Decoding Hosing and Heating Roles in a Warming Climate

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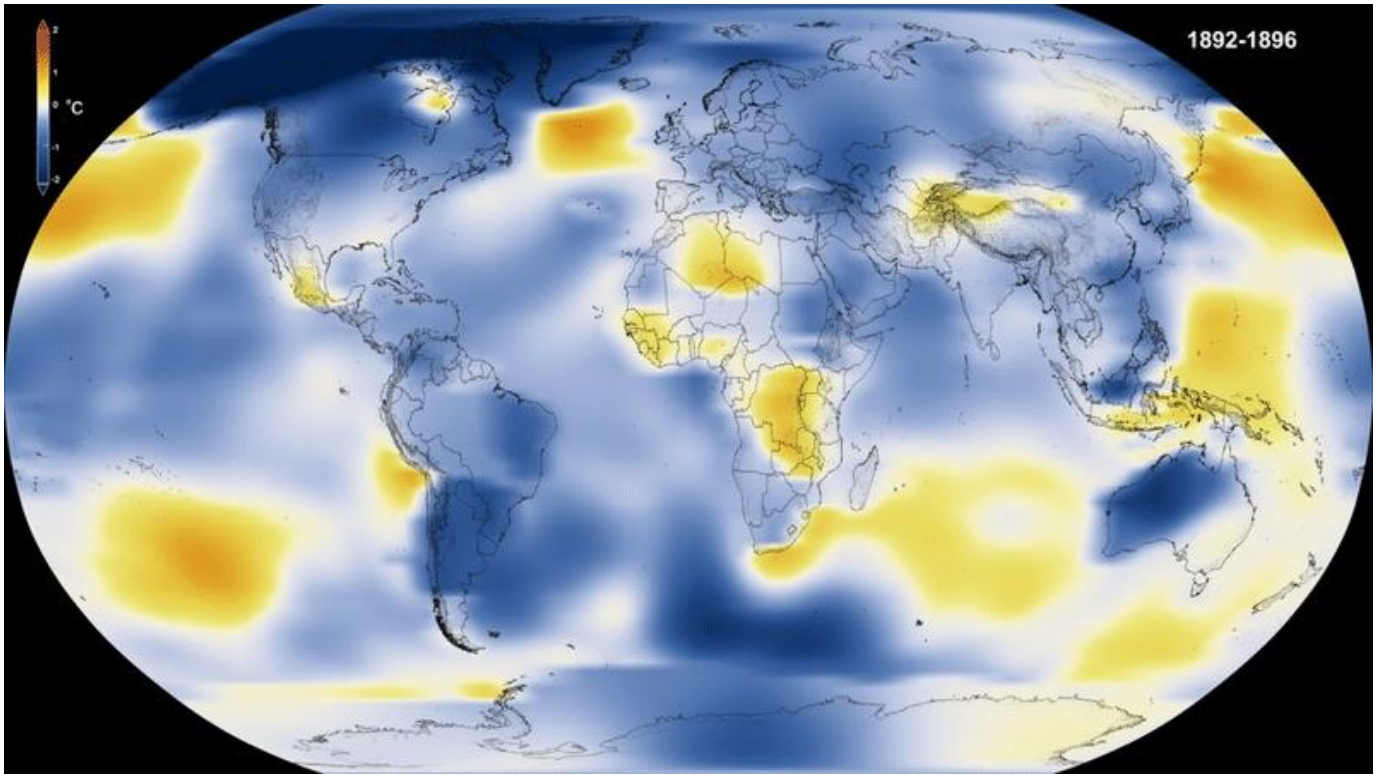
A Warming Climate



NASA/GSFC/Scientific Visualization Studio
https://www.giss.nasa.gov/research/news/20170118/2016gistempupdateblack.gif

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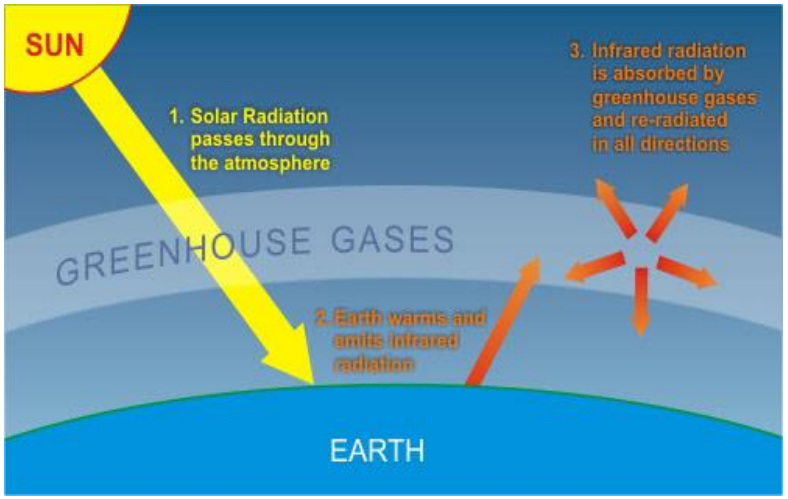
A Warming Climate

Resulting

Heating



Hosing

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Water Role – A Fundamental

Lapse Rate

Dry Air: $\Gamma_d = g/c_p = 9.8$ °C/km

Wet Air: $\Gamma_w = \ldots\ldots = 6\text{-}7$ °C/km

30%

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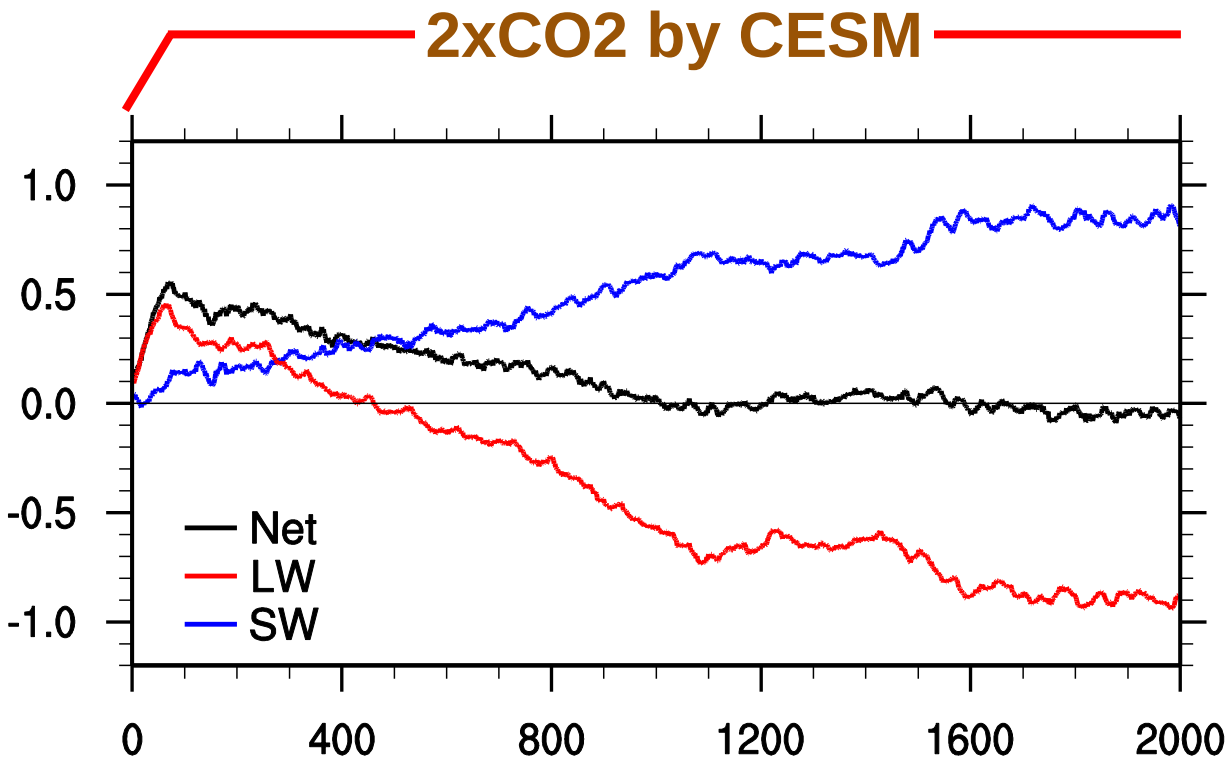
TOA Flux Change in a Warming Climate



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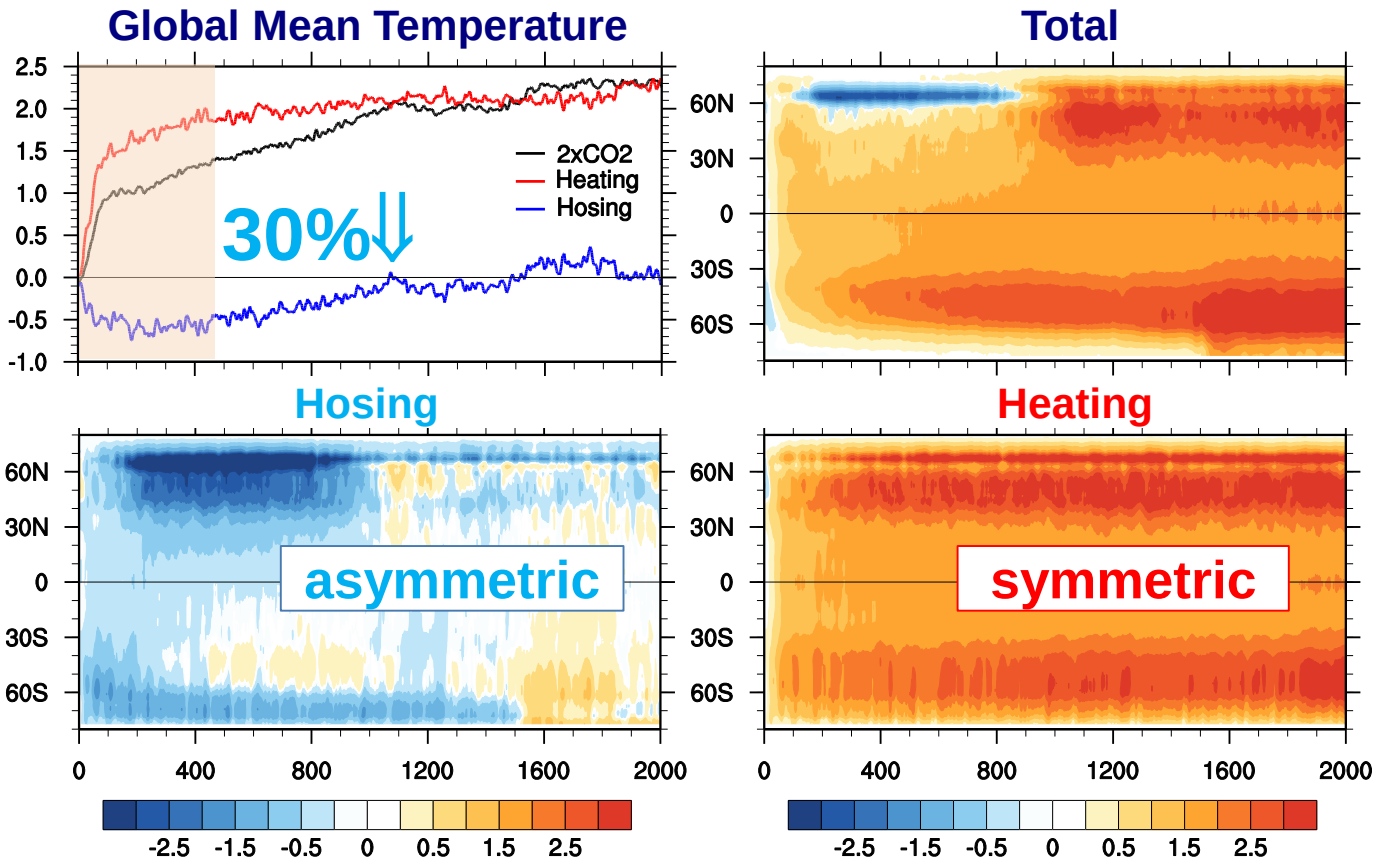
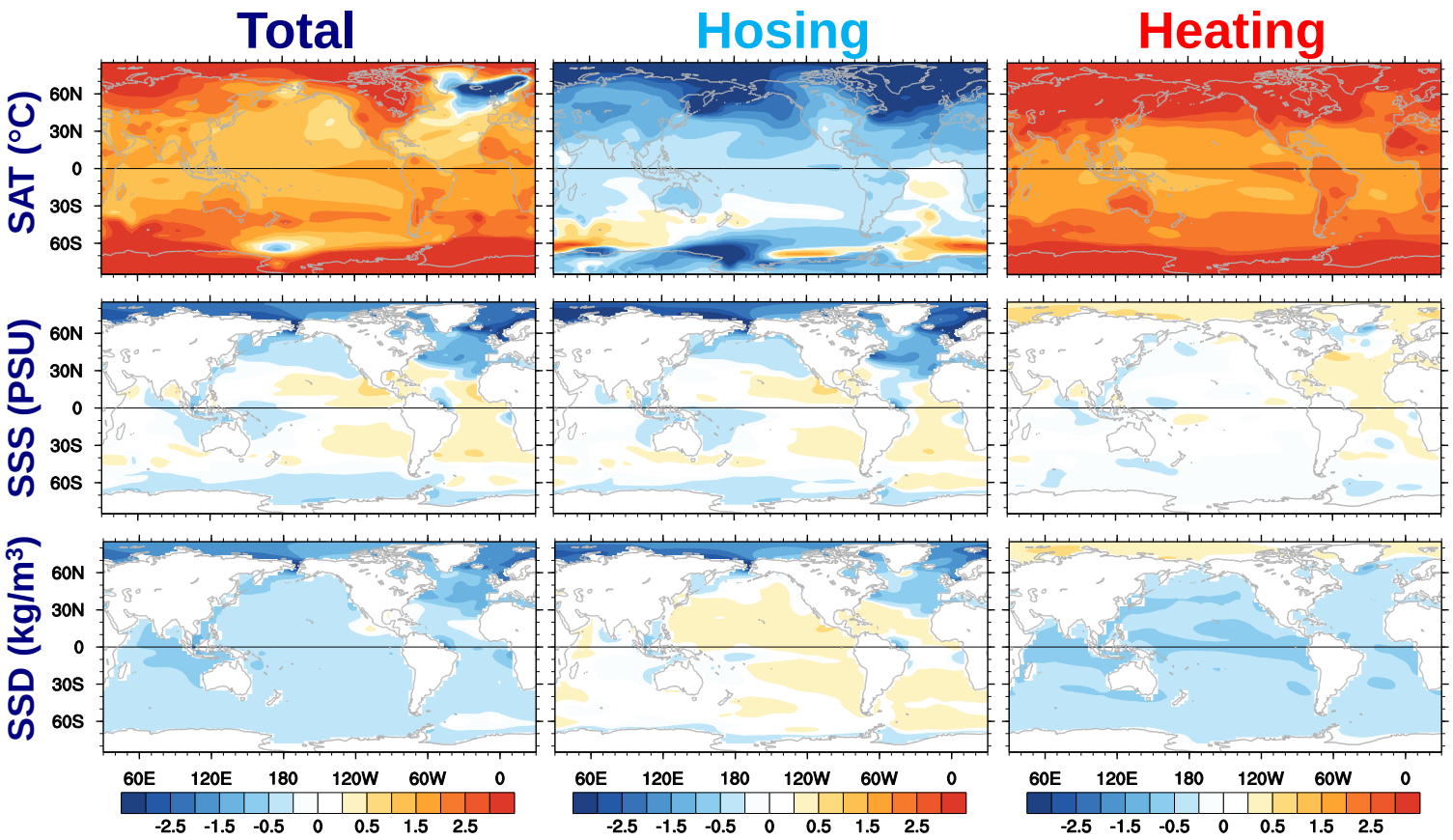
Global Temperature Evolution



Stage I

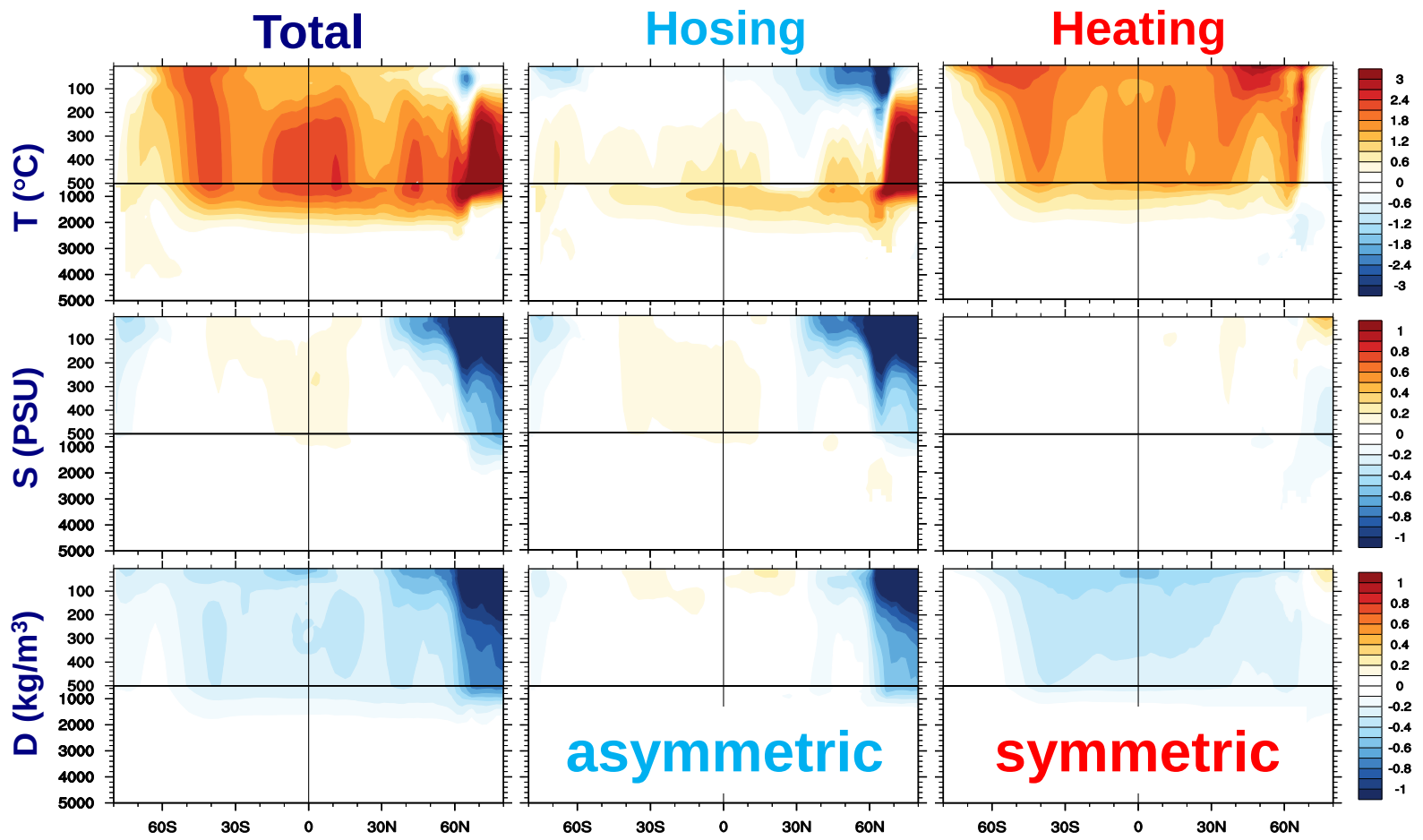
in Global Warming

Surface Changes

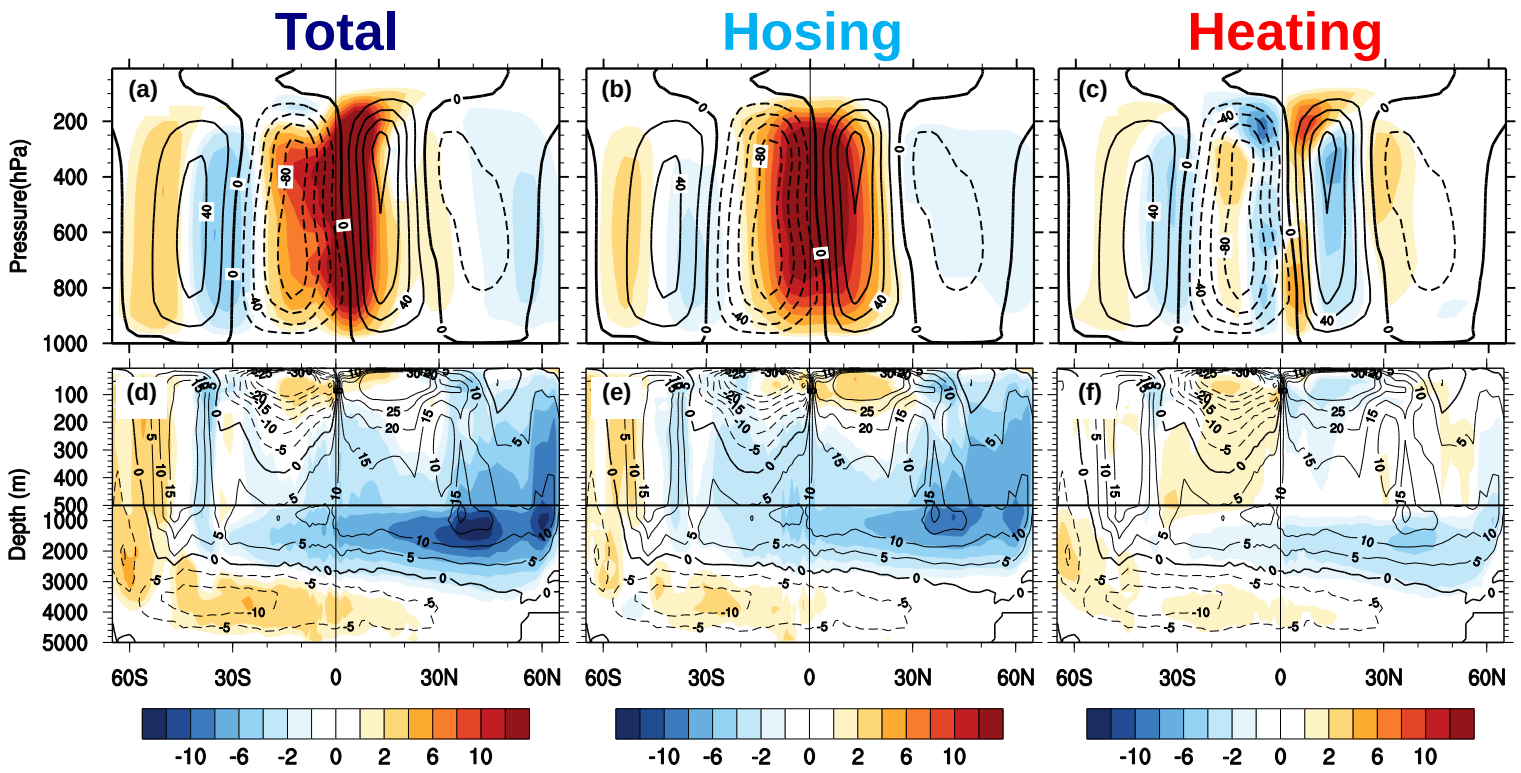


Freshwater results in cooling and freshening, asymmetric change

Ocean Changes



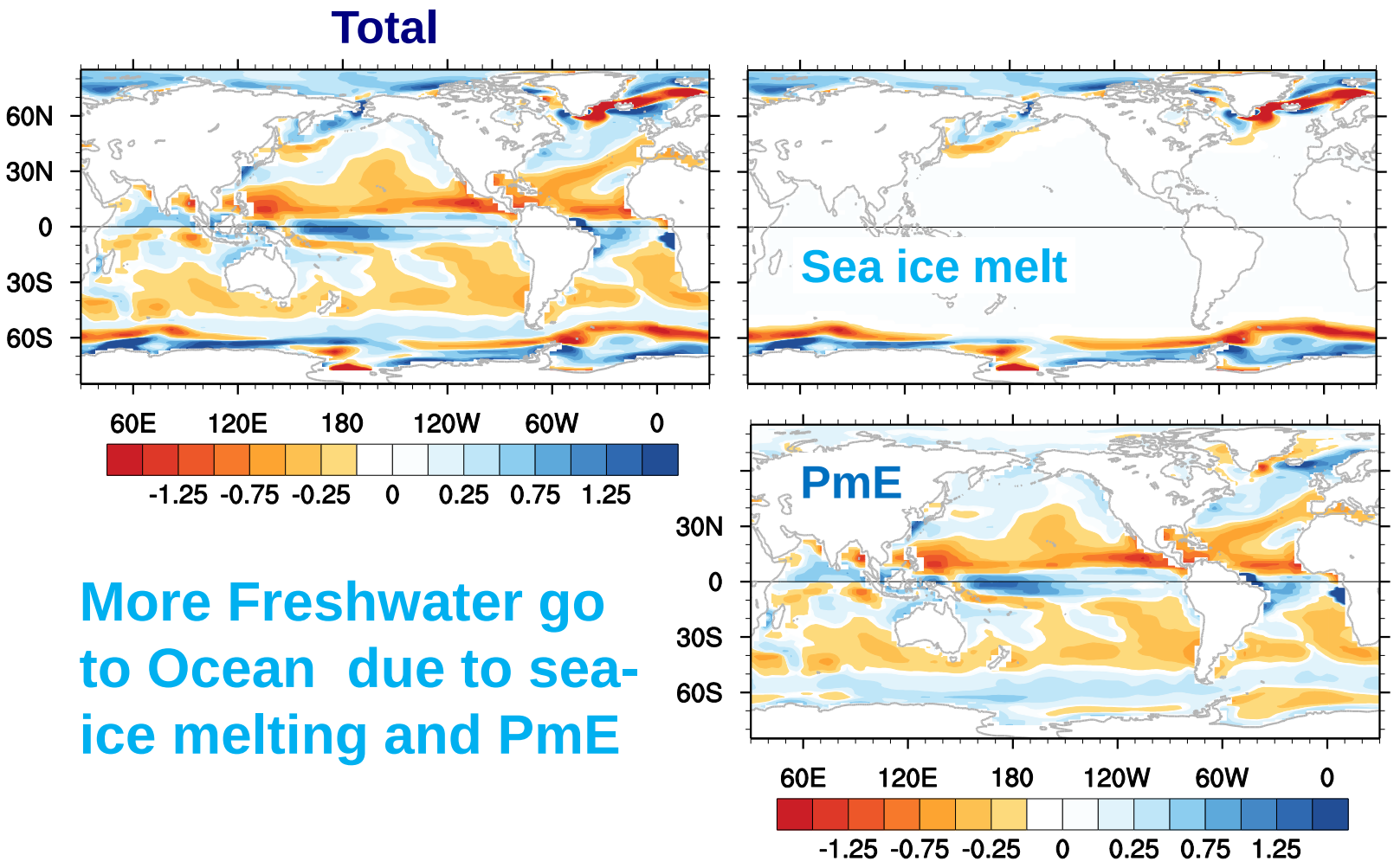
Atmosphere-Ocean MOCs



Hosing: HC and AMOC changes;

Heating: nearly unchanged

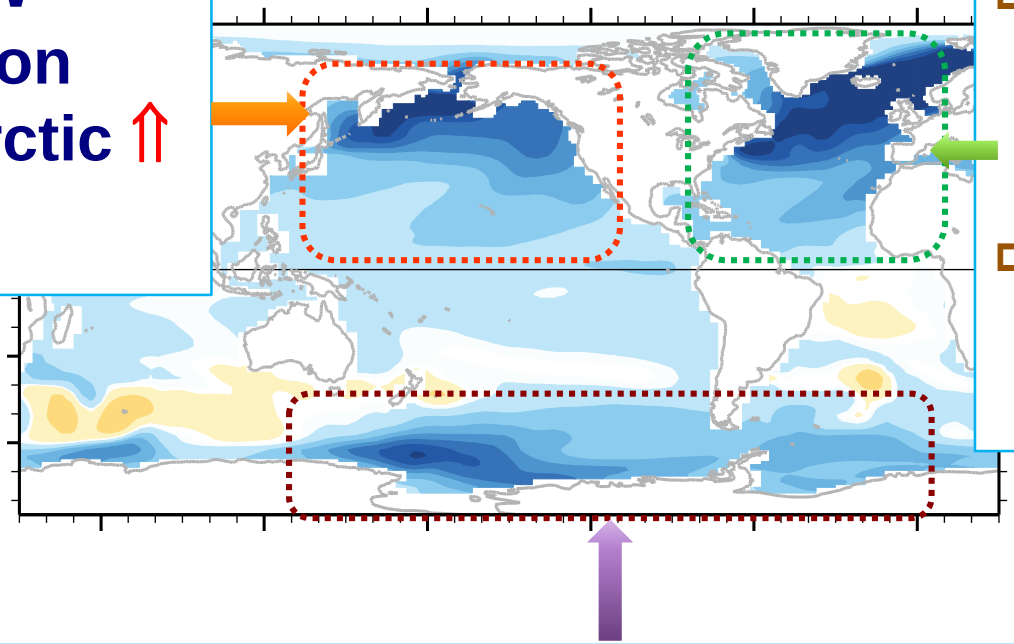
Fresh Water Change



More Freshwater go to Ocean due to sea-ice melting and PmE

Mechanism of Hosing Cooling

- Cold FW advection from Arctic ⇑
- SAT ⇓



- Freshwater ⇑ ➔ SSS ⇓ ➔ AMOC ⇓
- Cold water advection from Arctic ⇑

- Sea-ice melting ⇑ ➔ Northward Ekman flow ⇑ ➔ Ekman pumping ⇑

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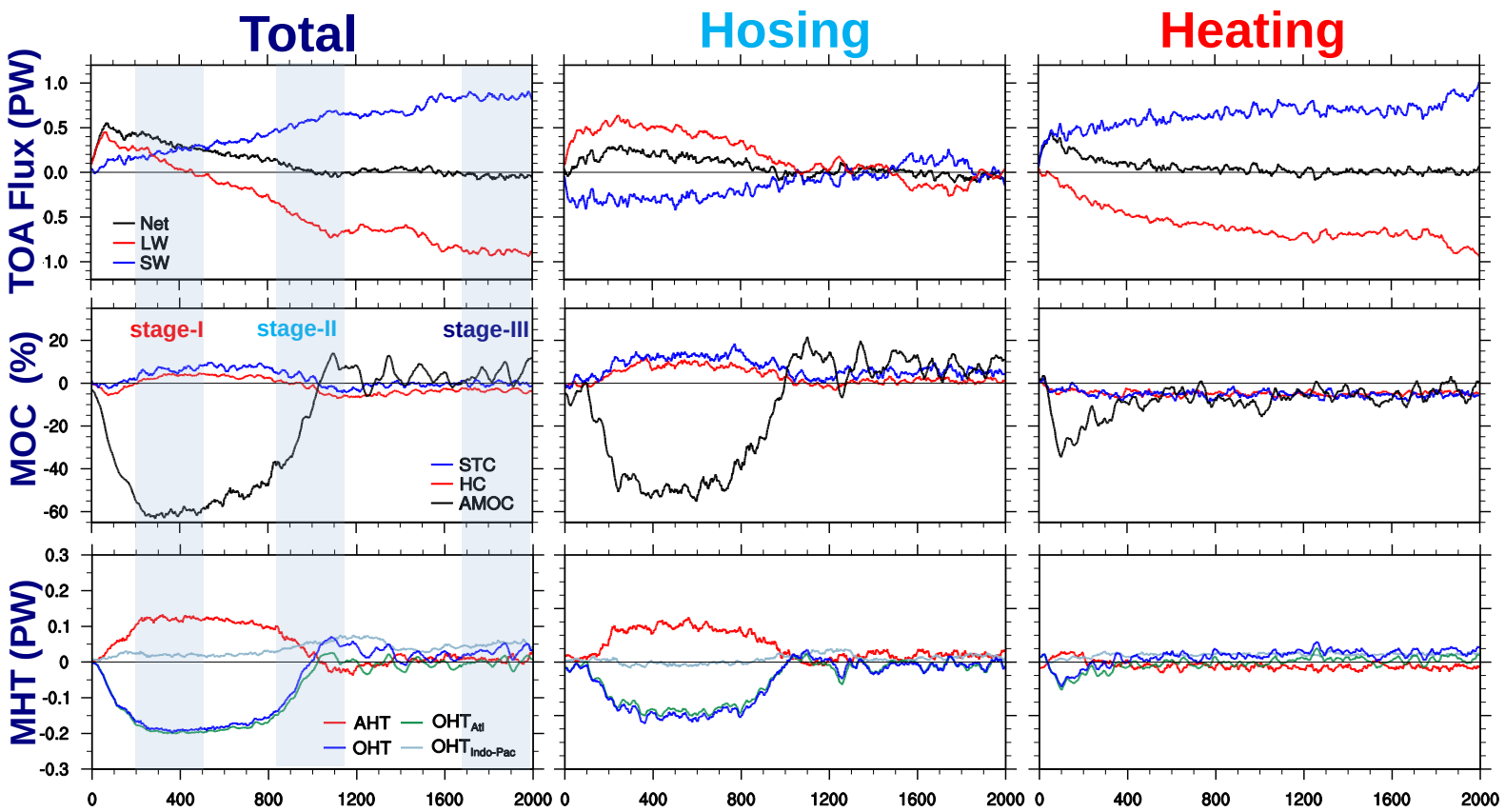
Evolution of MOCs and MHTs



Summary and Discussion

- Hosing: 30% cooling
  - Asymmetric changes
  - Arctic sea ice melting
  - AMOC ⇓ and HC ⇑
  - Baroclinic change in ocean T
- Heating: symmetric
  - Barotropic change in ocean T
  - Into the deep ocean
- More studies on different stages

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Thanks

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