Opposite responses of the dry and moist eddy heat transport into the Arctic in the PAMIP experiments

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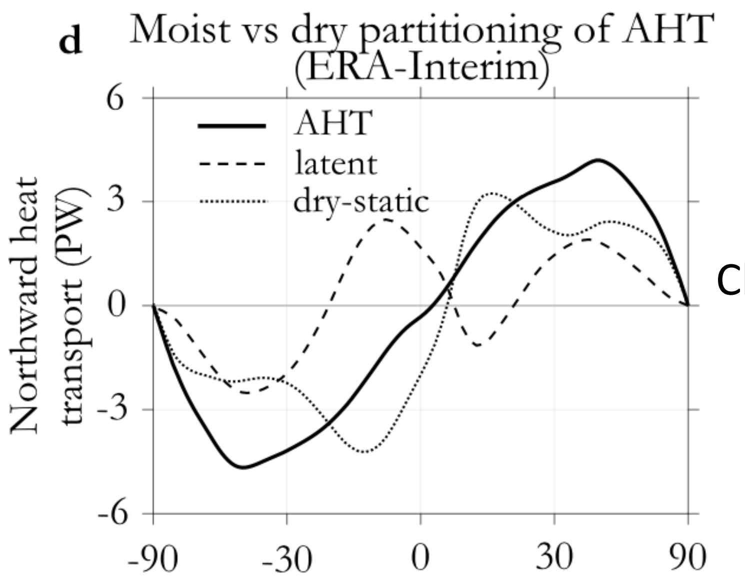
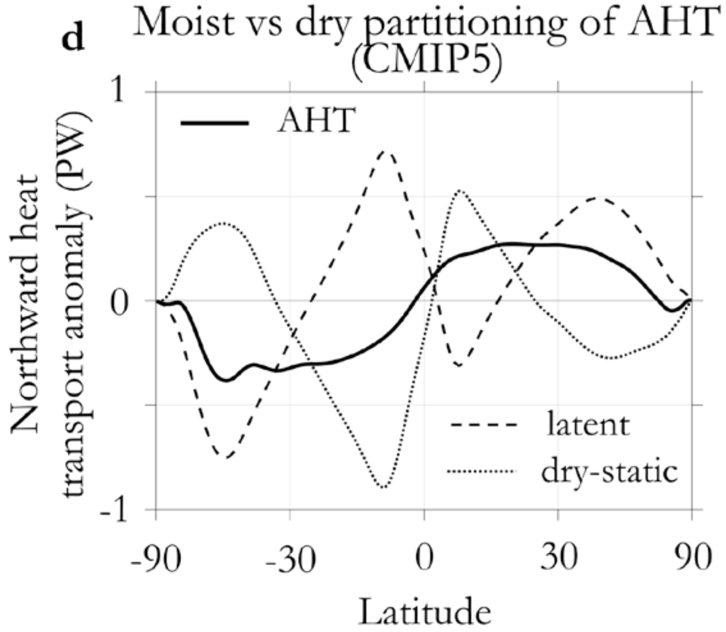
Atmospheric heat transport and eddies

- Heat transport is needed to compensate for the differential heating between the poles and the equator.
- The larger part of this is done by **transient eddies** that arise from baroclinic instability.
- Large cancellation between dry and moist energy transport into the Arctic

Atmospheric heat transport



Climatology



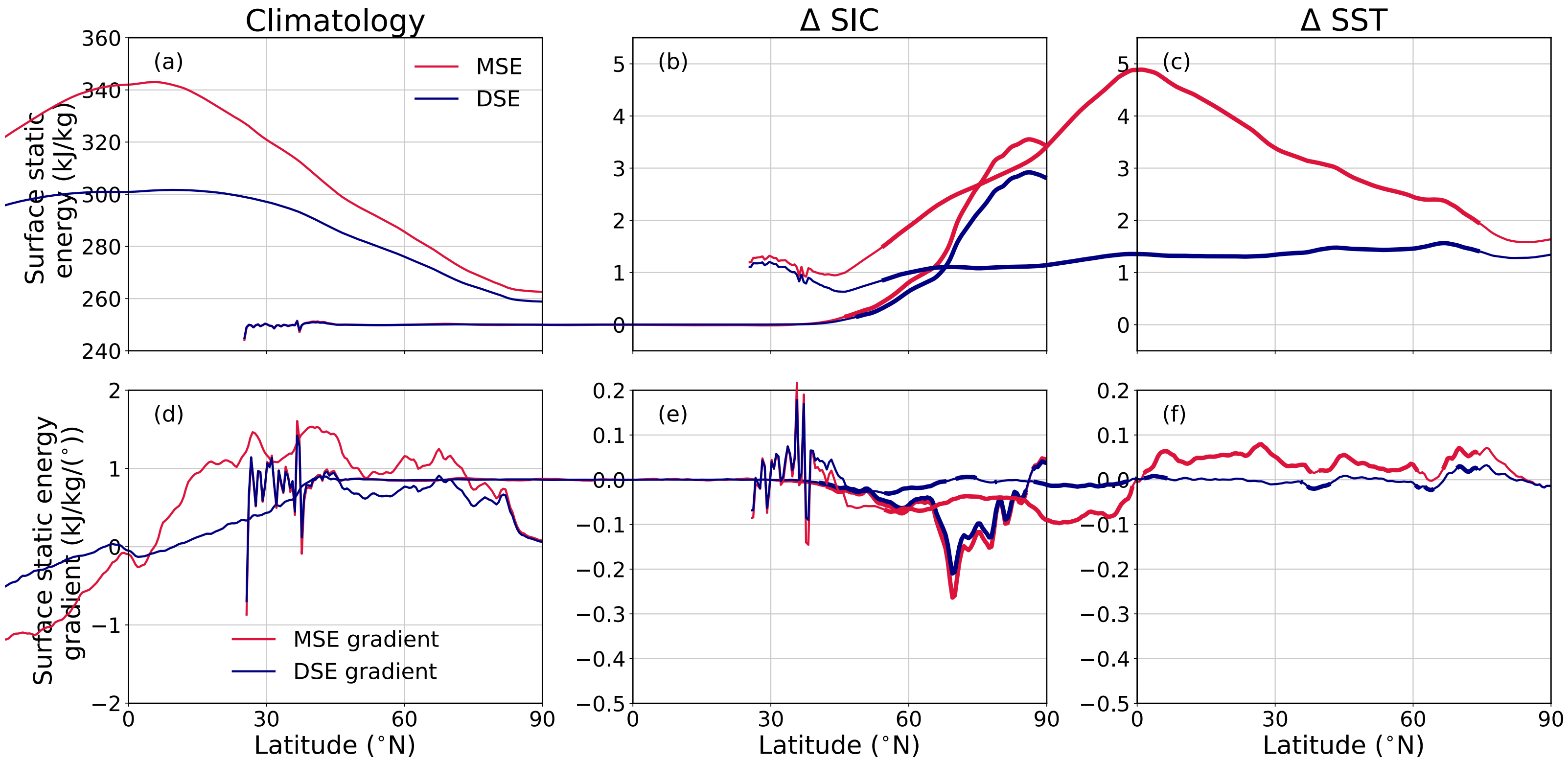
Model response to GHG forcing

Armour et al. 2019

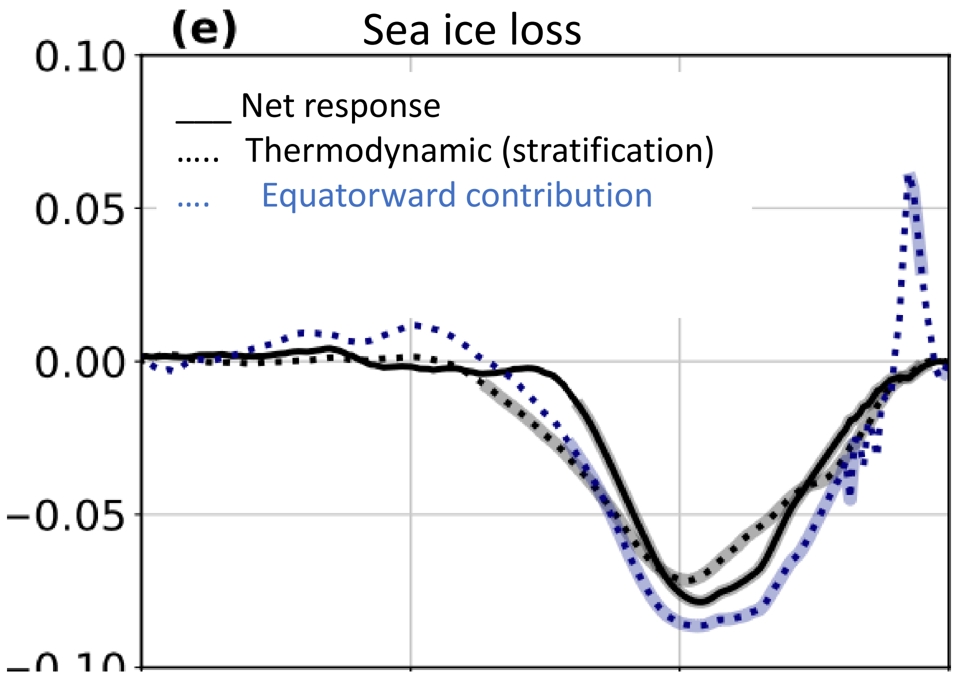
Wallace and Hobbs (2006)

Surface response to the PAMIP forcings

- Weakening of the MSE gradient in ΔSIC
- Strengthening of the MSE gradient in ΔSST
- Previous work has shown a strong relationship between the MSE gradient and the eddy poleward heat transport. (eg. Armour et al. 2019, Shaw et al. 2018)



Dynamical and thermodynamic responses of the PHT response



Ocean warming

____ Net response
..... Thermodynamic (stratification)
•-• Dynamical (mass flux)

Conclusions

- DoE E3SM and other PAMIP results show very consistent partitioning in MSE transport, thermodynamic, and dynamic responses.
  - Sea ice loss warms the equatorward branch of the circulation, SST warming drives strong poleward mass fluxes.
- The meridional structure of the response to sea surface warming remains intriguing.
- This is all within a fixed SST framework – long coupled runs with clean comparisons are current challenge.