Detecting Arctic sea ice melt onset with a satellite simulator

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Photo: UW Polar Science Center

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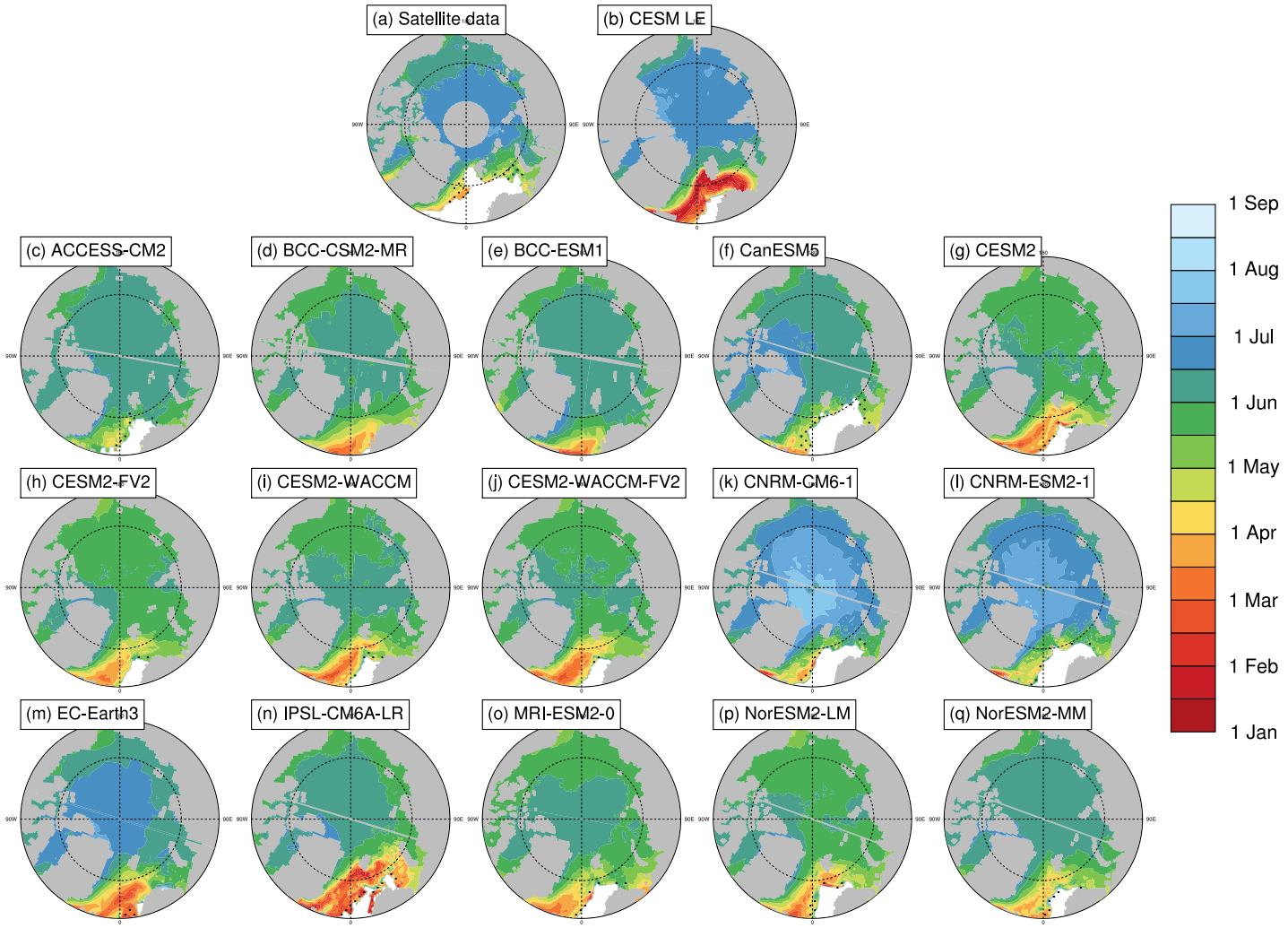
Melt onset and other seasonal transition dates can be used to evaluate how well climate models represent sea ice

- CMIP6 models show realistic but varying melt onset dates
- Model differences in melt onset are unlikely due to internal variability alone

  → We can use these differences to investigate other modeled sea ice characteristics

- However, comparisons between climate models and satellite observations are indirect



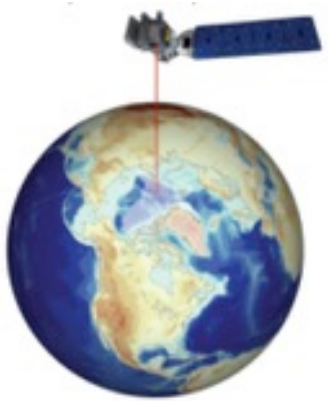
Smith, et al., 2020, *The Cryosphere Discussions*

Using a satellite simulator, we can compare melt onset dates between climate models and satellite observations more directly

Modeled

Observed

Observed brightness temperatures ← SSM/I, SMMR, AMSR-E



Global earth system models (MPI-ESM and CESM2) → Standard model sea ice melt onset dates

(Derived here from surface temperature)

Current method of comparison

Satellite-derived sea ice melt onset products

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Observed

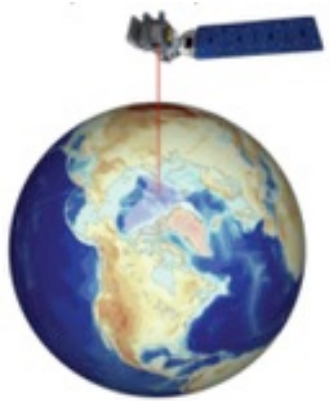
ARC30 satellite simulator[1,2]

Simulated brightness temperatures

New comparison

Observed brightness temperatures

SSM/I, SMMR, AMSR-E



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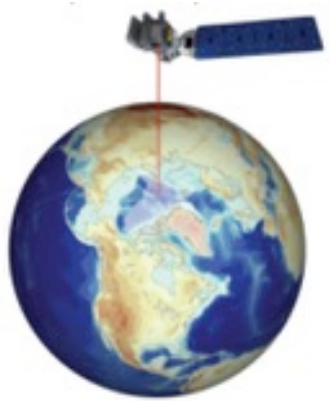

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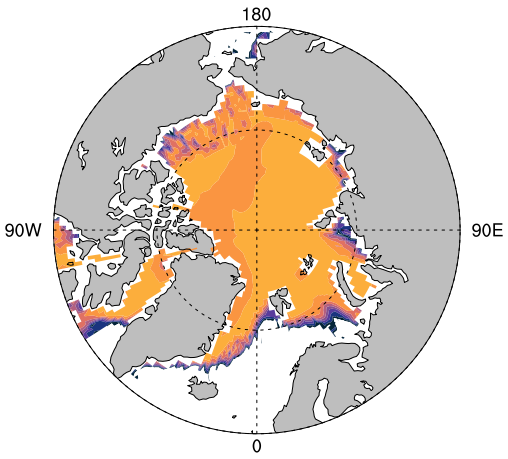
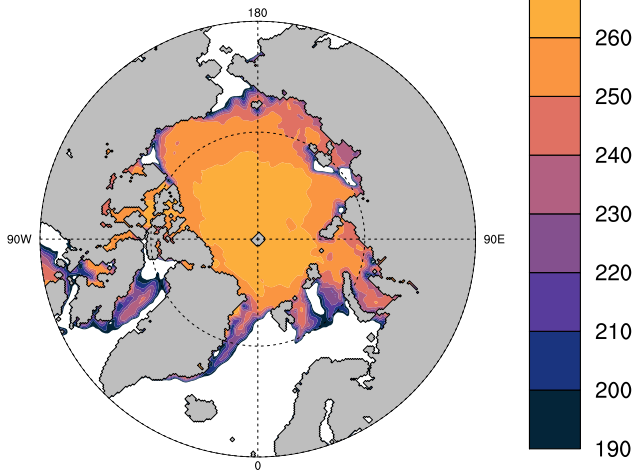
Preliminary results: melt onset dates

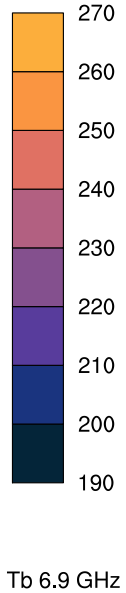
Average brightness temperatures
June 2003

CESM2



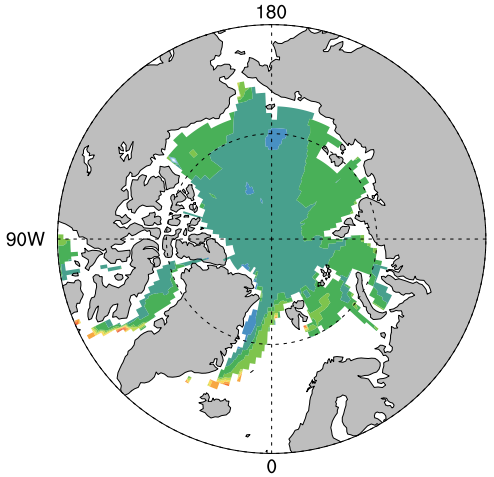
Satellite data



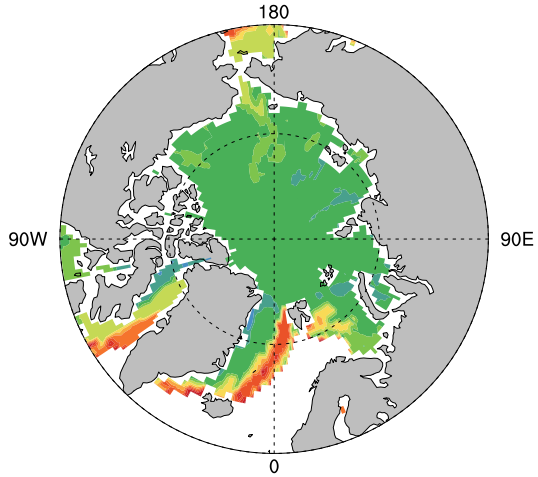


CESM2 melt onset 2003

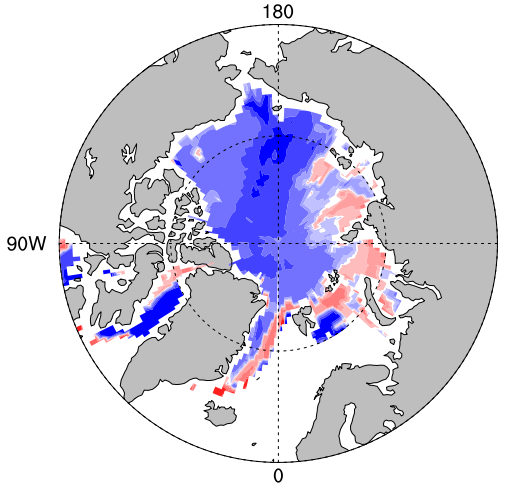
(a) Using TB 6.9 GHz



(b) Using surface temperature



Difference in days (b) – (a)



- ARC30 can produce realistic brightness temperatures for CESM2
- By comparing melt onset date methods, we can quantify the uncertainty introduced by model/satellite definition differences