



Sensitivity of Polar Climate to Improved Partitioning of Visible and Near-Infrared Solar Bands

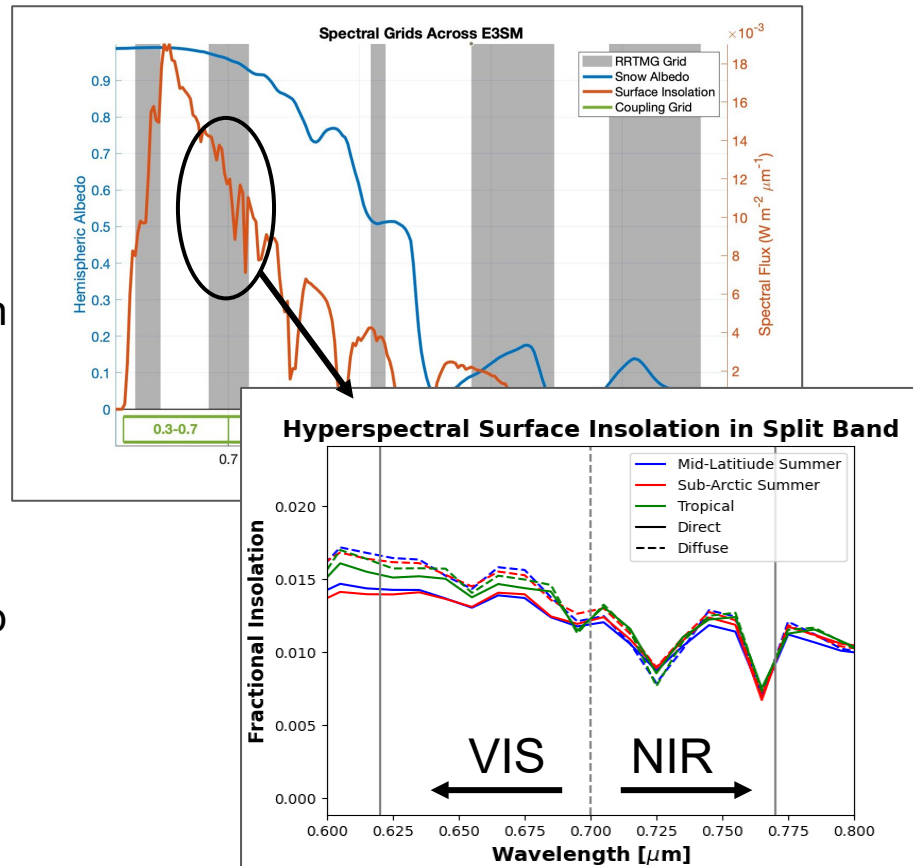
Juan P. Tolento¹, Charlie Zender¹, Andrew Roberts², Erin Thomas²

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Background

- NAMIP: Investigate impact of shortwave spectral resolution on modeled sea ice algal growth in global and regional ESMs, first implementing and investigating physical changes and computational cost in atmospheric - sea ice - ocean coupling
- Most ESMs exchange fluxes/albedos between components across two bands partitioned at $0.7\mu\text{m}$
- Atmospheric spectral grid does not have a partition at $0.7\mu\text{m}$, so flux within the overlap band is split evenly between NIR and VIS band
- Too much NIR flux and too little VIS flux to surface components



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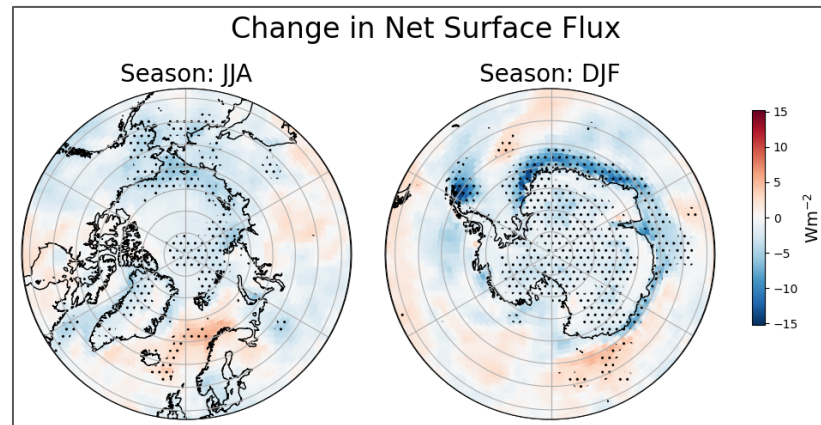
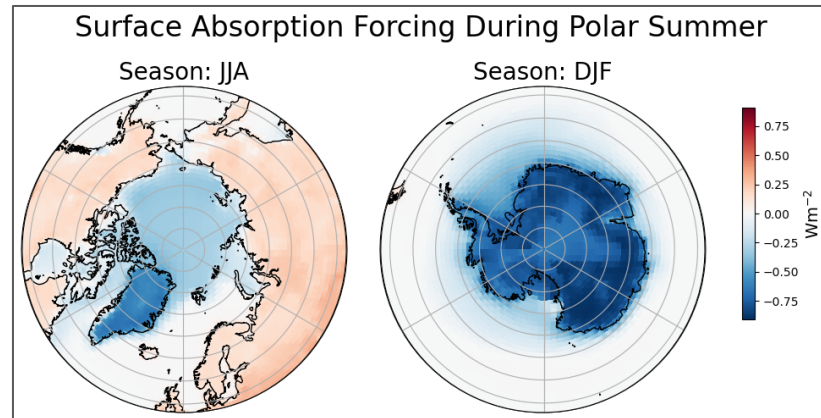
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Key Points:

- Reparametrize partitioning of split band flux from 50/50, to 55/45
 - Shifts $\sim 3\text{-}5 \text{ Wm}^{-2}$ from NIR to VIS
- Instant decrease in net surface flux over snow up to 0.91 Wm^{-2}
- Century long fully coupled simulation shows forcing is amplified (up to 10x) particularly strong over regions of sea ice



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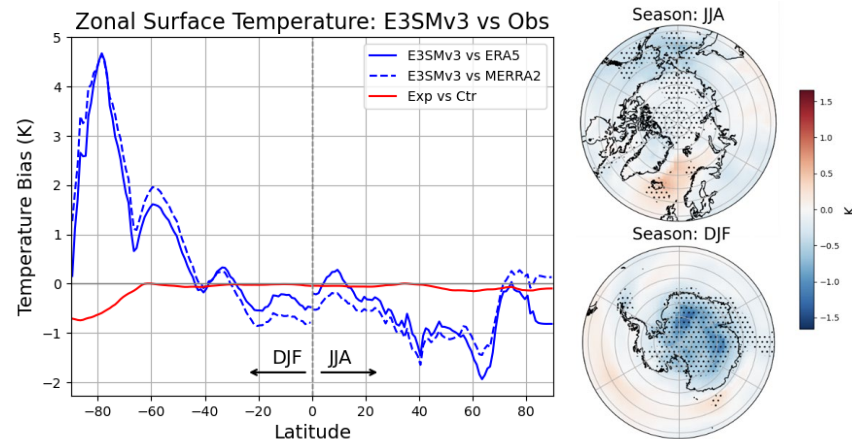
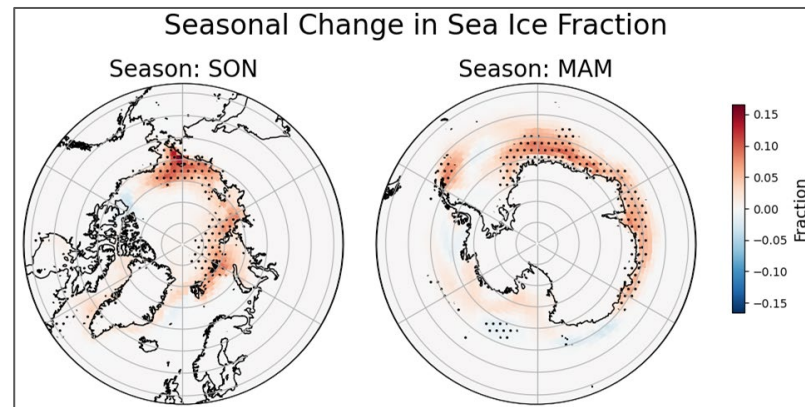
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Key Points:

- Increases in sea ice area
 - Up to 5%
 - Notable increases during local fall seasons

- Reduction in model biases:
 - Polar summer in E3SMv3 may be too hot ~4.5 K
 - Improved partitioning of split band reduces polar temperatures by up to 0.7 K





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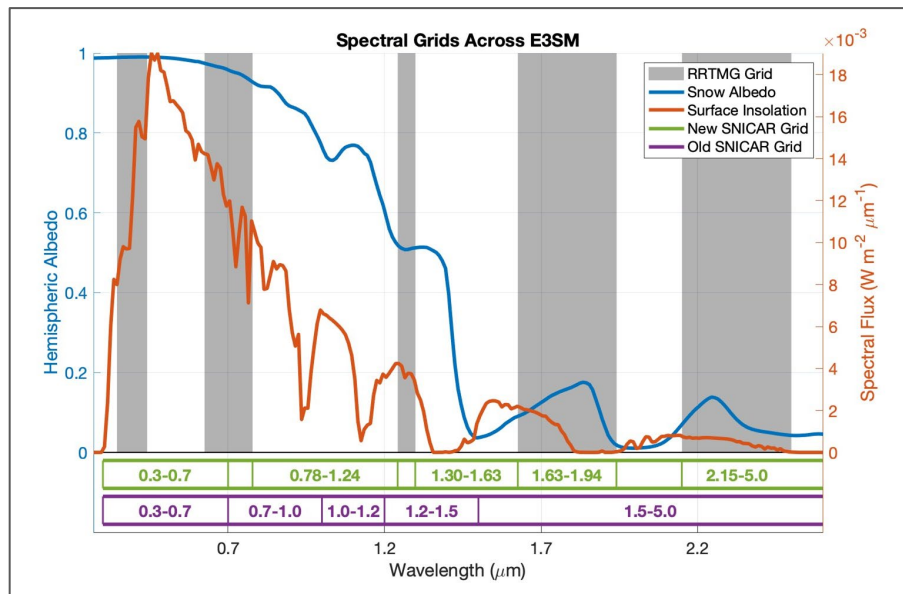
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Conclusions:

- Polar climate is sensitive to spectral distribution of incident radiation
- Shifting $<5 \text{ Wm}^{-2}$ from NIR to VIS band leads to statistically significant increases in albedo, sea ice area, and reduction in surface temperature

Future Work:

- Push towards a spectrally consistent, high resolution exchange of solar fluxes/albedos between atmospheric and cryospheric surface components in coupled models



More details available on preprint of submitted manuscript:

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