

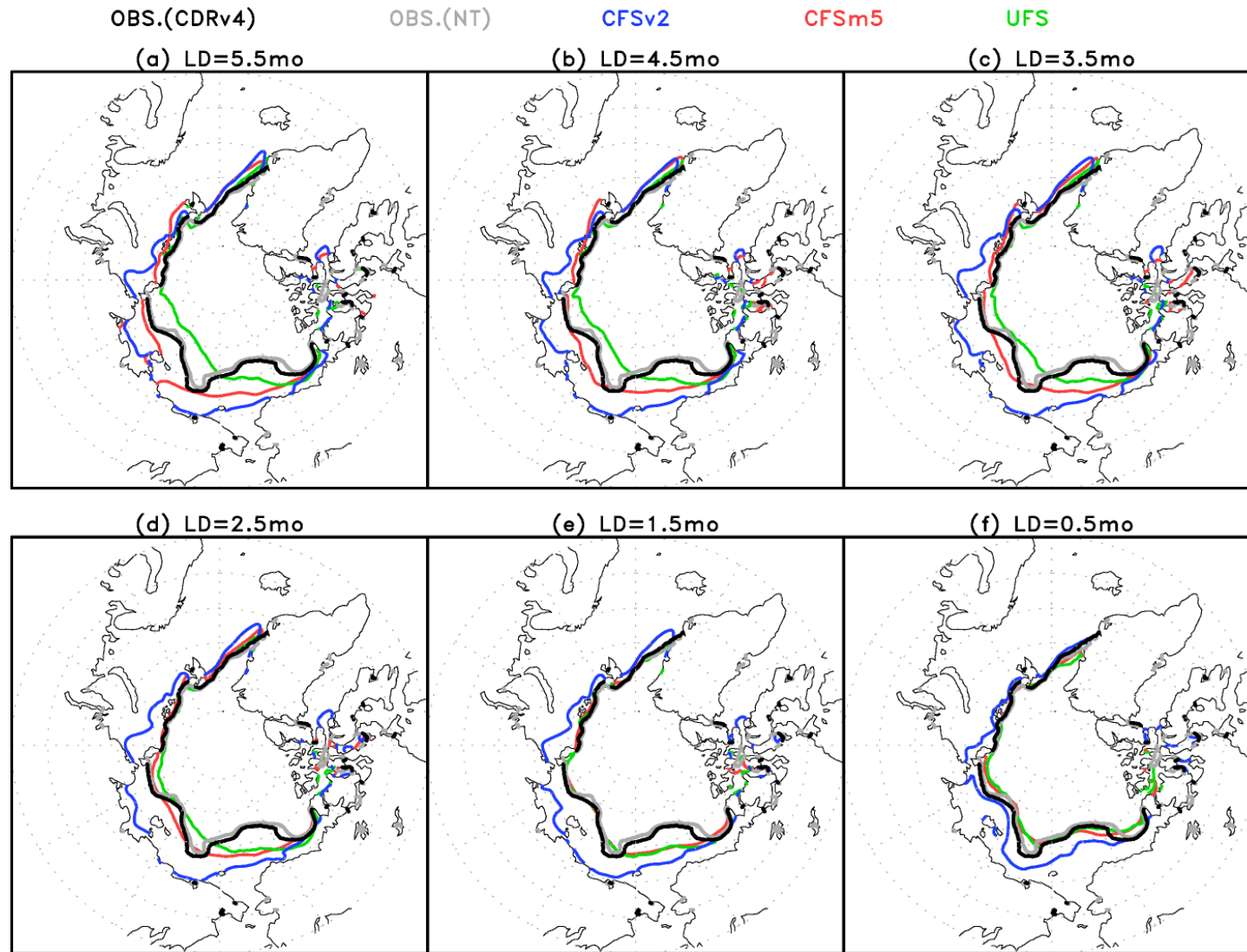
# Seasonal sea ice hindcasts with UFS

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- **Hindcast configurations:**
  - **Model:** UFS P5 with some adjustments about cloud parameters
  - **ICs:** CFSR OCN/ATM + CSIS ICE
  - **Period:** Mar.-Aug. IC (21-25), 2007-2020
- **Validations:**
  - **OBS:** SICs from NOAA/NSIDC CDR v4
  - **Prior hindcasts:** CFS5m (5 members)+CFSv2 (10 members)

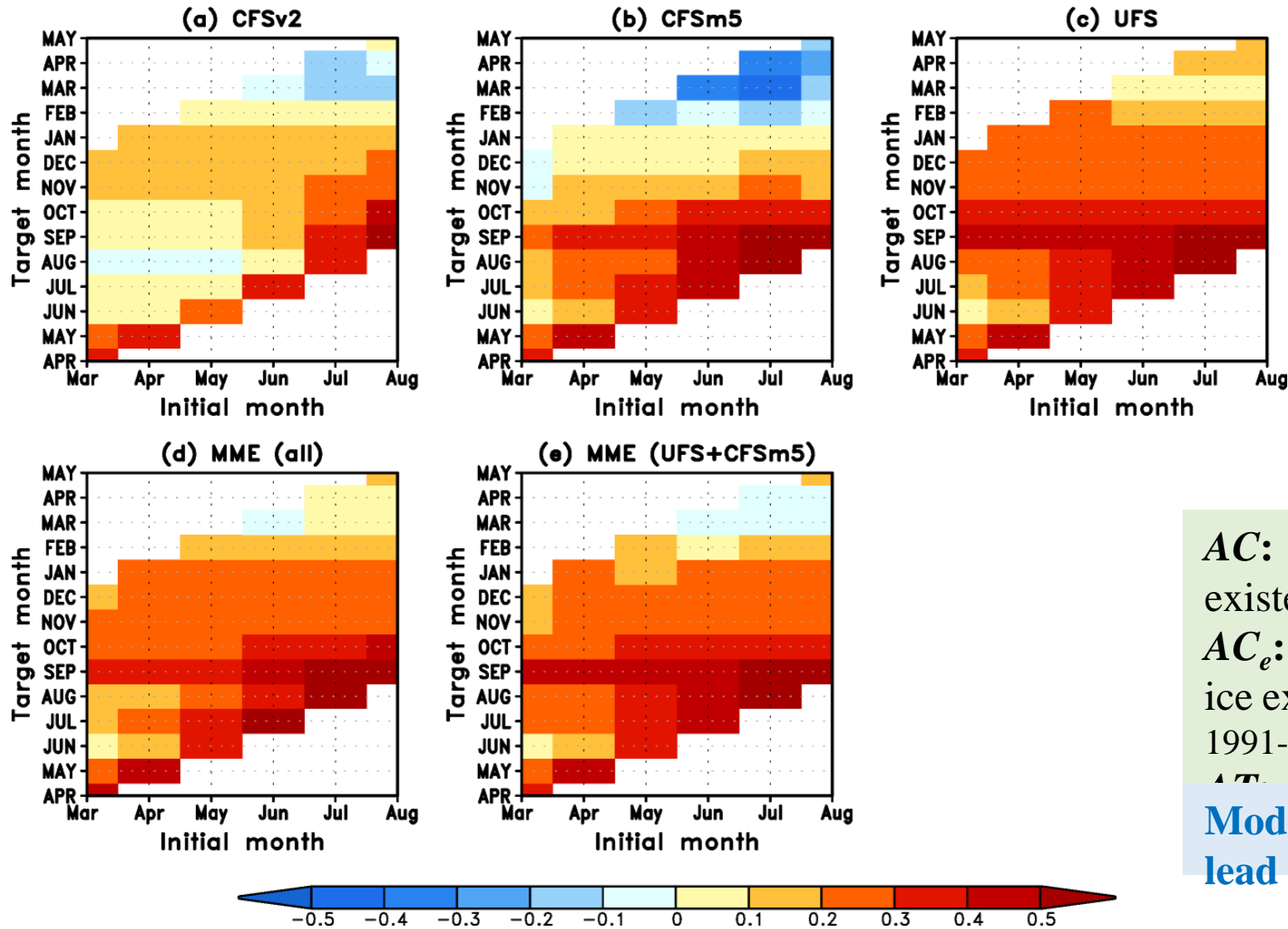
Mean hindcast and observed 15% sea ice concentration  
during September (2007–2020)



Sea Ice Area:

- 1) CFSv2 > OBS at all lead times;
- 2) CFSm5 > OBS at LD > 1mo;
- 3) UFS ≈ OBS but with errors in spatial distributions

Heidke Skill Score of Sea ice existenc (SIC>0.15)  
during 2007–2020: bias-corrected SIC



$$HSS = \frac{AC - AC_e}{AT - AC_e}$$

**AC:** Area of correct forecast of sea ice existence

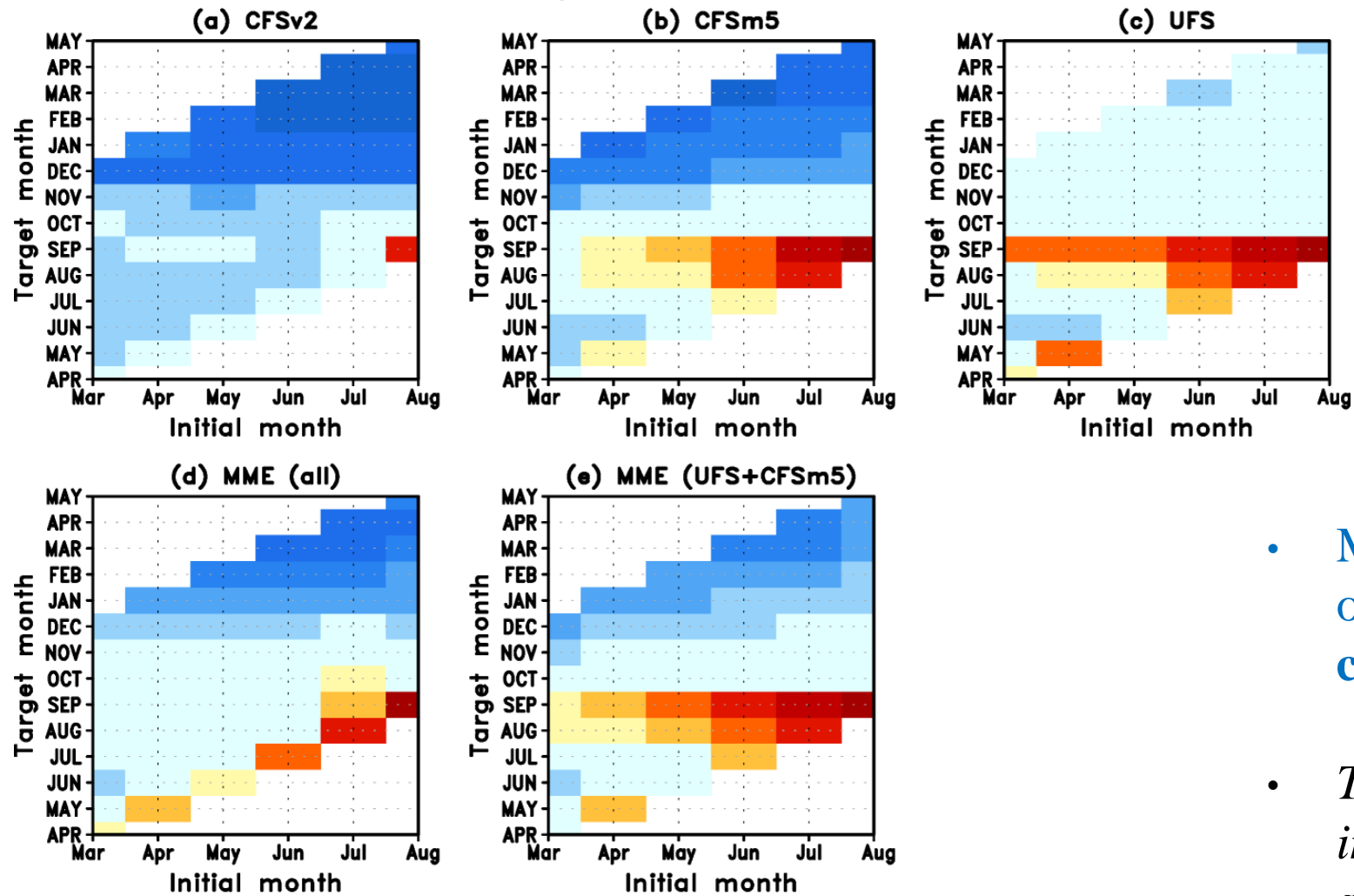
**AC<sub>e</sub>:** Area of expected correct forecast of sea ice existence (using climatological SIC during 1991-2020 here)

**AT:** Area of total forecast of sea ice existence

**Model SICs are bias-corrected by removing lead time-dependent climatologies;**

- CFSm5 better than CFSv2 for summer target season
- UFS improves over CFSm5 and CFSv2 for all target seasons
- UFS is better than or comparable to MMEs

Heidke Skill Score of Sea ice existenc (SIC>0.15)  
during 2007–2020: raw SIC



- Model SICs are model direct outputs **with no any bias corrections.**
- *The essential no skill suggests the importance of bias corrections in seasonal sea ice predictions.*

Main points:

- This work is the first attempt with the UFS for seasonal predictions;
- UFS presents better performance in seasonal prediction of Arctic sea ice than current operational systems;
- Bias corrections are still critical for skillful seasonal prediction of sea ice with the contemporary model systems.