

Sea Level in the UK Earth System Model: representation of processes and projections

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Jonathan Gregory^{1,2,6}, Colin Jones^{1,7} and the UKESM1 team^{6,8}

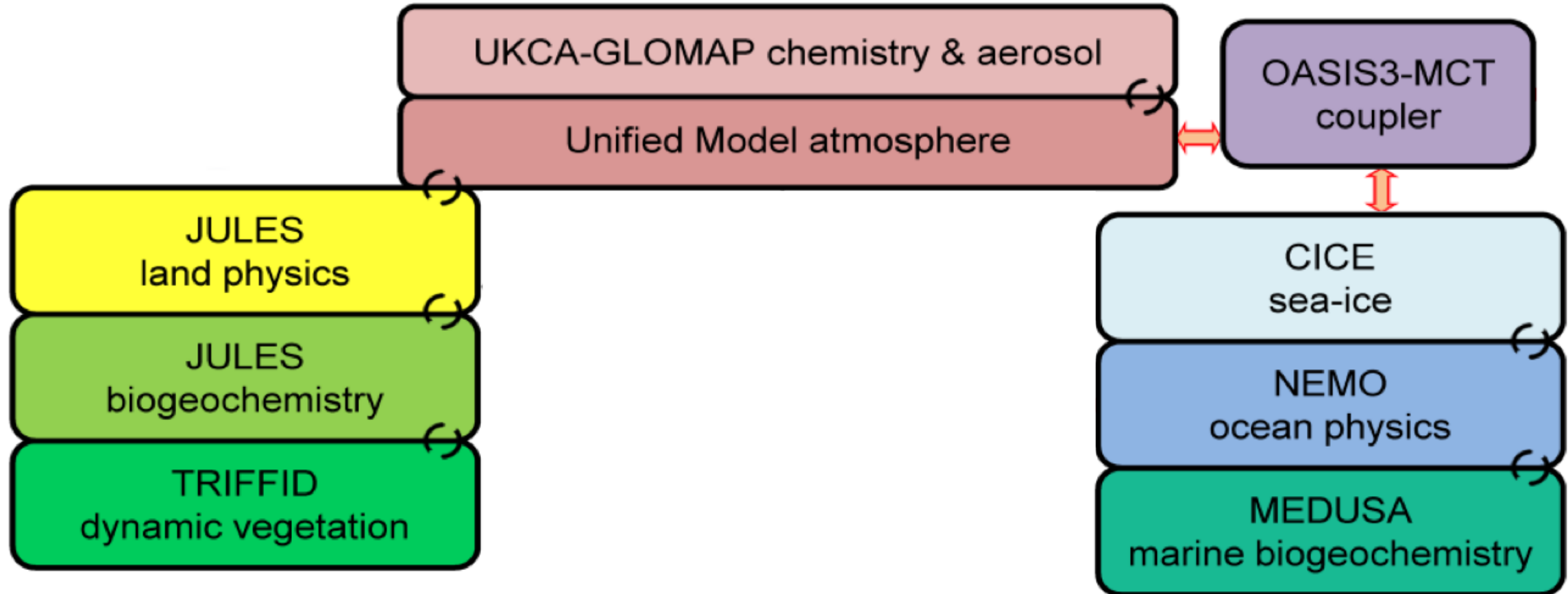
1. National Centre for Atmospheric Science
2. Meteorology, University of Reading
3. Centre for Polar Observation and Modelling
4. Glaciology, University of Bristol
5. British Antarctic Survey, Cambridge
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7. University of Leeds
8. NERC Centres

UKESM1

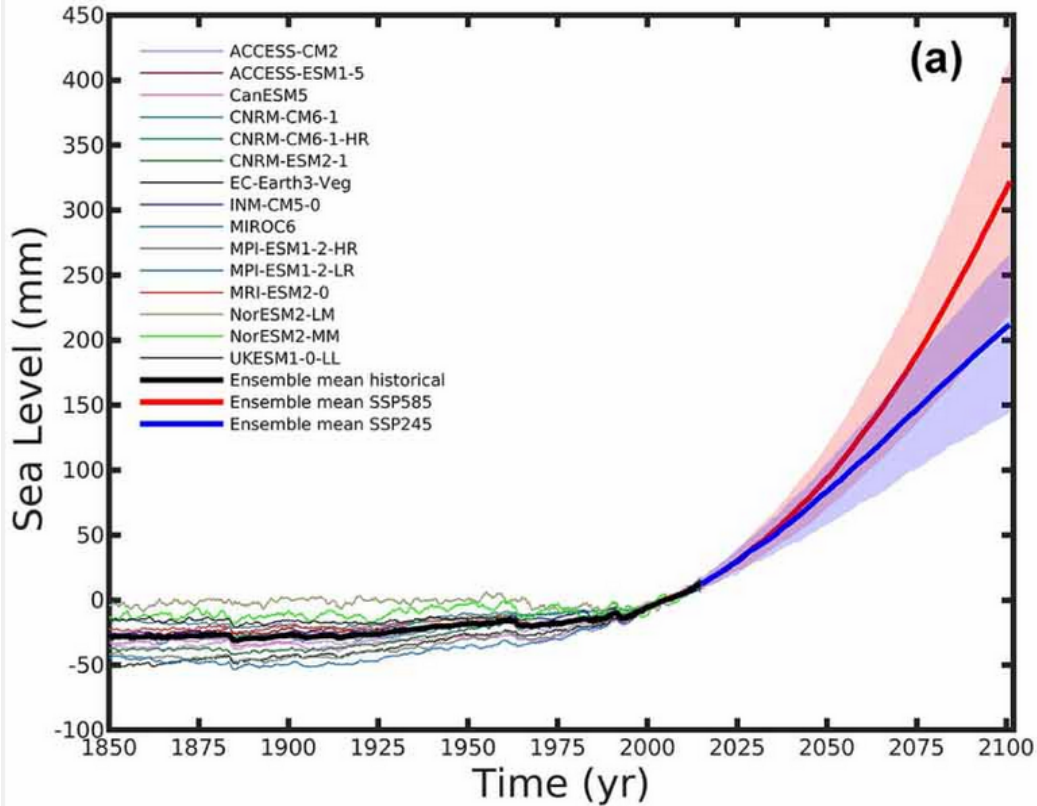


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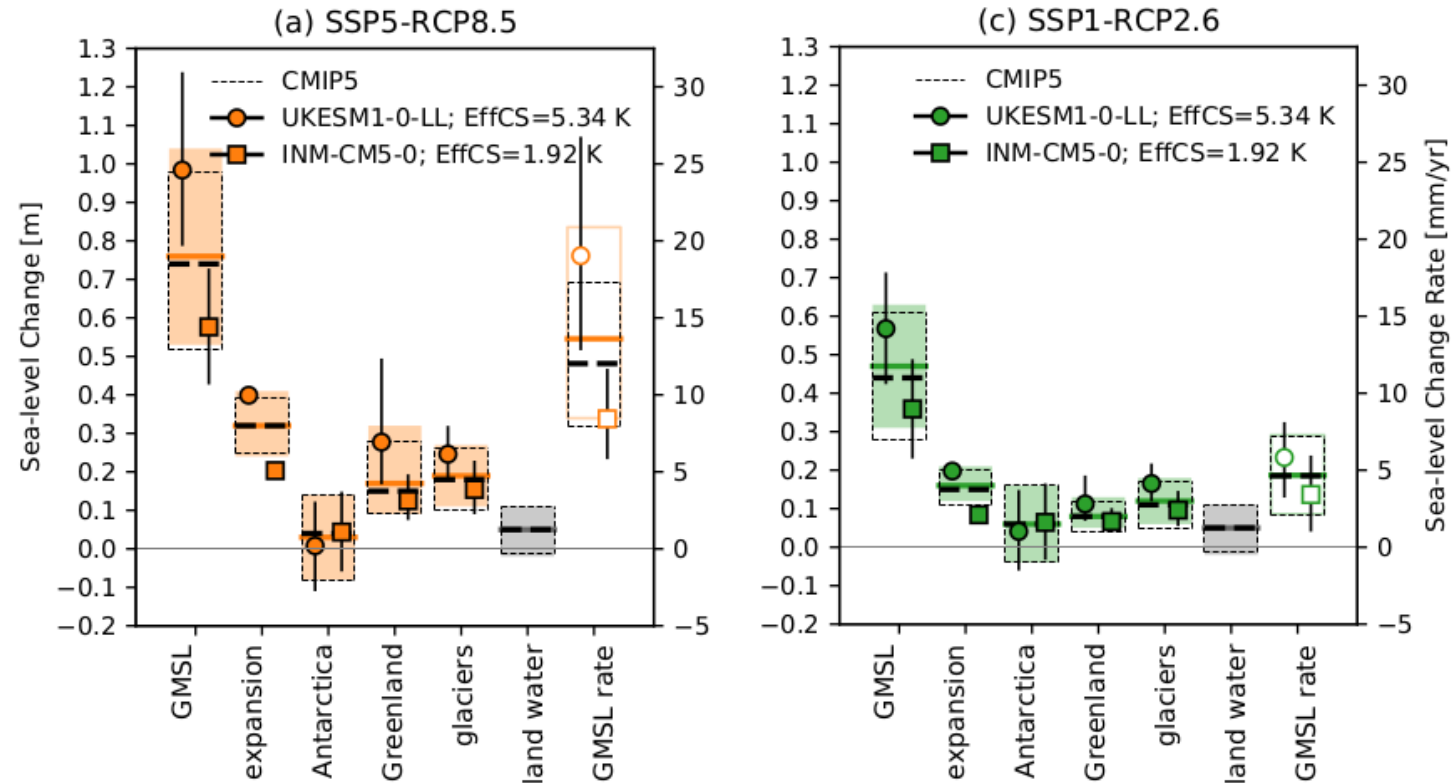
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GMSL derived from UKESM1



GMSL change and components in 2100 relative to 1986–2005



Jevrejeva et al., "Global mean thermosteric sea level projections by 2100 in CMIP6 climate models", Environ Res Lett, 2020

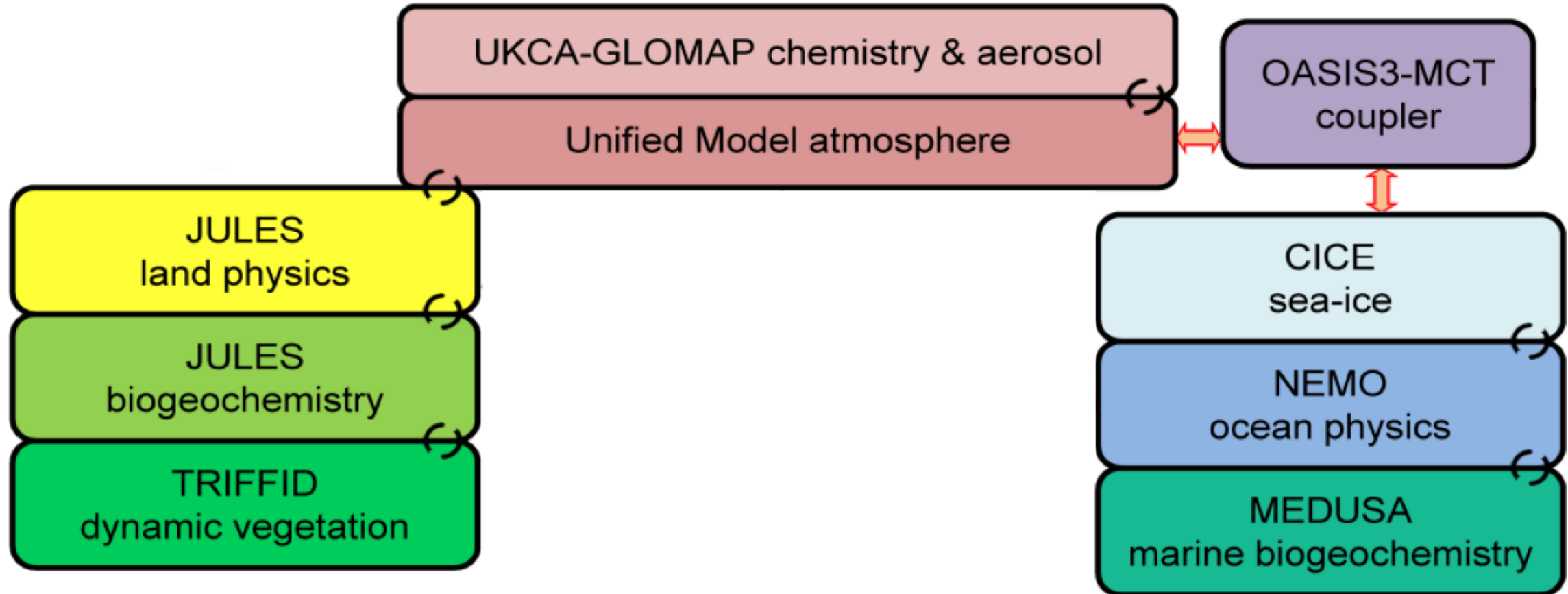
Hermans et al., "Projecting Global Mean Sea-Level Change Using CMIP6 Models", Geophys Res Lett, 2021

UKESM1



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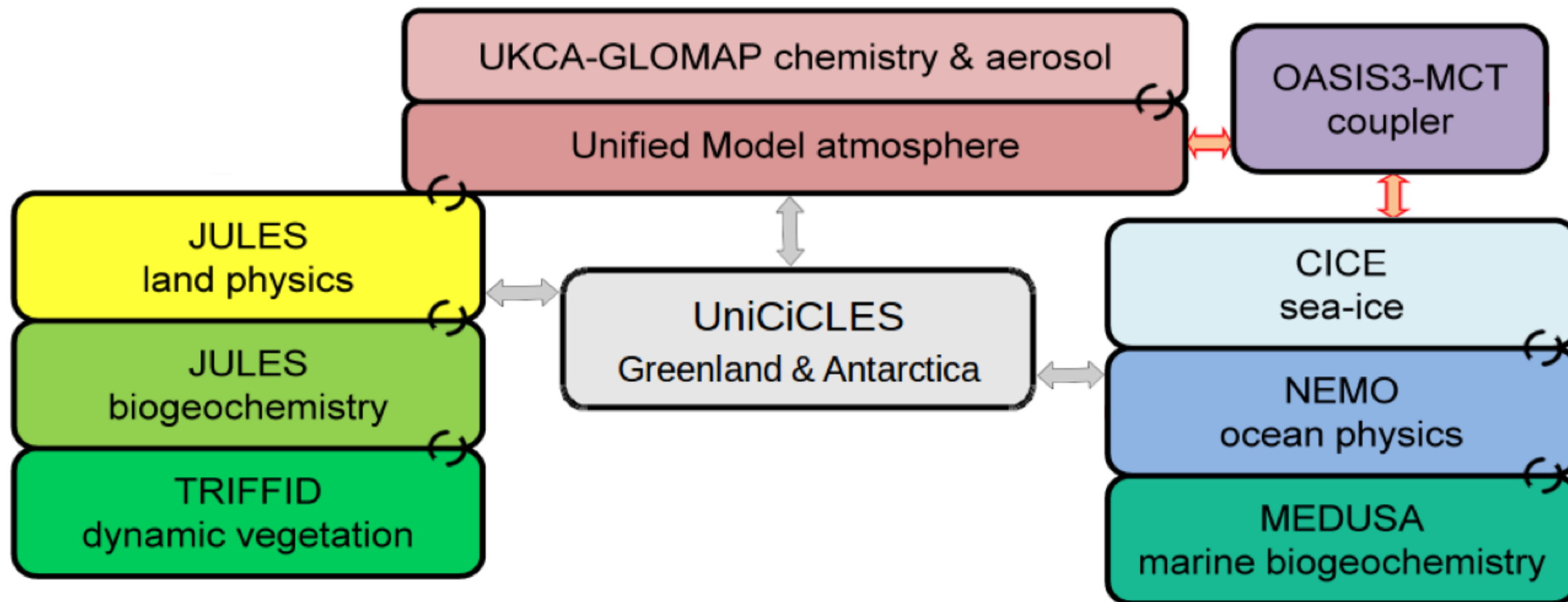


UKESM1-ice



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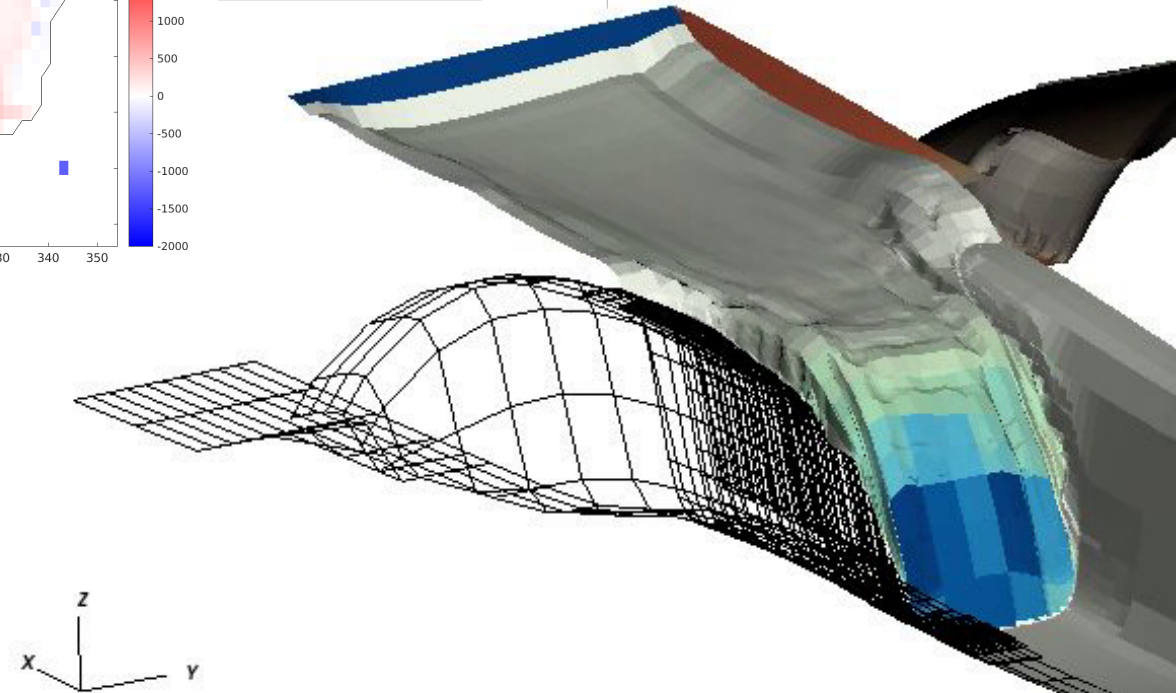
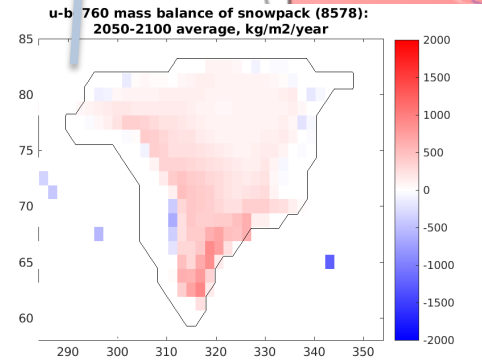
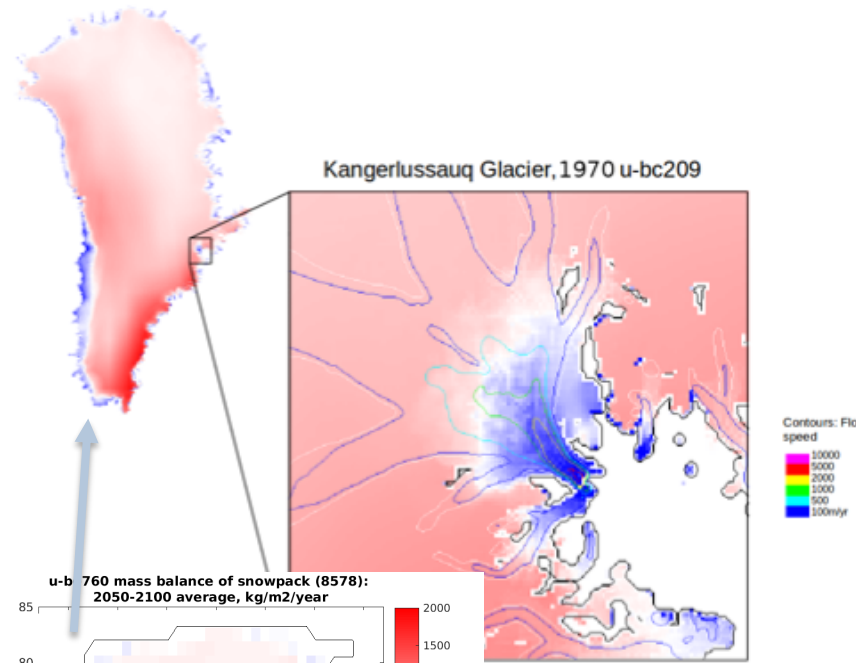
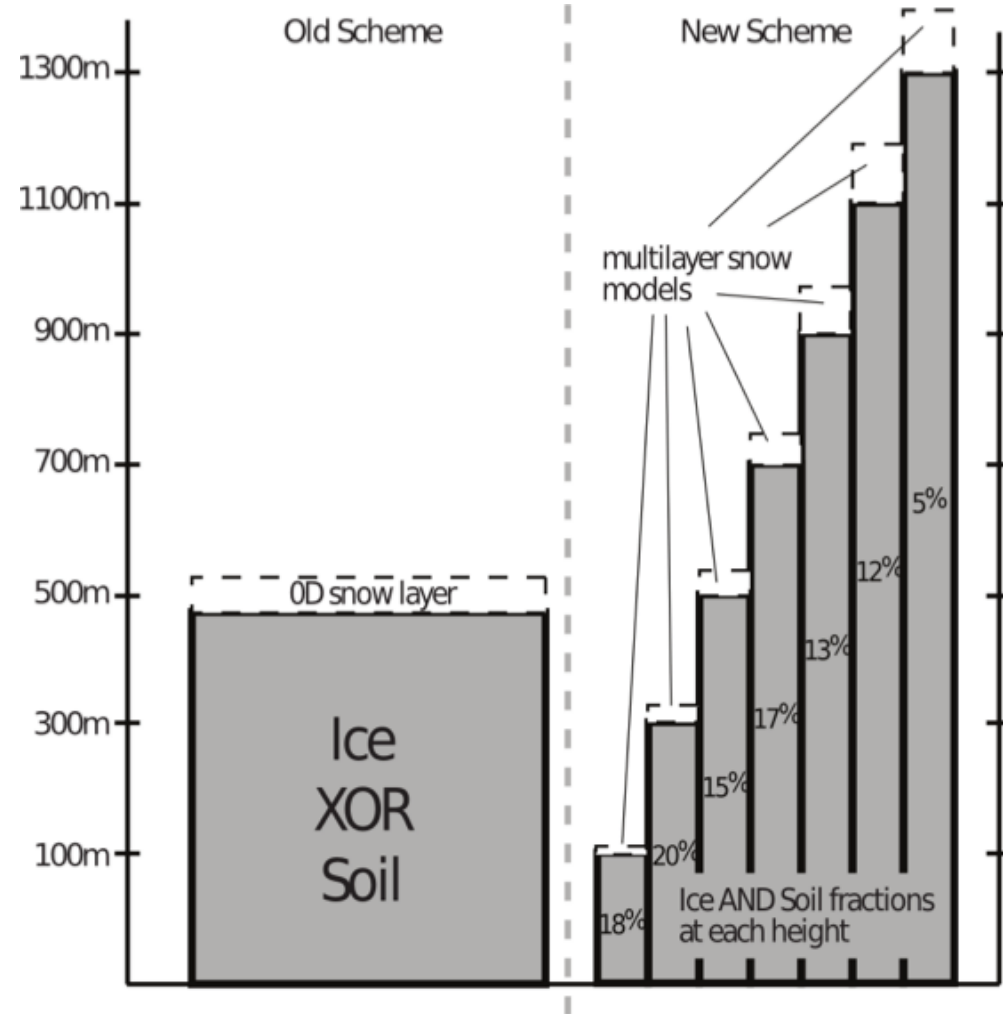


UKESM1-ice



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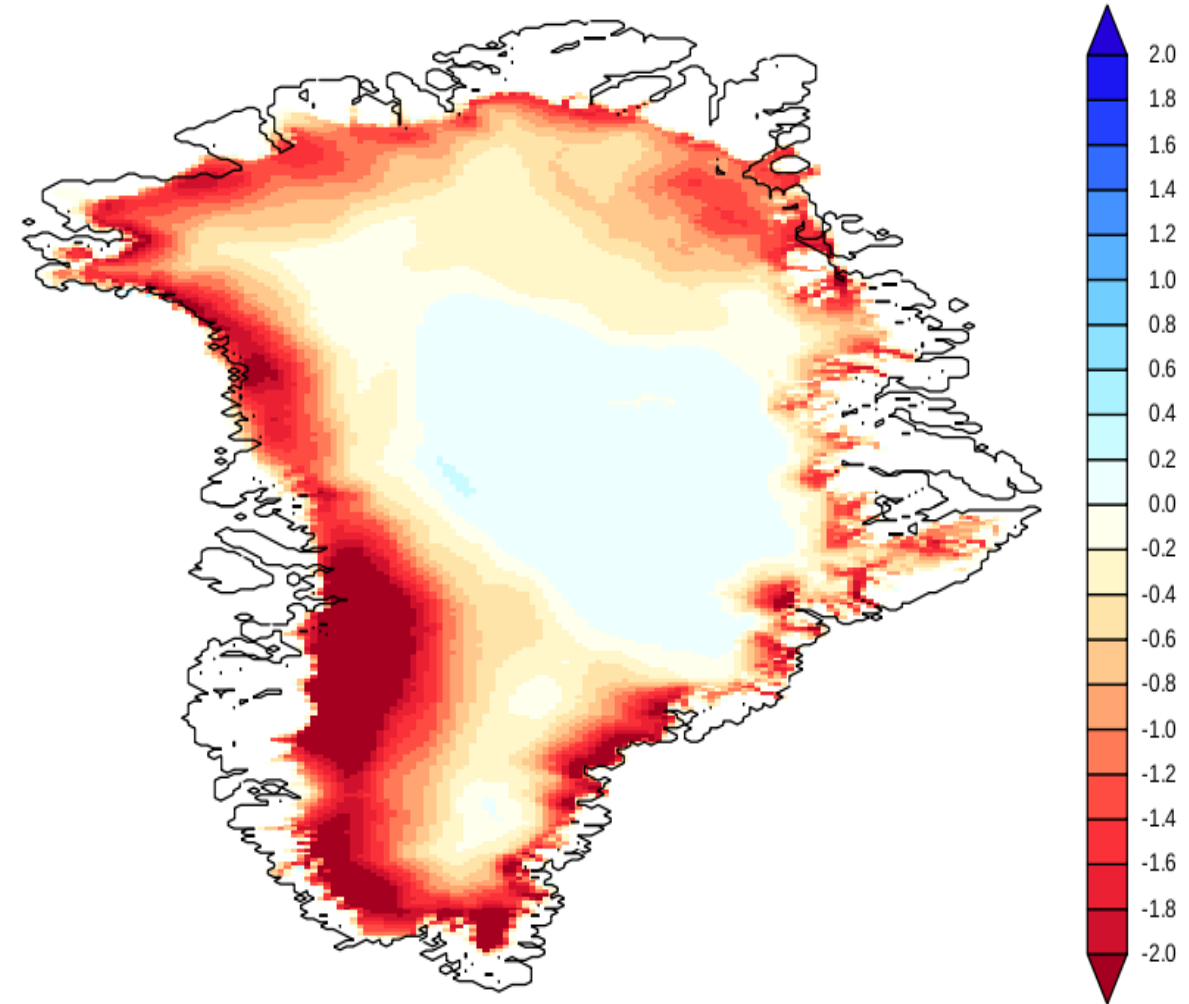
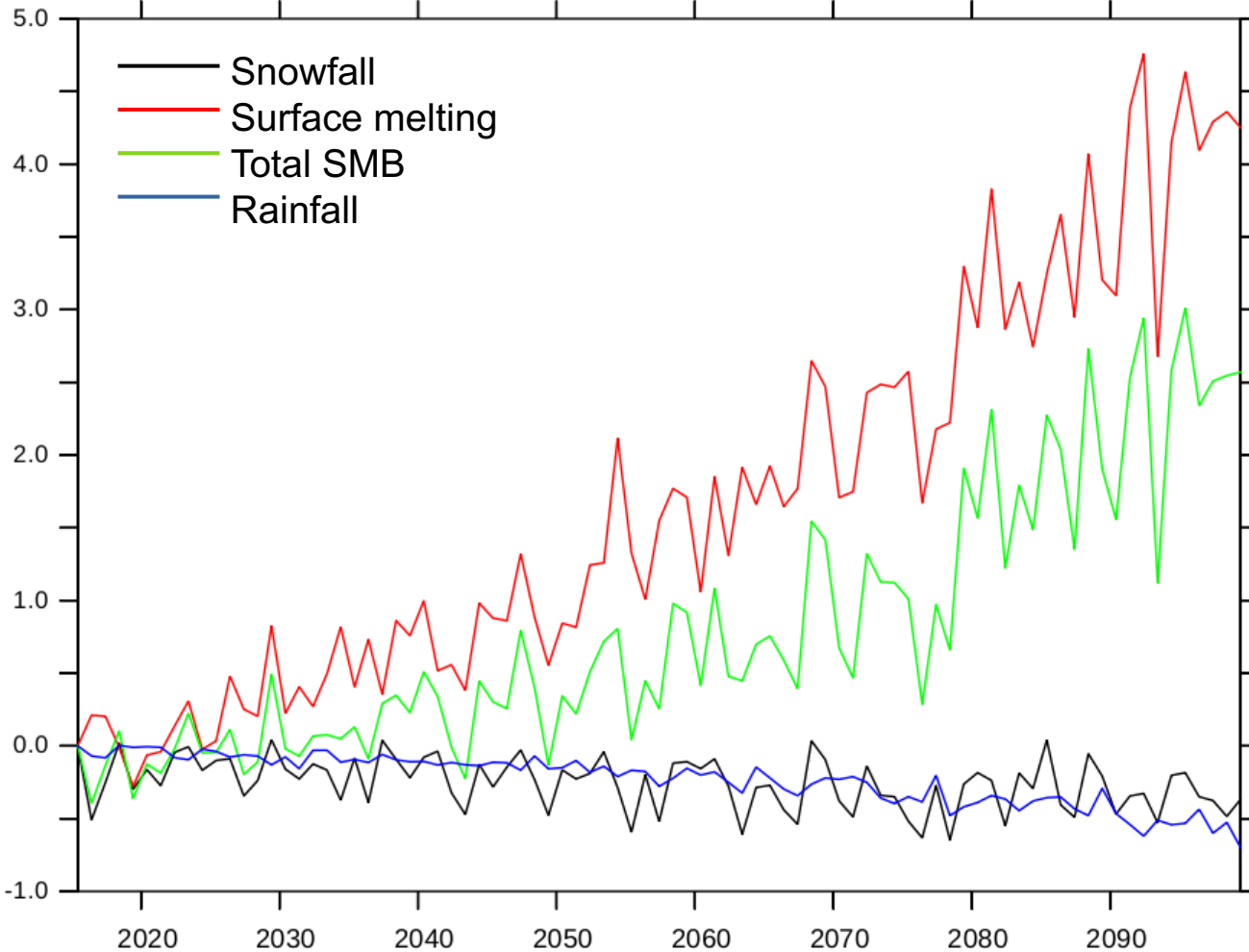
Greenland Surface Mass Balance (SSP5-8.5)



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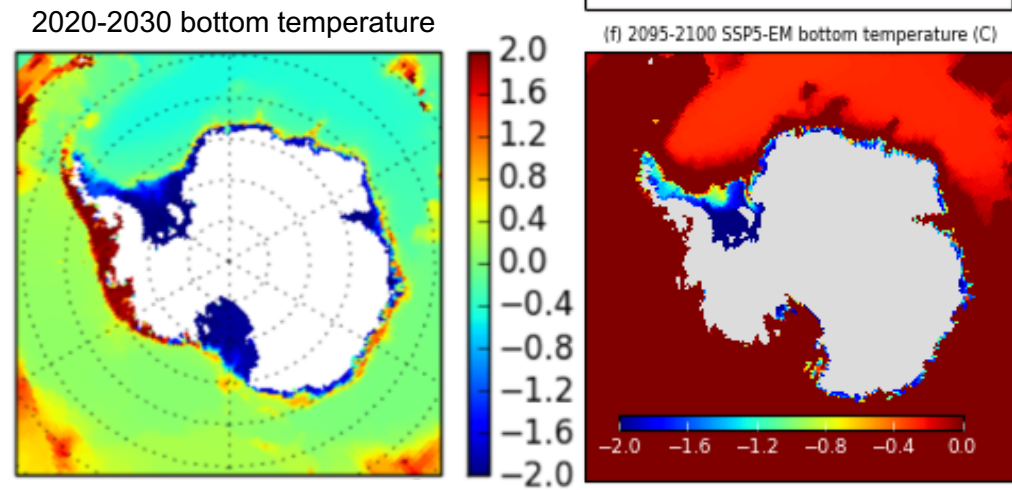
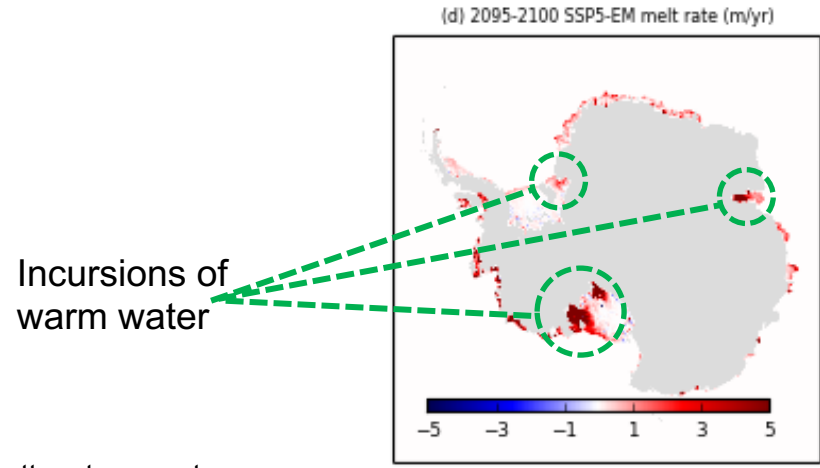
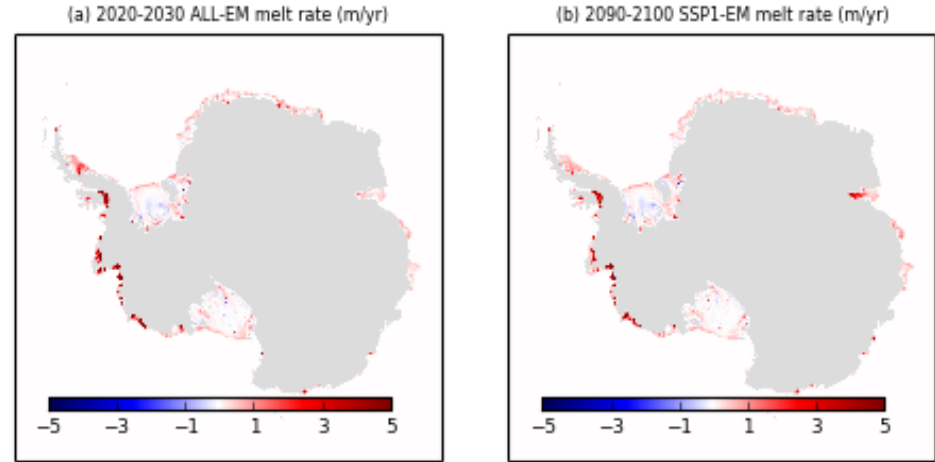
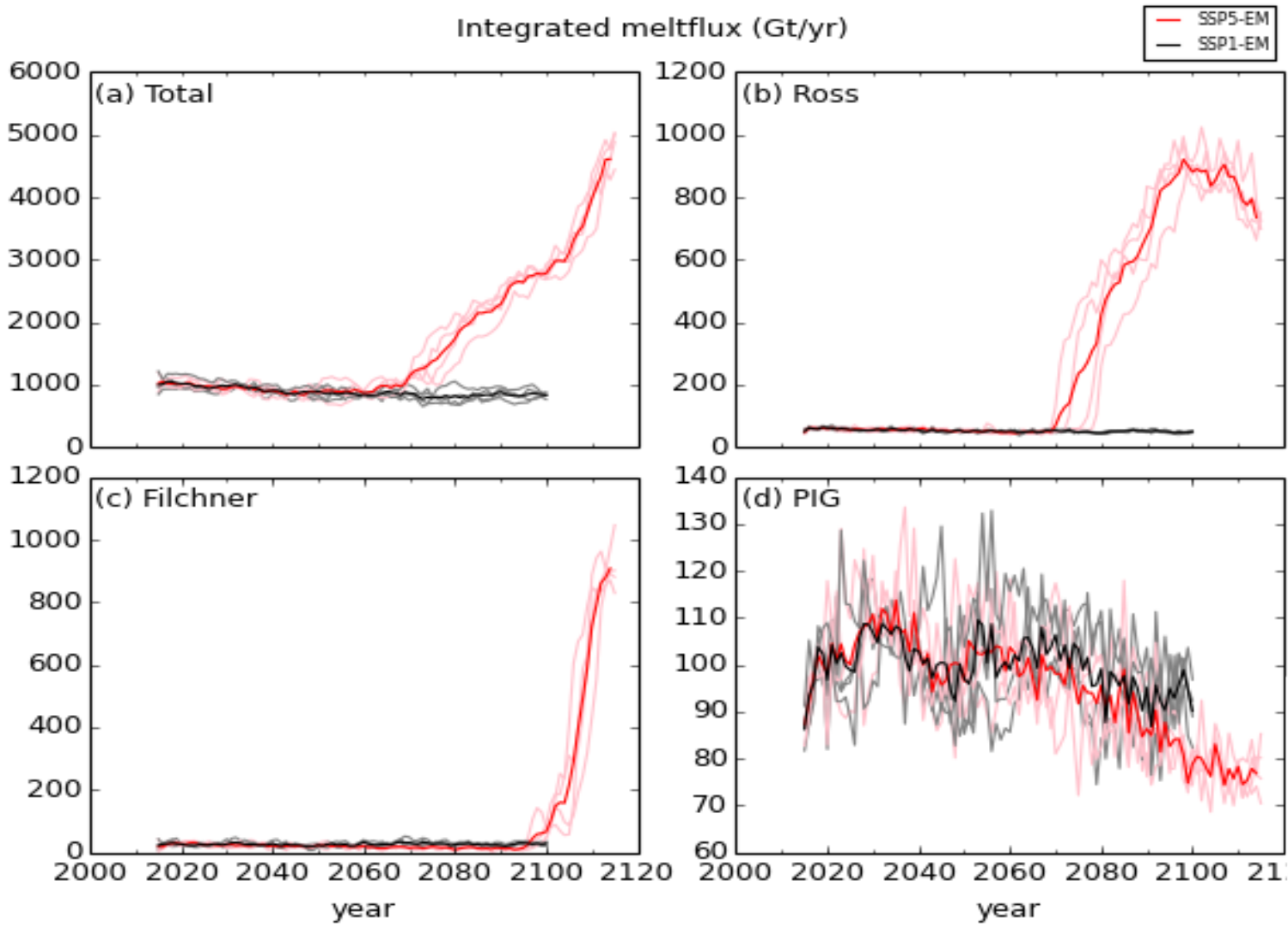


SMB component anomalies relative to present
(equivalent contribution to mean sea level, mm/yr)



Change in SMB 2100-2015 (m/yr)

Antarctic Shelf Melting (SSP5-8.5)



Siahaan et al., "The Antarctic contribution to 21st century sea-level rise predicted by the UK Earth System Model with an interactive ice sheet", in prep

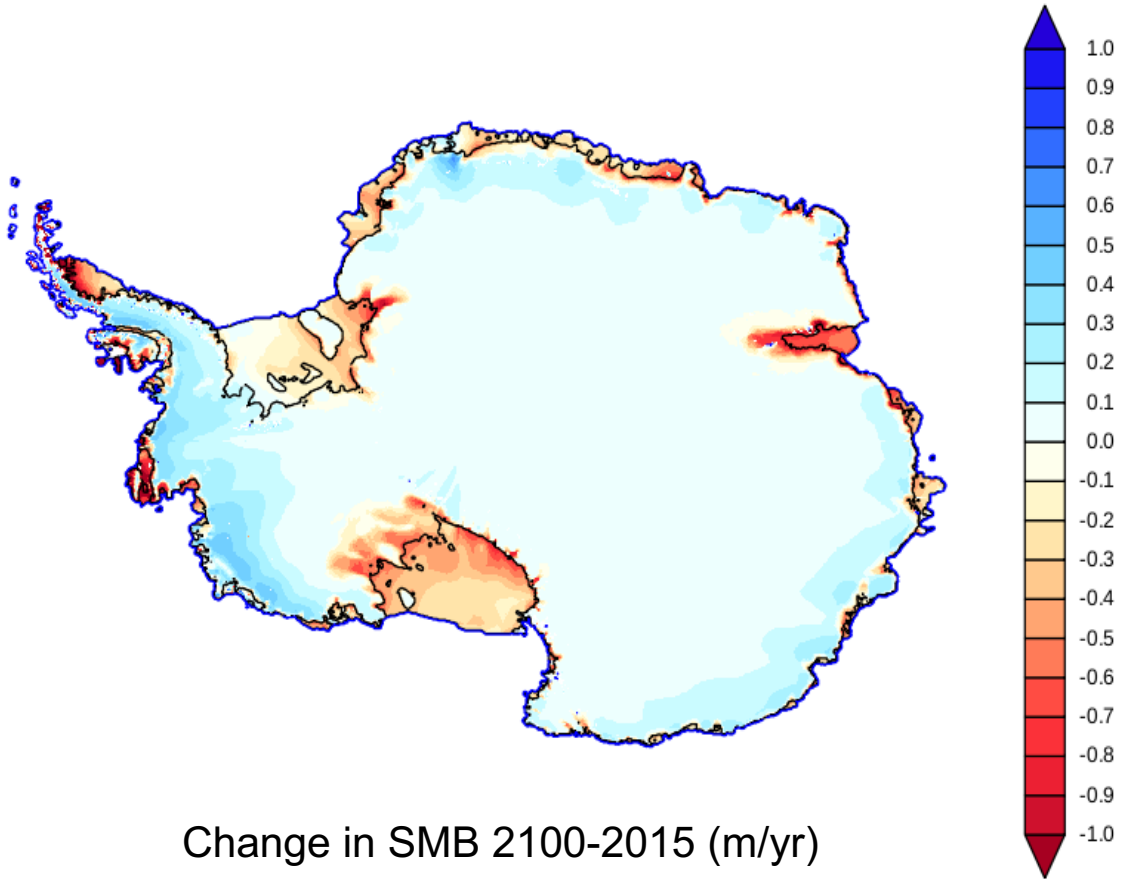
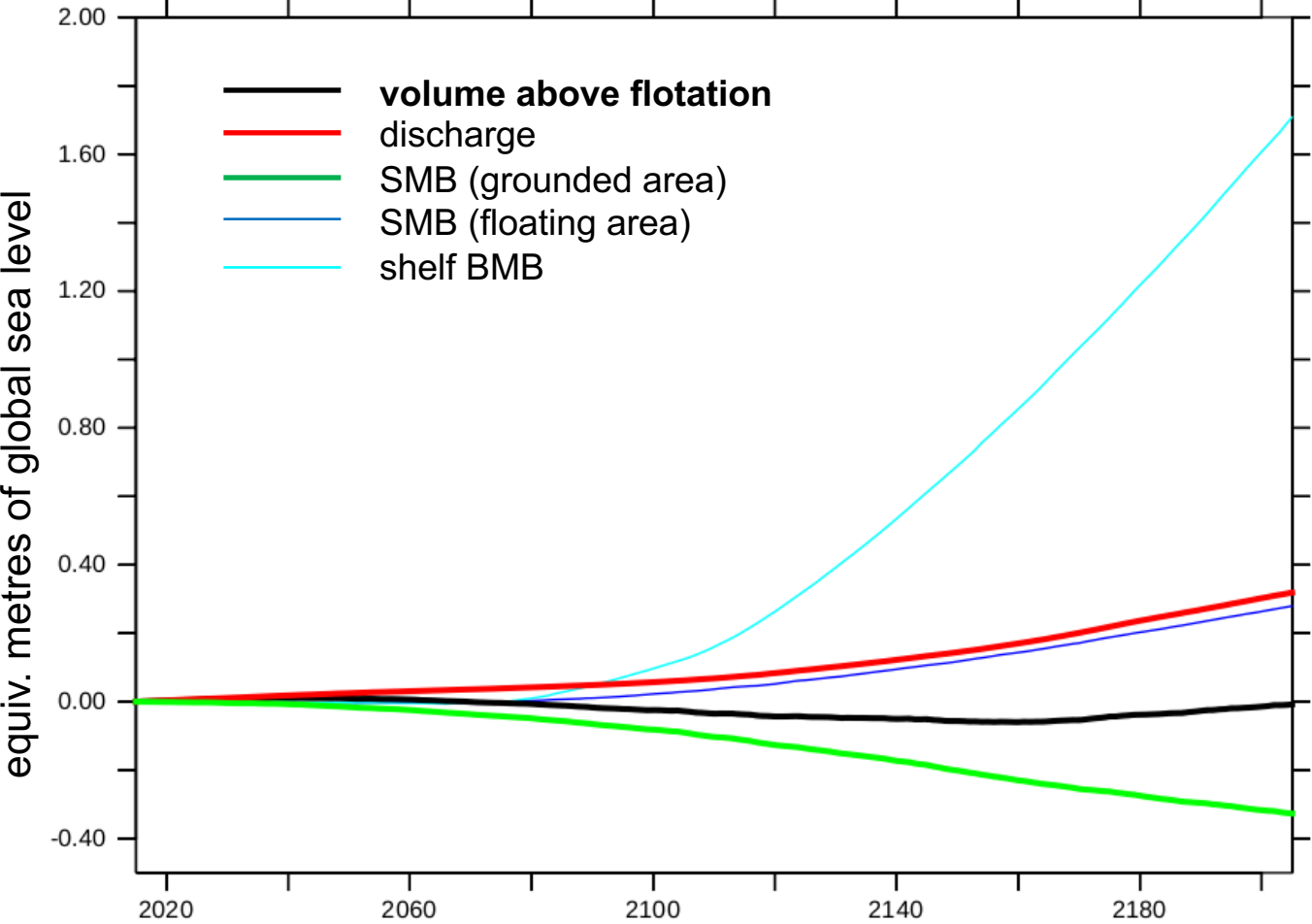
Antarctic Mass Balance (SSP5-8.5)



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Cumulative changes in AIS mass components

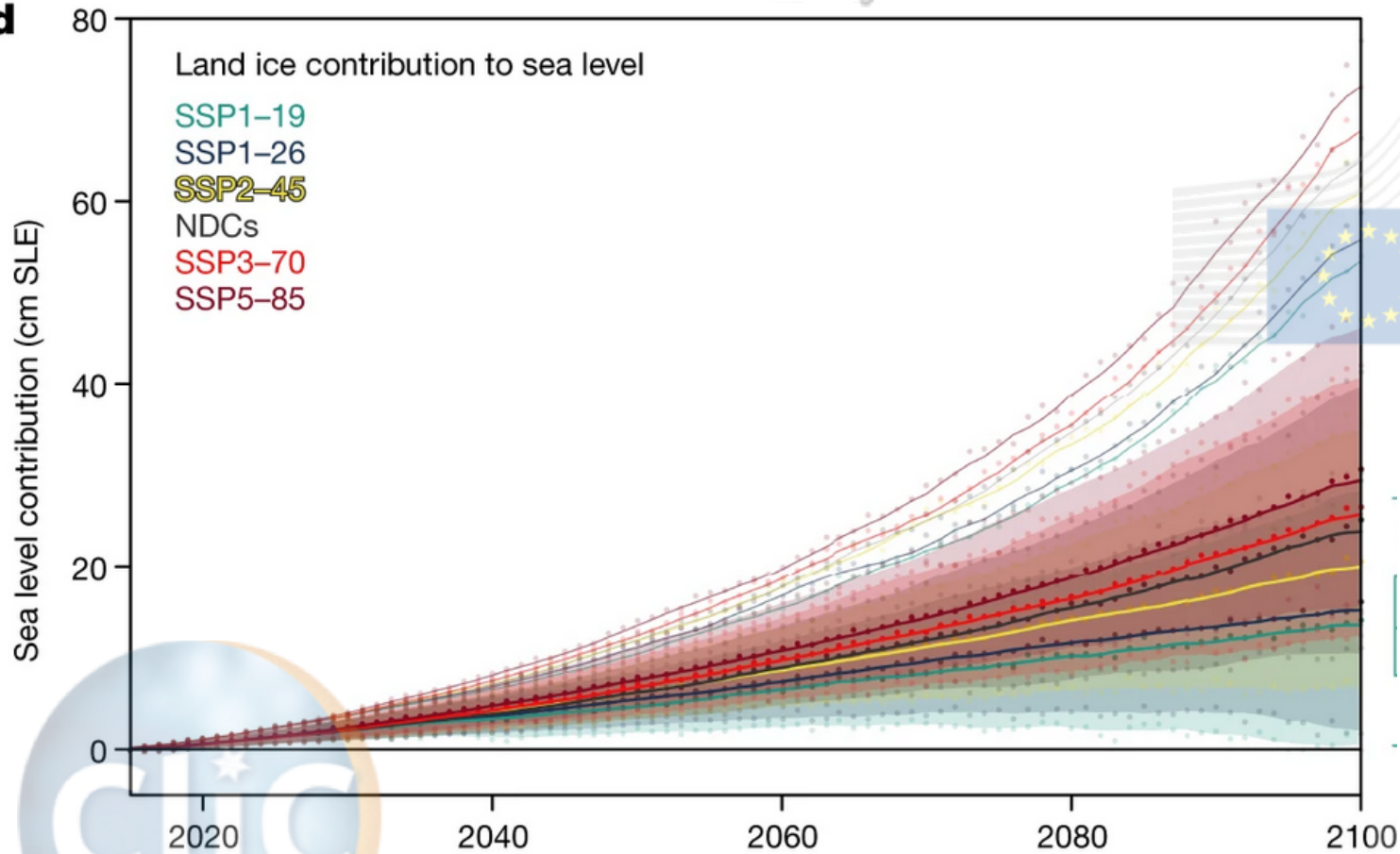


Change in SMB 2100-2015 (m/yr)

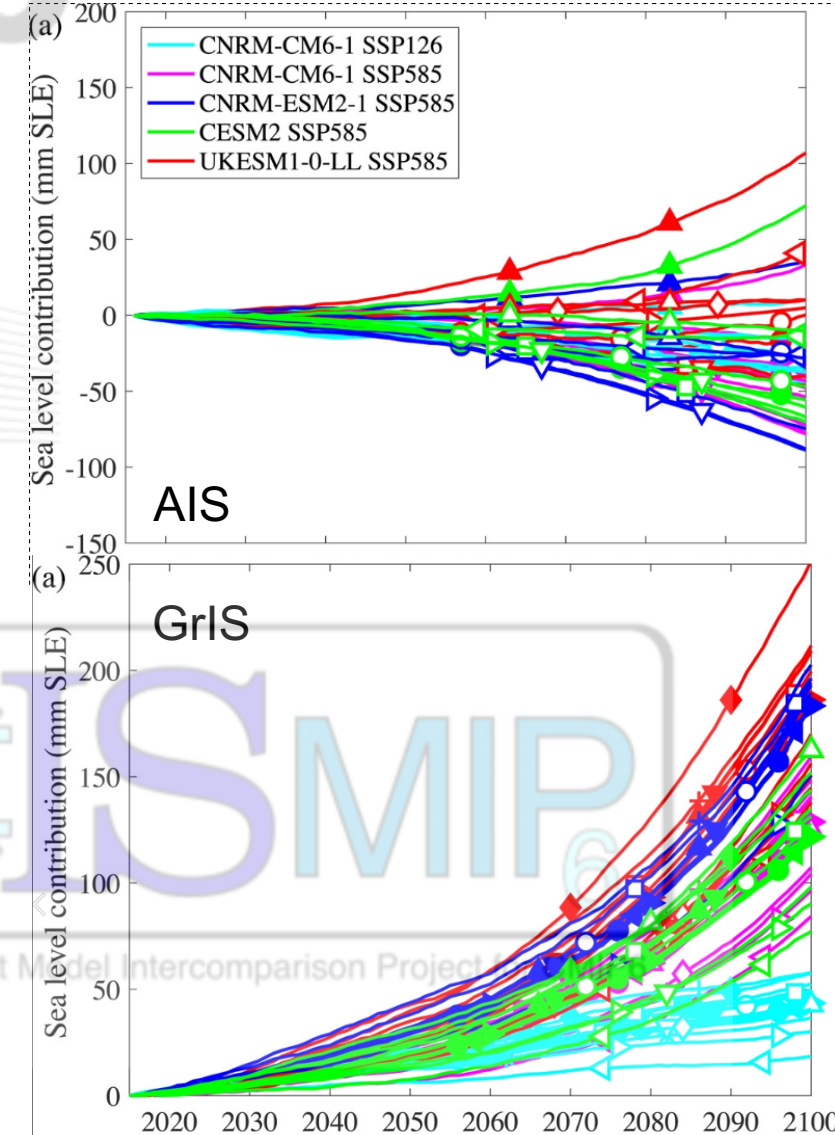
International comparisons



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Edwards et al., "Projected land ice contributions to twenty-first-century sea level rise", Nature 2021



Ice Sheet Model Intercomparison Project

Future directions

- Introduce interactive ice as a standard option in UKESM suites
- Allow fracturing and true retreat/collapse of Antarctic ice shelves
- Balance increasing spatial resolution with improved parameterisations of unresolved areas
- Work with  Hydro-JULES to derive glacier mass balance in UKESM simulations
- Link with coastal shelf modelling for regional aspects
- Focus on low likelihood/high impact events with global consequences

