Anomaly assimilation of hydrographic profile data with the Norwegian Climate Prediction Model (NorCPM)

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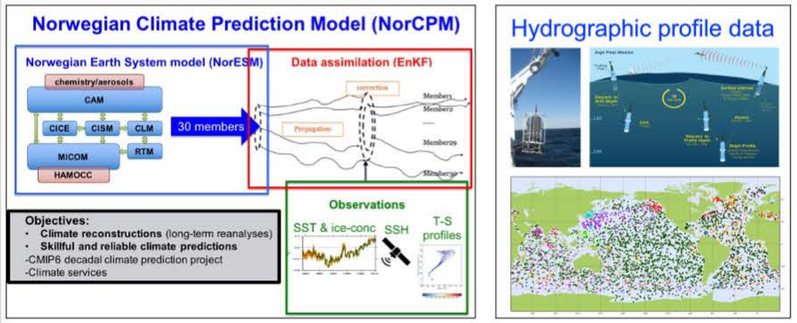
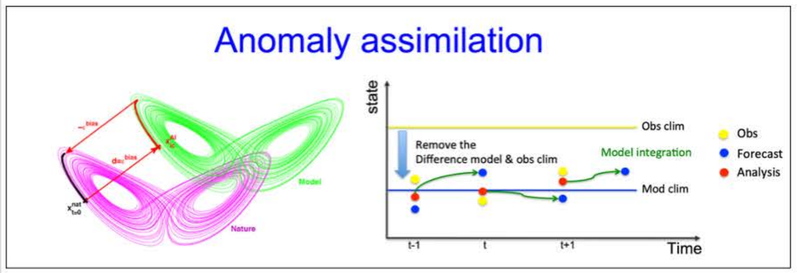
Introduction





Profile anomaly assimilation is **challenging**:
- Large uncertainty in the observed climatology due to sparse and inhomogenously distributed observations
- Rely on Objective Analysis (heavy post-processing of the data)

Experiments

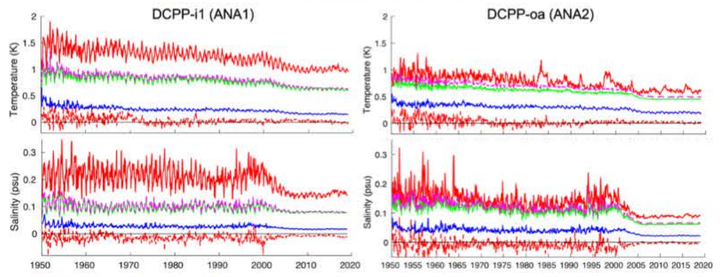
- NorCPM1 CMIP6 DCPP-i1 (assim-i1, ANA1 and HIN1):
  - ✅ EnKF (advanced)
  - ❌ Inconsistence between data and its climatology
- DCPP-oa similar to DCPP-i1, but with assimilation of EN4 objective analysis near observation locations (assim-oa, ANA2 and HIN2):
  - ❌ Optimal interpolation (simple)
  - ✅ Consistence between data and its climatology
- Reanalysis: monthly anomaly assimilation (AA) with 30 ensemble members over 1950-2018
- Hindcast: decadal hindcast with 10 ensemble members starting from each November over 1960-2018

Reference

Bethke, I., et al.: NorCPM1 and its contribution to CMIP6 DCPP, Geosci. Model Dev. Discuss. https://doi.org/10.5194/gmd-2021-91, 2021.

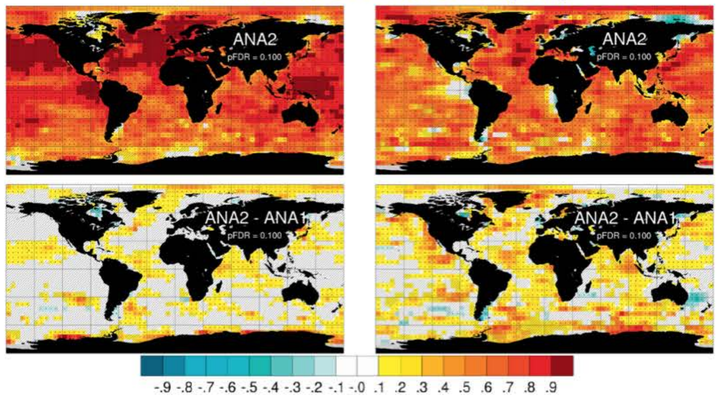
Reanalysis validations

Global assimilation statistics

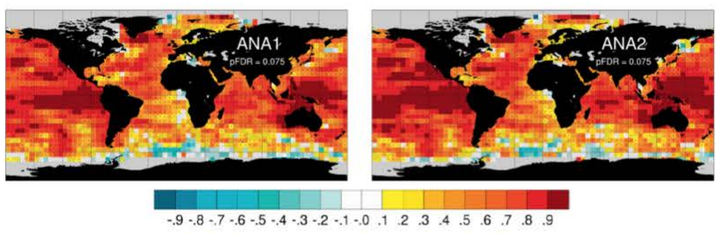


RMSE, mod spread, obs uncertainty, model spread + obs uncertainty

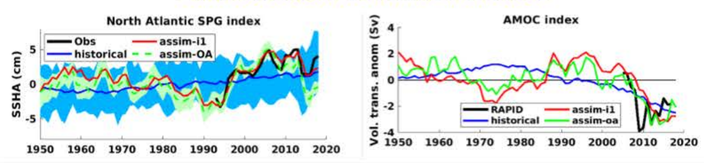
Validation for T300 and S300 (EN4)



Detrended SSH ACC

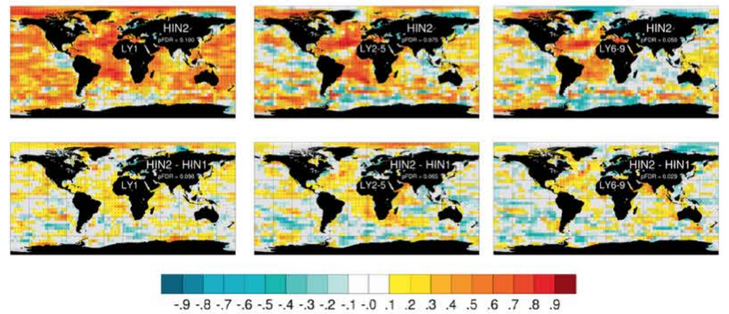


Atlantic ocean circulation indices

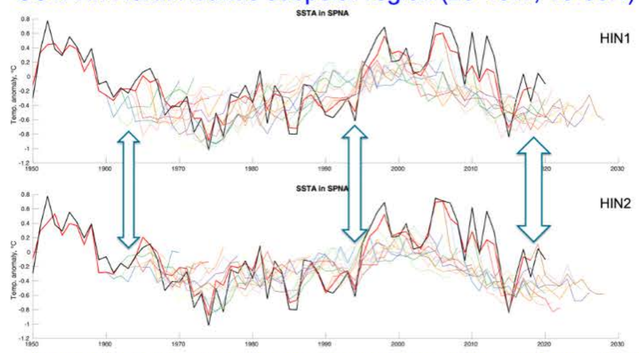


Hindcast validations

S300 prediction skill (with trend)



SSTA in North Atlantic subpolar region (20-45W, 45-60N)



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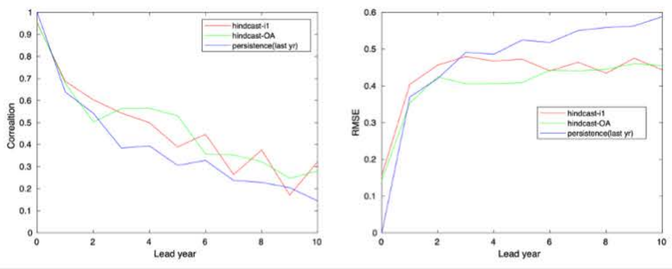

Conclusions

- More reliable performance in terms of assimilation statistics and more realistic variability in heat content, salt content and SSH, poorer agreement with observed AMOC after 2014
- Enhance the prediction skill of salt content up to 6-9 lead years
- Enhance the prediction skill of SSTA in the North Atlantic subpolar region