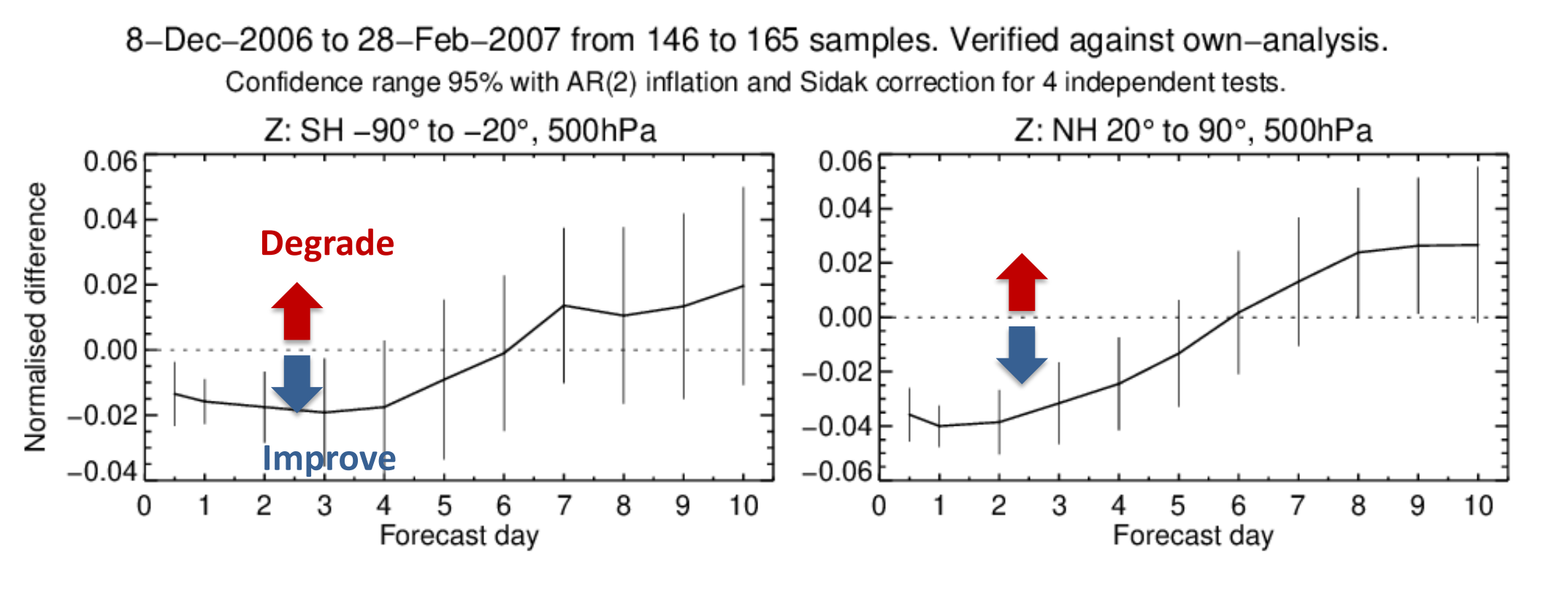
'Control': IFS cy49r2_v3, Tco399 (~28 km), 137 levels.

01 Dec 2006 – 28 Feb 2007

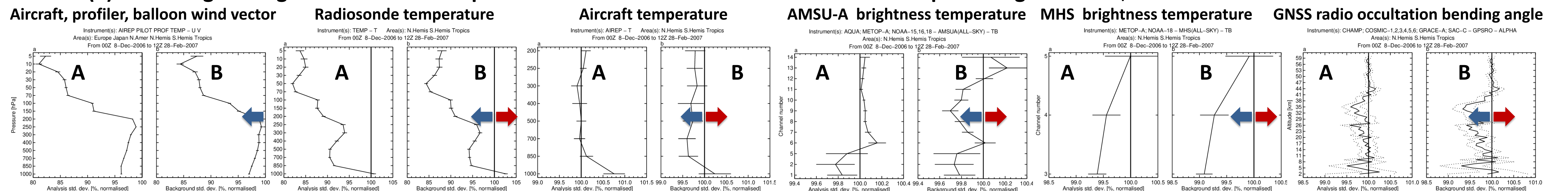
'C3SInSitu': adds the observations above.

- Land surface & marine surface:**
A duplicate check is made, per record basis, at 0.15°x0.15° in each 4D-Var timeslot (30 minutes here)
- Upper-air balloon ascents:**
New observations are used *instead of* those used in the Control. Bias corrections suggested by the data provider are applied before assimilation.

Metrics (1) Relative change in 10-day forecast Z500 RMSE.



Metrics (2) Percentage change in observation departure standard deviation due to in-situ obs. input changes – After / Before assimilation.



Status as of October 2024. Additional observations may be acquired before ERA6 production starts.