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Total sea-level rise and the relative importance of its contributions (1993–2015)

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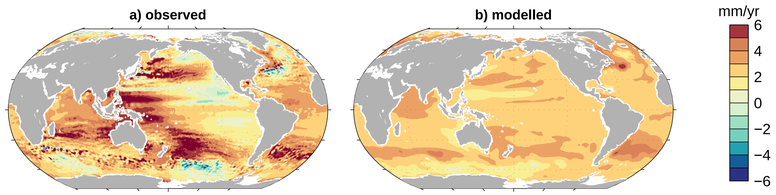
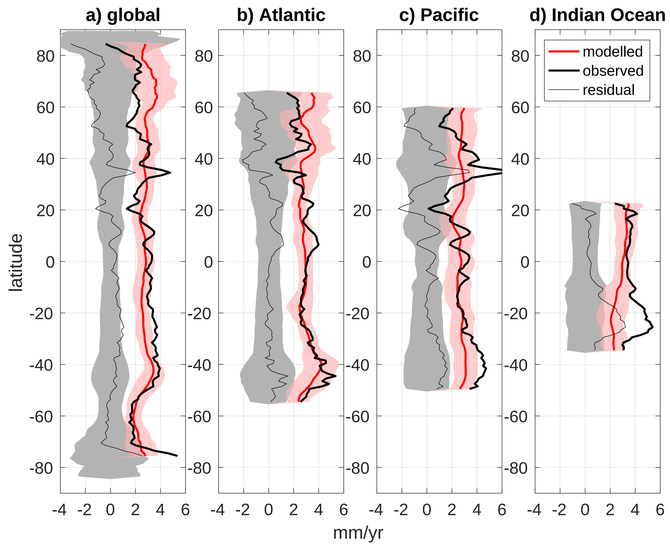
The comparison of observed and ensemble-mean modelled sea-level trends highlights the importance of internal variability:



Observed and modelled linear trends in zonally averaged sea level are outside of what can be expected from internal variability:



Linear trends in zonally averaged sea level (1993–2015) for observations (black) and models (red). The shaded area presents the magnitude of natural variability in steric and dynamic sea level as derived from control simulations.

Acknowledgments

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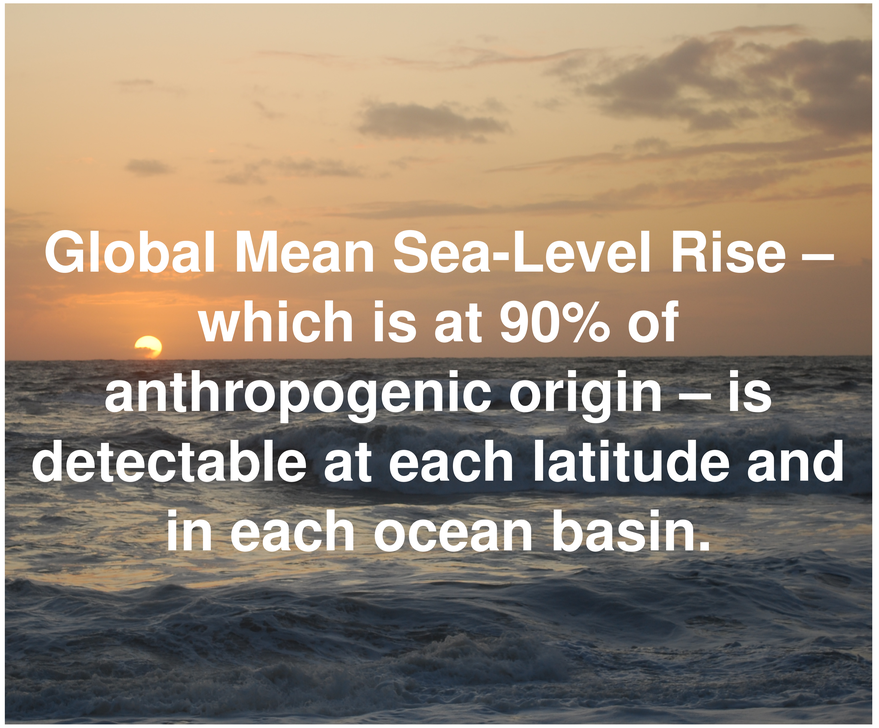


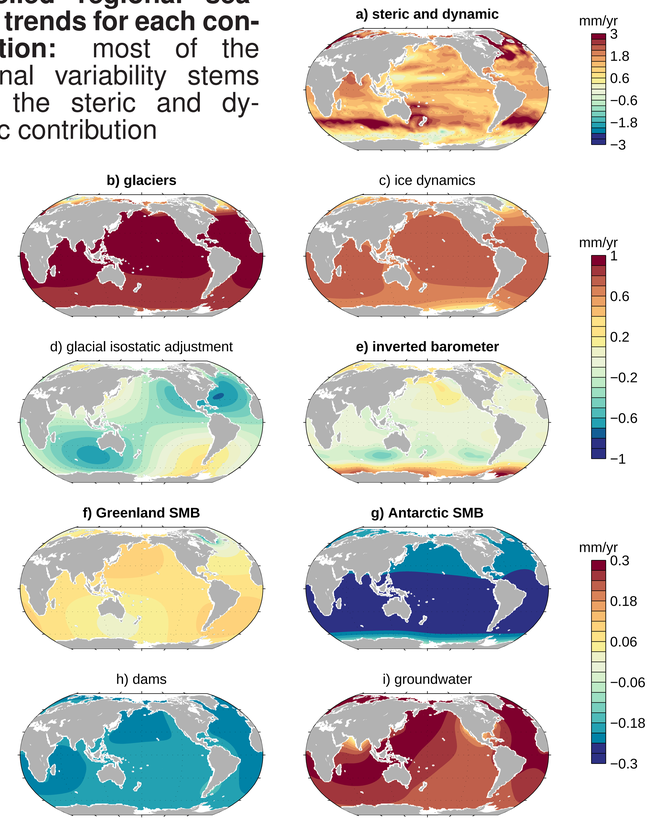
Various factors contribute to absolute sea-level changes:

- **steric and dynamic**: changes in water mass properties (temperature and salinity) and ocean circulation
- shrinking or growing **glaciers**
- **ice dynamics**: ice sheet mass changes due to dynamic ice flow
- **glacial isostatic adjustment**: slow and ongoing changes in the sea surface after the end of the last ice age
- **inverted barometer**: response of sea surface to change in atmospheric sea-level pressure
- surface mass balance (**SMB**) of Antarctic and Greenland ice sheets
- changes in landwater storage: **dams** and **groundwater**

Global mean trend of each contribution:

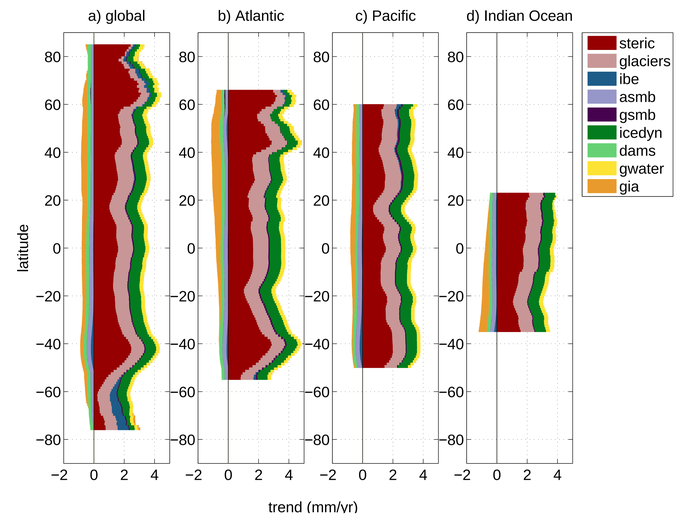
contribution	mean (mm/yr)	contribution	mean (mm/yr)
steric and dynamic	1.48±0.37	Greenland SMB	0.07±0.05
glaciers	0.93±0.23	Antarctic SMB	-0.25±0.08
ice dynamics	0.69	dams	-0.21
GIA	-0.27	groundwater	0.25
inverted barometer	0		
total observed	2.91±0.34		
total modelled	2.7±0.43		

Modelled regional sea-level trends for each contribution: most of the regional variability stems from the steric and dynamic contribution



Contributions derived from process-based models are shown in bold. Note the different color scales.

Modelled zonal trends per contribution: over most of the ocean area, the largest contributions to sea-level rise is from the steric contribution and mass loss from land ice



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