


Multiyear predictability of extratropical North Atlantic sea surface temperatures (SST) in hindcasts initialized with wind stress anomalies

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HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES



Can we use observed wind stress anomalies to push the model into a state close enough to reality to make skilful SST predictions?



"Initialization runs" with prescribed wind stress anomalies (from ERA-interim)



Initialized hindcasts (predictions) – no prescribed wind stress

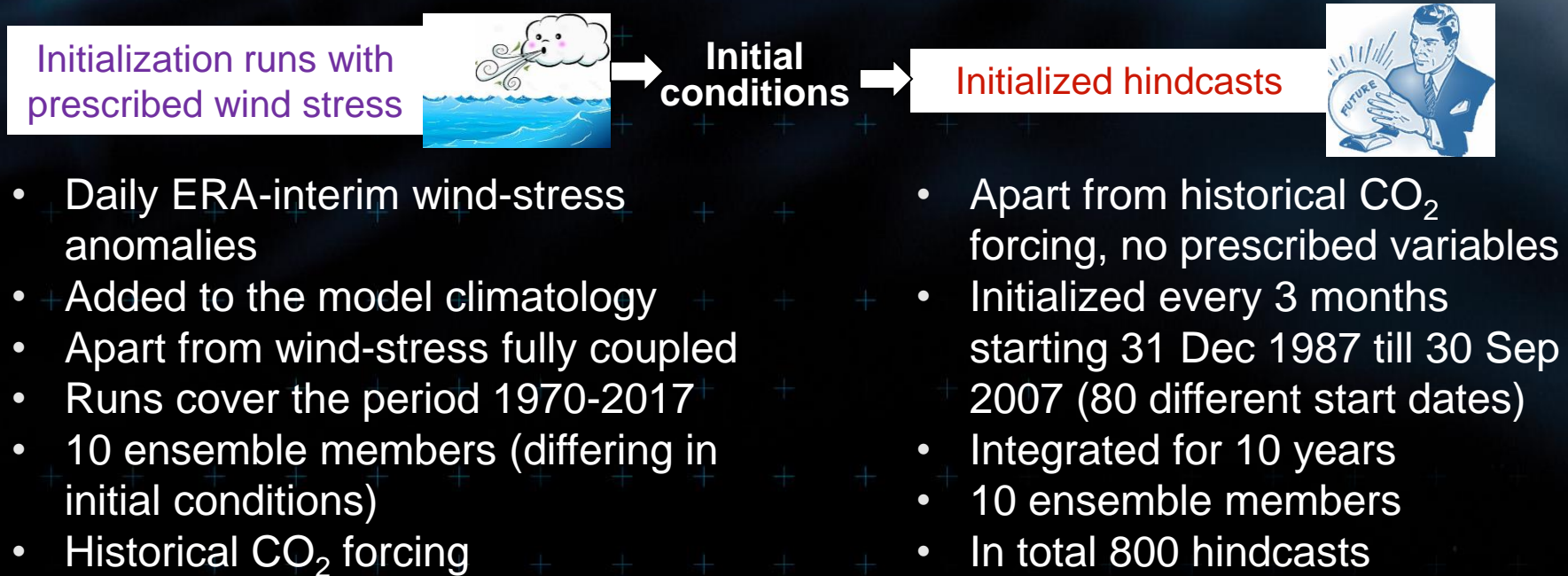


Initial conditions

Boundary condition: Historical CO₂ forcing

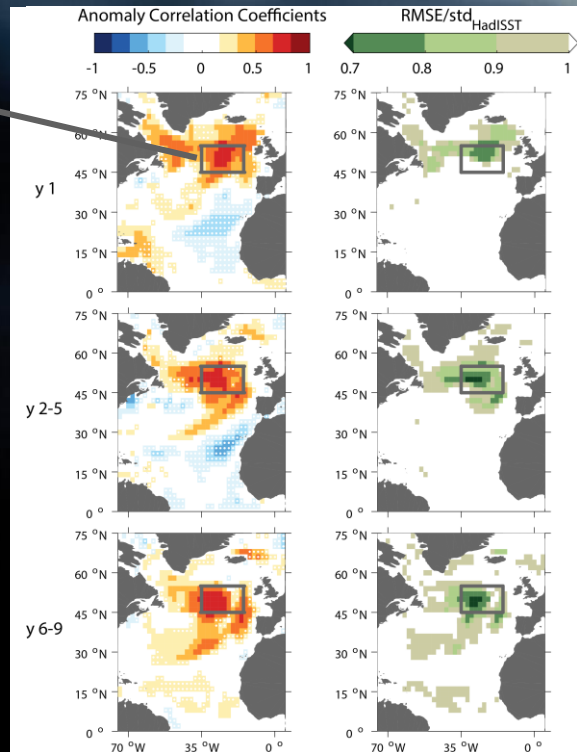
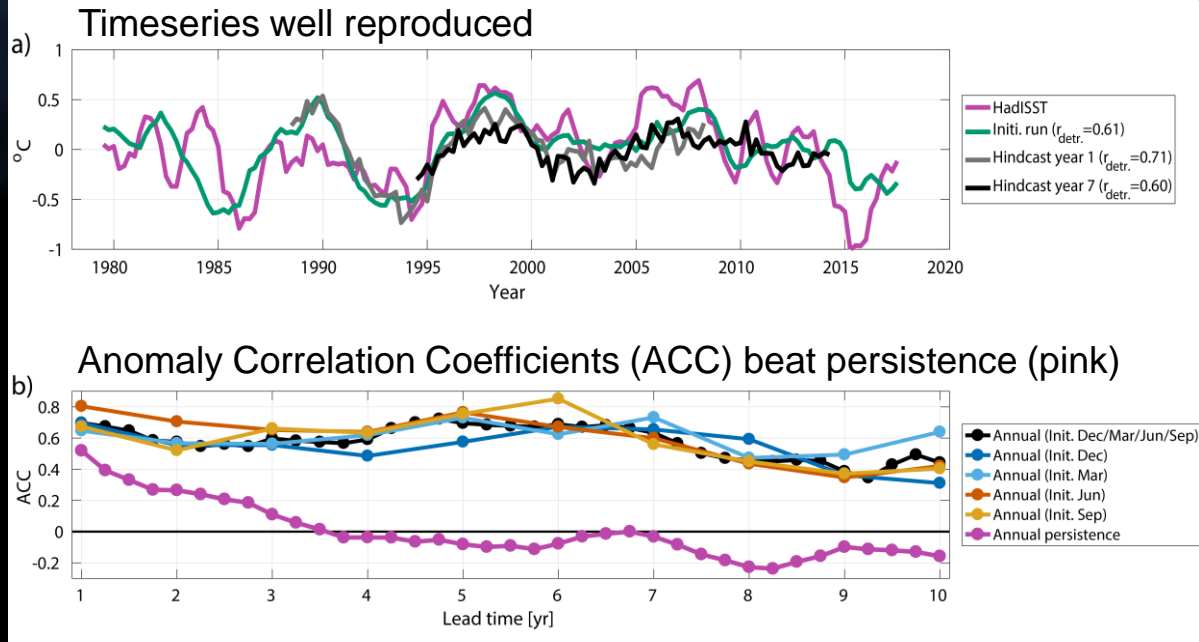
Kiel Climate Model *(Park et al. 2009)*

- Atmospheric component: ECHAM5, T42 (~2.8°) horizontally, 19 vertical levels
- Ocean-sea ice component: NEMO, ~2° horizontally, 31 vertical levels



Significant skill of the hindcast ensemble-mean to predict annual SST anomalies in the extratropical North Atlantic several years ahead

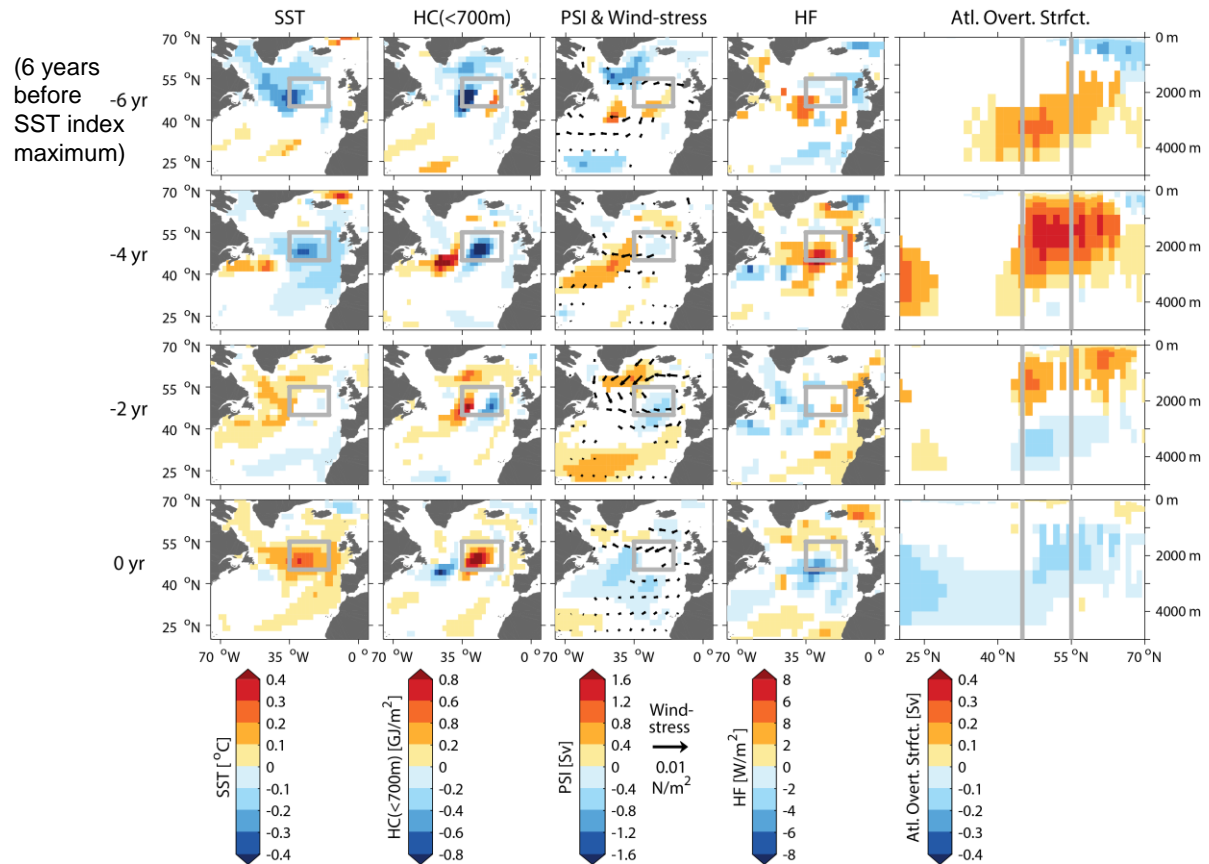
SST index (averaged over the grey box)



Wind-driven ocean dynamics are the source for this predictive skill

- Wind-driven response of PSI (barotropic streamfunction) causes subsurface heat (HC<700m) build-up
- Heat further maintained by circulation and moving eastward over several years
- HF (heat flux, defined downward) is only damping SST anomalies

Ensemble-mean hindcast regressions onto the SST index (box)



Schematic mechanism

