Global Warming Projection by GHGs Stabilization and Overshoot Scenarios

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Objectives

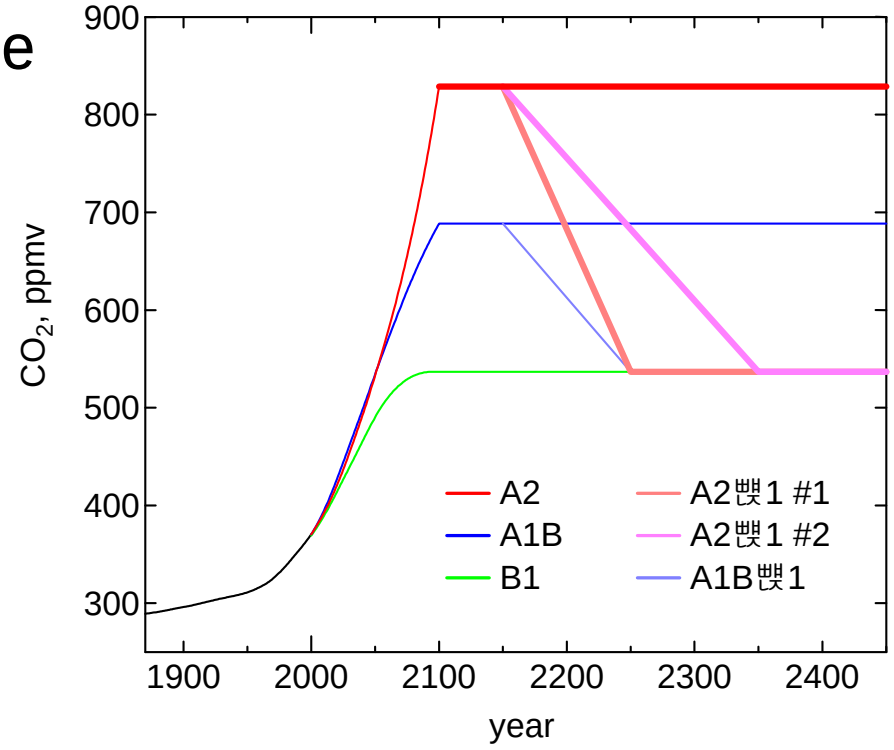
* In future, using new technology, international regulation, etc., can we reduce GHGs emission and, stabilize or decrease atmospheric GHGs concentration?

* If so, how the climate response to it?

  Different pathway to stabilized or overshoot scenario makes different future climate?

Experimental Setup

- Stabilized GHGs at SRES A2 level (2100-)
- Two overshoot GHGs profiles
  - overshoot to A2, then, recover to B1 after 2150
  - 100-year decline phase
  - 200-year decline phase
- T85_gx1v3 CCSM3



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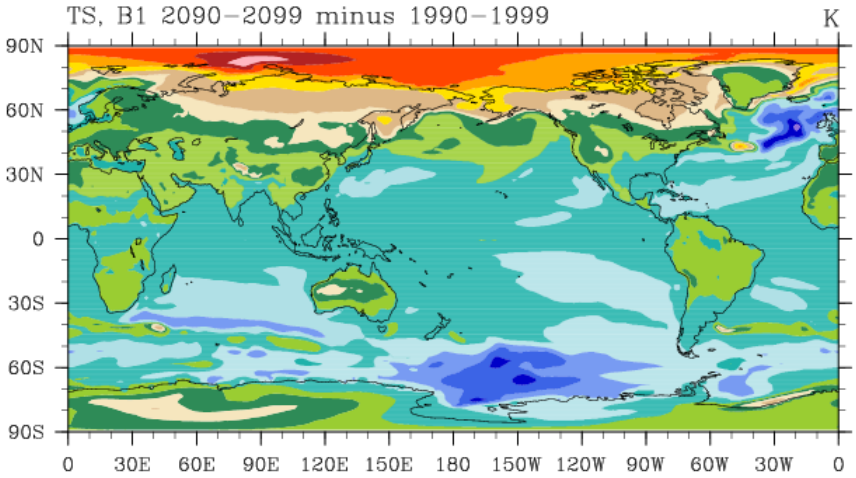
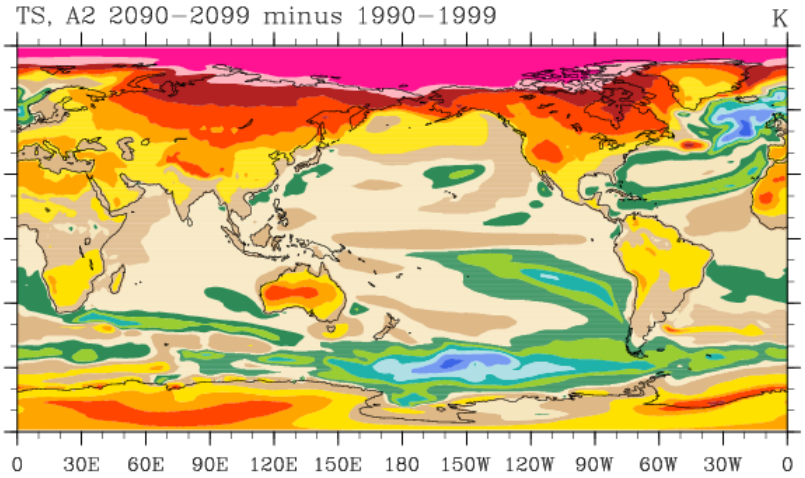
Spatial Pattern of TS Change (2090s – 1990s)

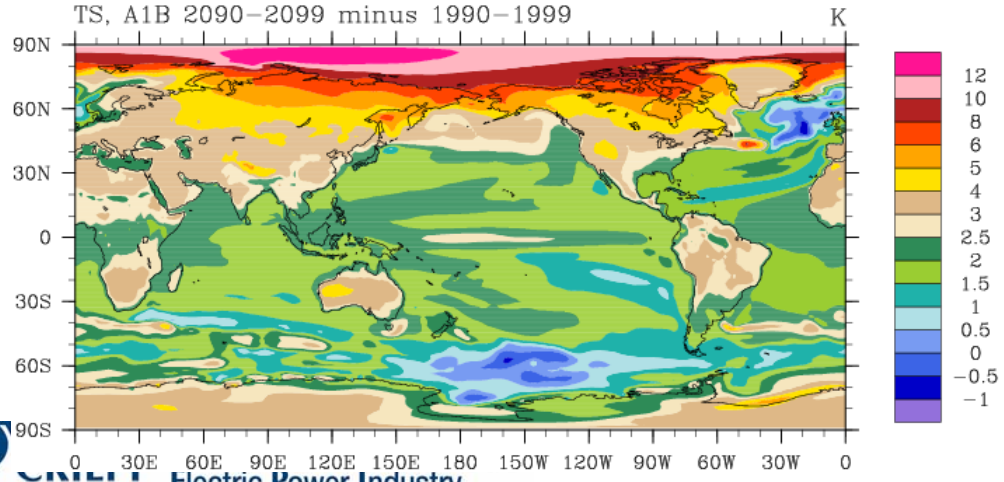
SRES B1



SRES A2



SRES A1B



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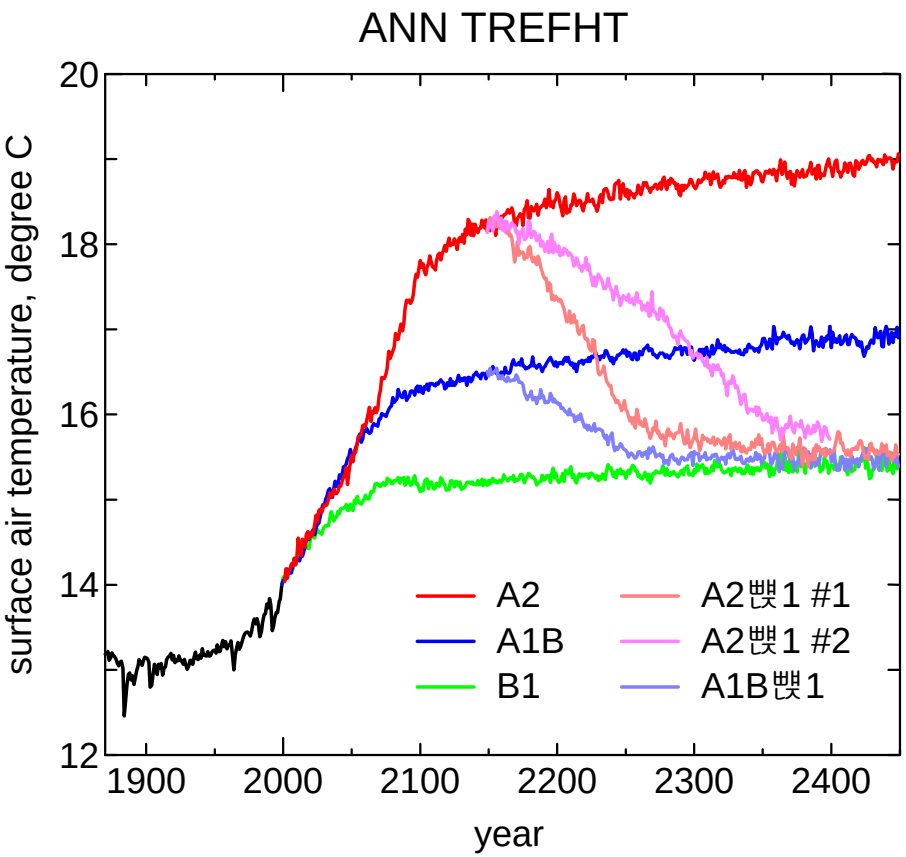
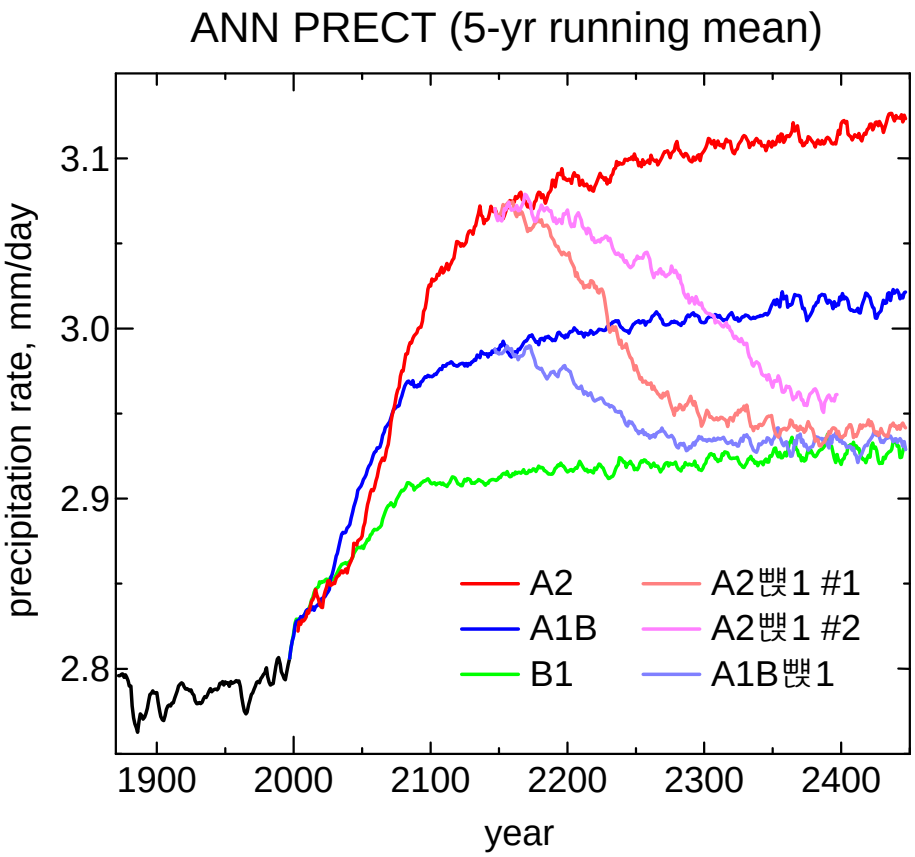
Temporal Change of Surface Air Temp. and Precipitation





- temperature rise during 21C: 3.7 degree C (A2), 2.5 (A1B), 1.5 (B1)
- larger temperature increase after GHG stabilization under A2

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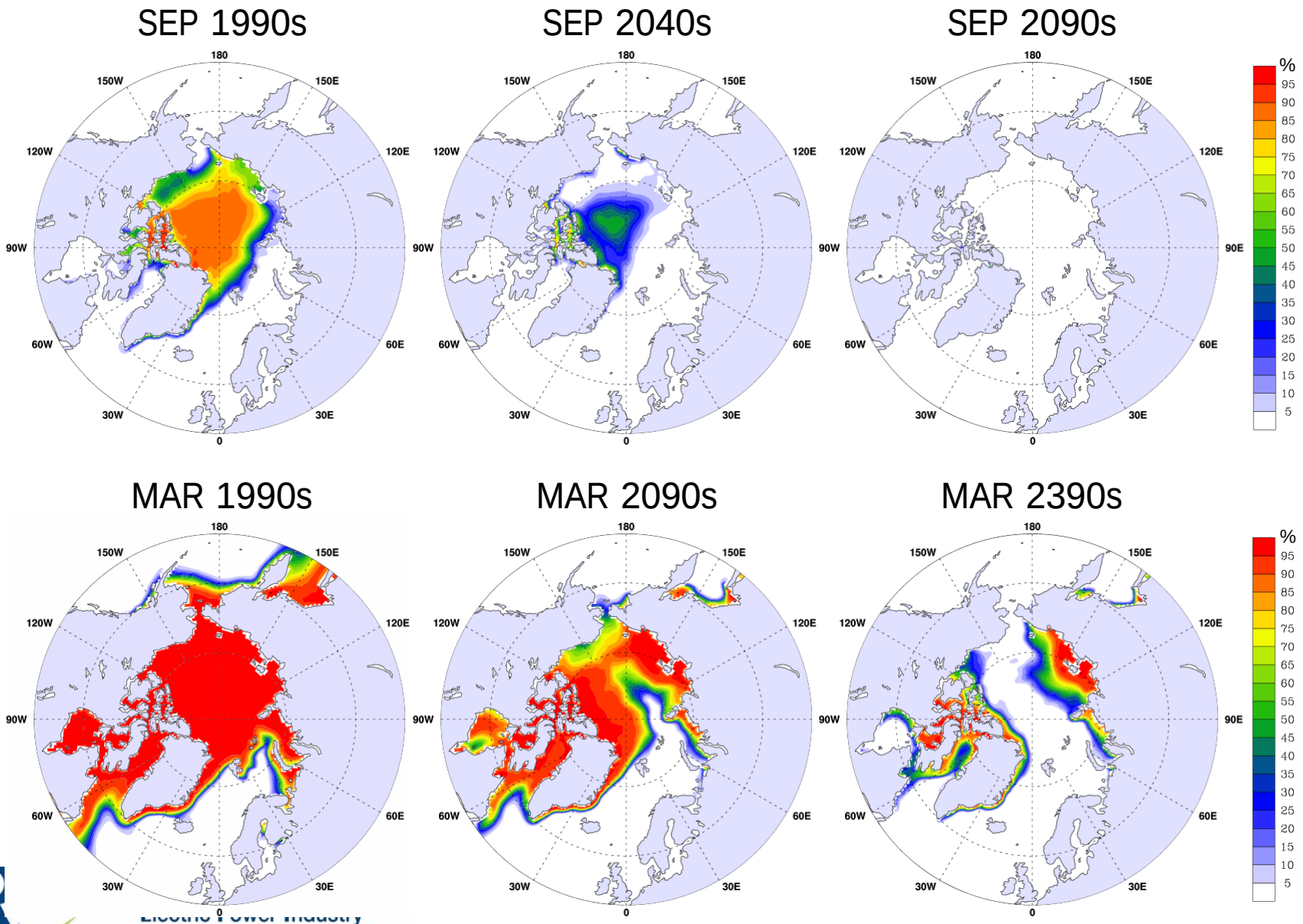
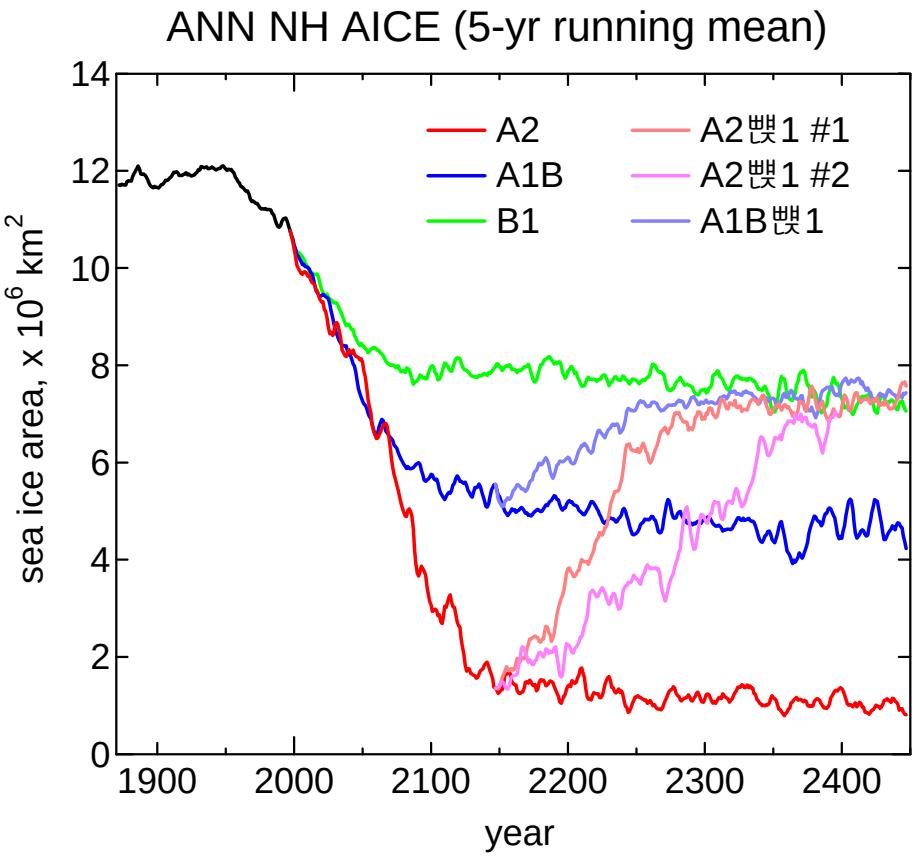
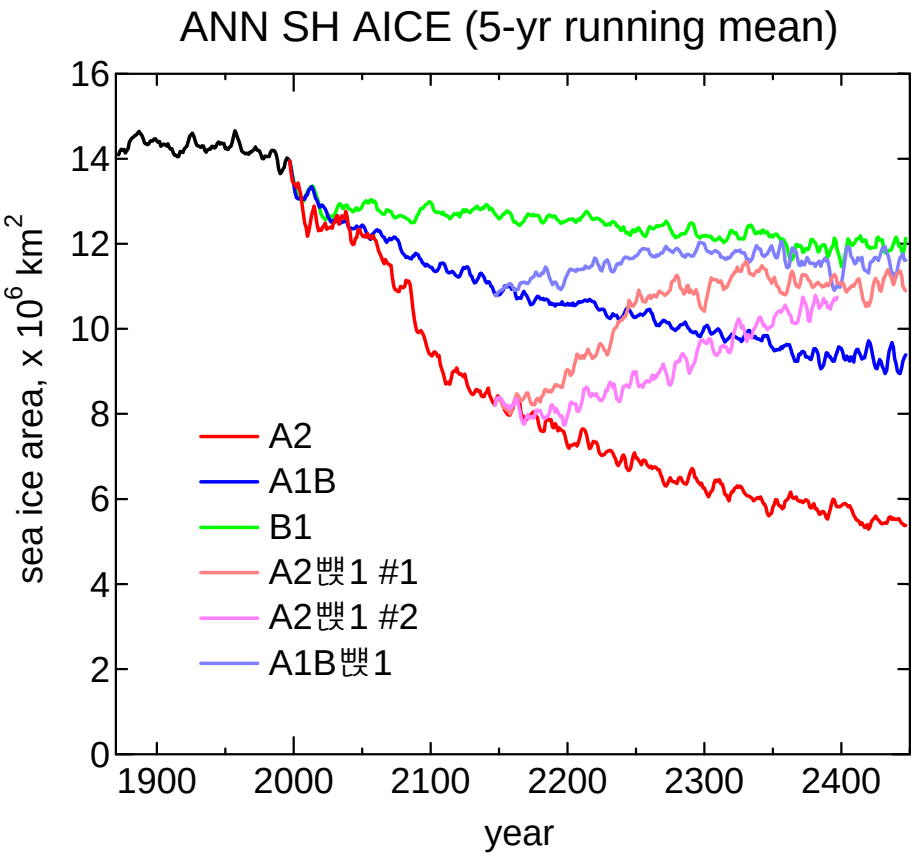
Sea Ice Concentration in Northern Hemisphere (A2)



Temporal Change of Sea Ice Area





- rapid decrease during 21C in northern hemisphere
- continuous decrease after stabilization in southern hemisphere

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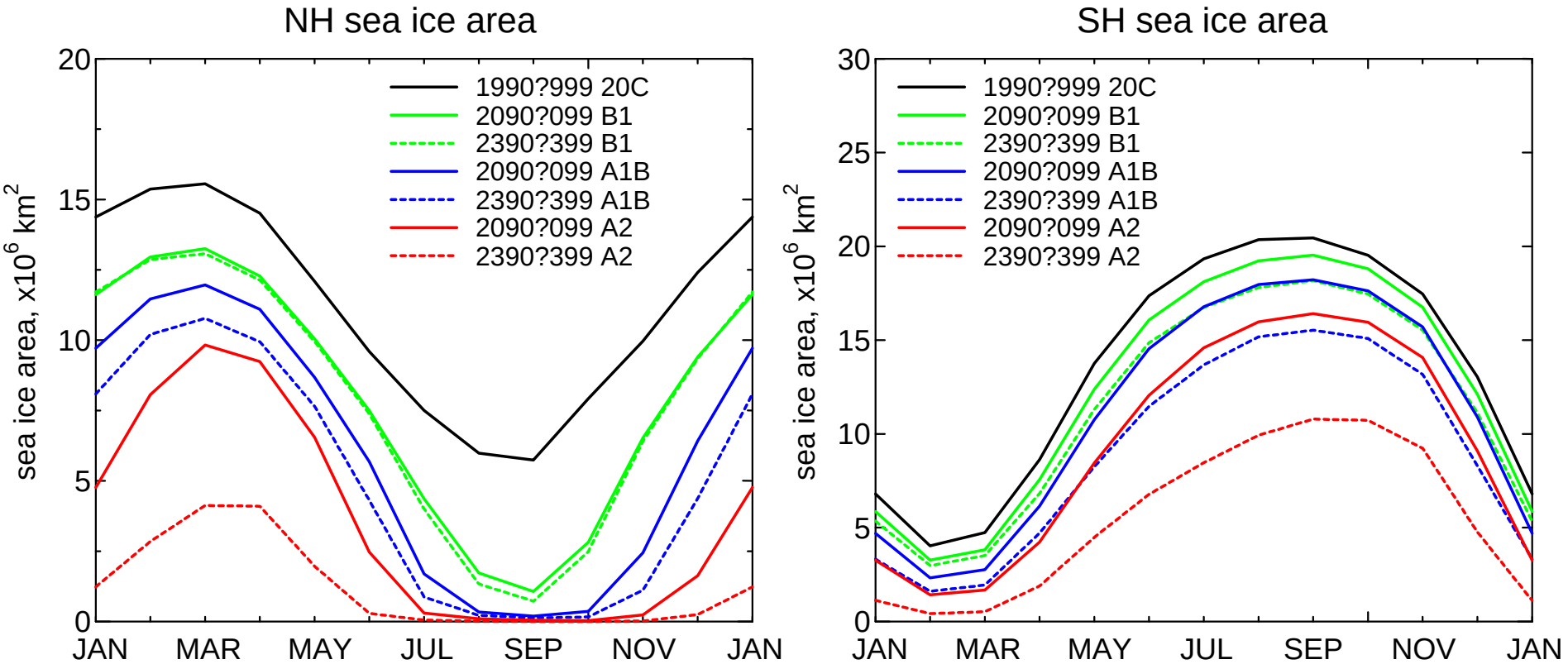
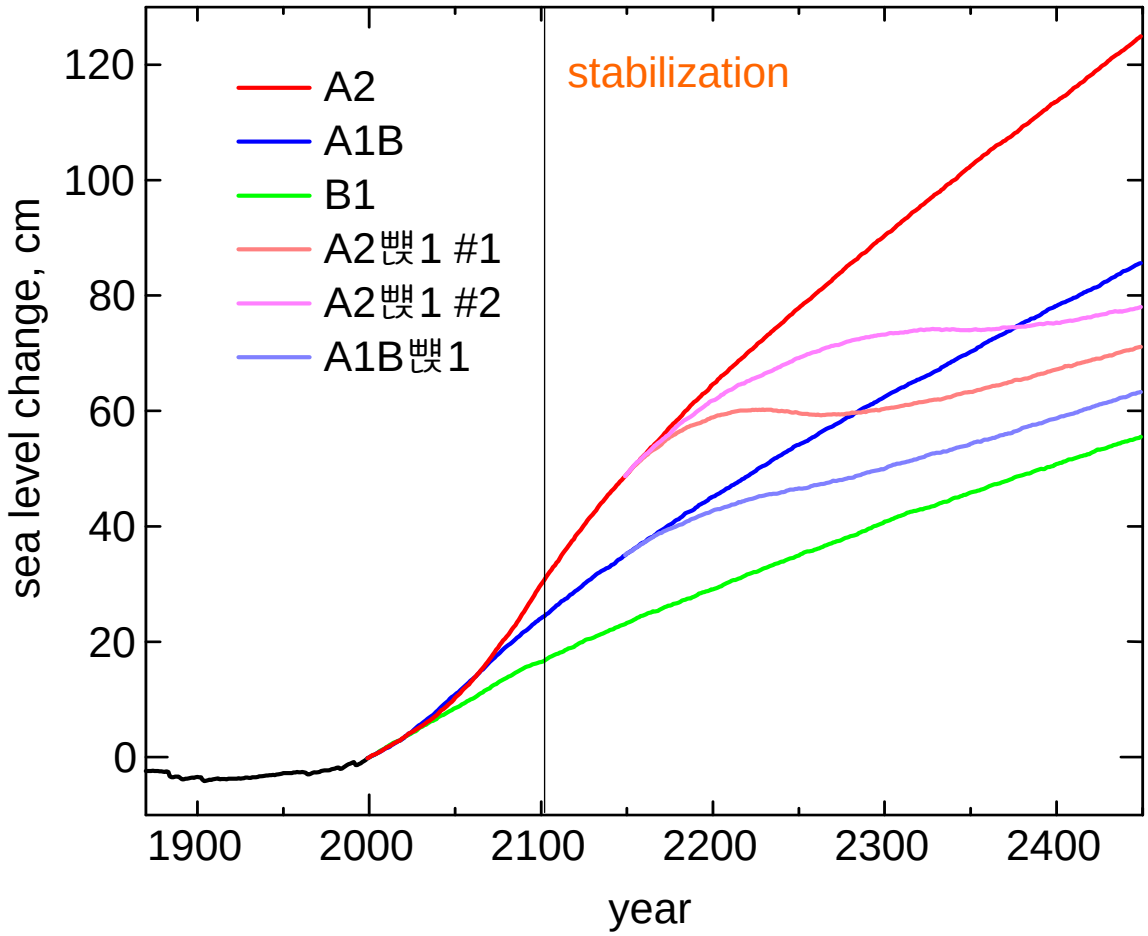
Sea Ice Area Seasonal Cycle (stabilization cases)



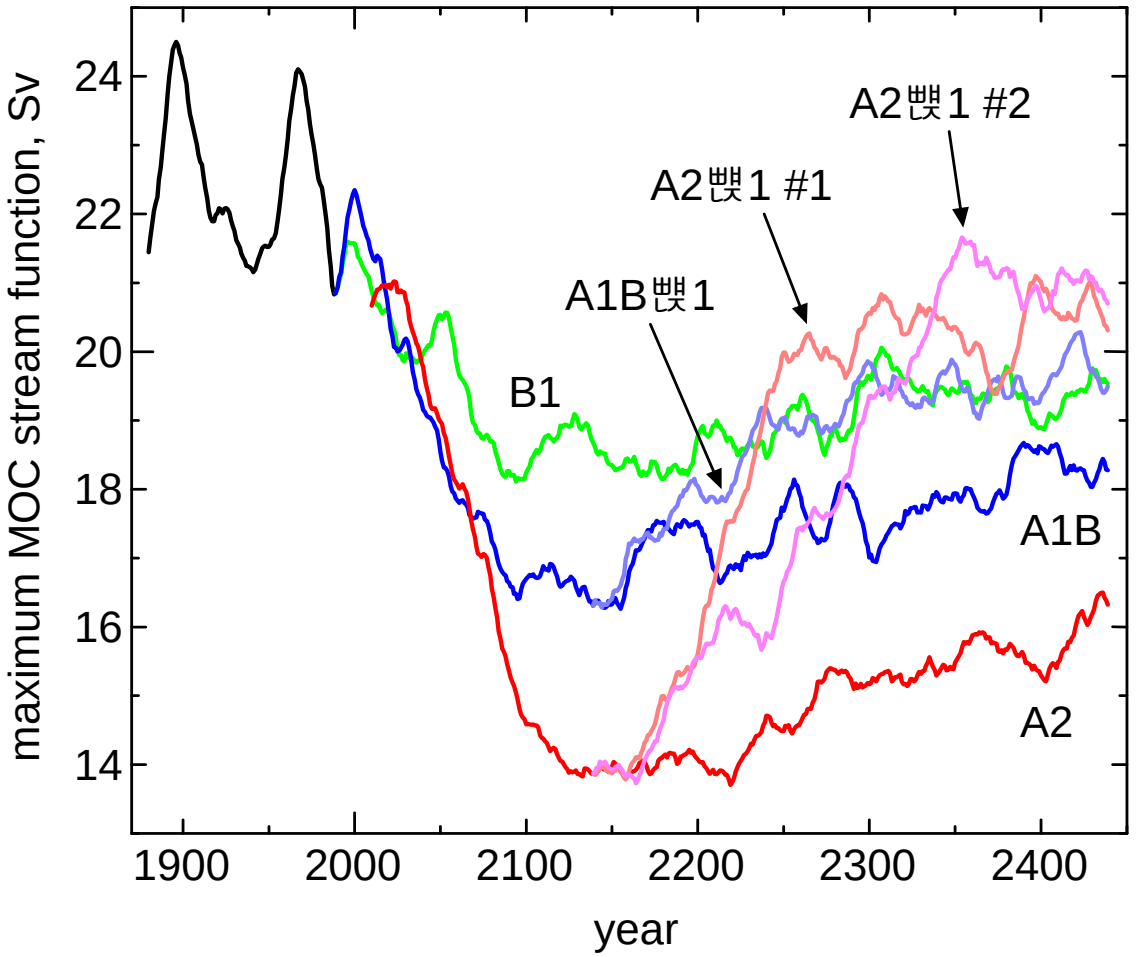
- significant reduction after GHGs stabilization at SRES A2 level
- arctic sea ice disappears in summer and fall

Sea Level Rise due to Thermal Expansion



- sea level rise: 25 cm (A2), 18 cm (A1B), 11 cm (B1) during 21C
- depends on GHGs increase paths (hysteresis effect)

Temporal Change of N.A. MOC (21-yr running mean)



- gradual recovery after GHG stabilization
- rapid recovery at GHG decline phase in the overshoot cases

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Summary

* Climate response to stabilization and overshoot scenario is studied using CCSM3.

* Close agreement obtained between the temporal change of atmospheric CO_2 concentration and global mean surface temperature, sea ice extent, etc, because of quick response of atmosphere.

* Sea surface rise increases after the stabilization or overshoot due to the heat accumulation in the ocean.

*Biogeochemical process (carbon cycle) in ocean and land is not included. Ice sheet melt on Greenland and Antarctic is also not considered, here.

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Thank You

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