

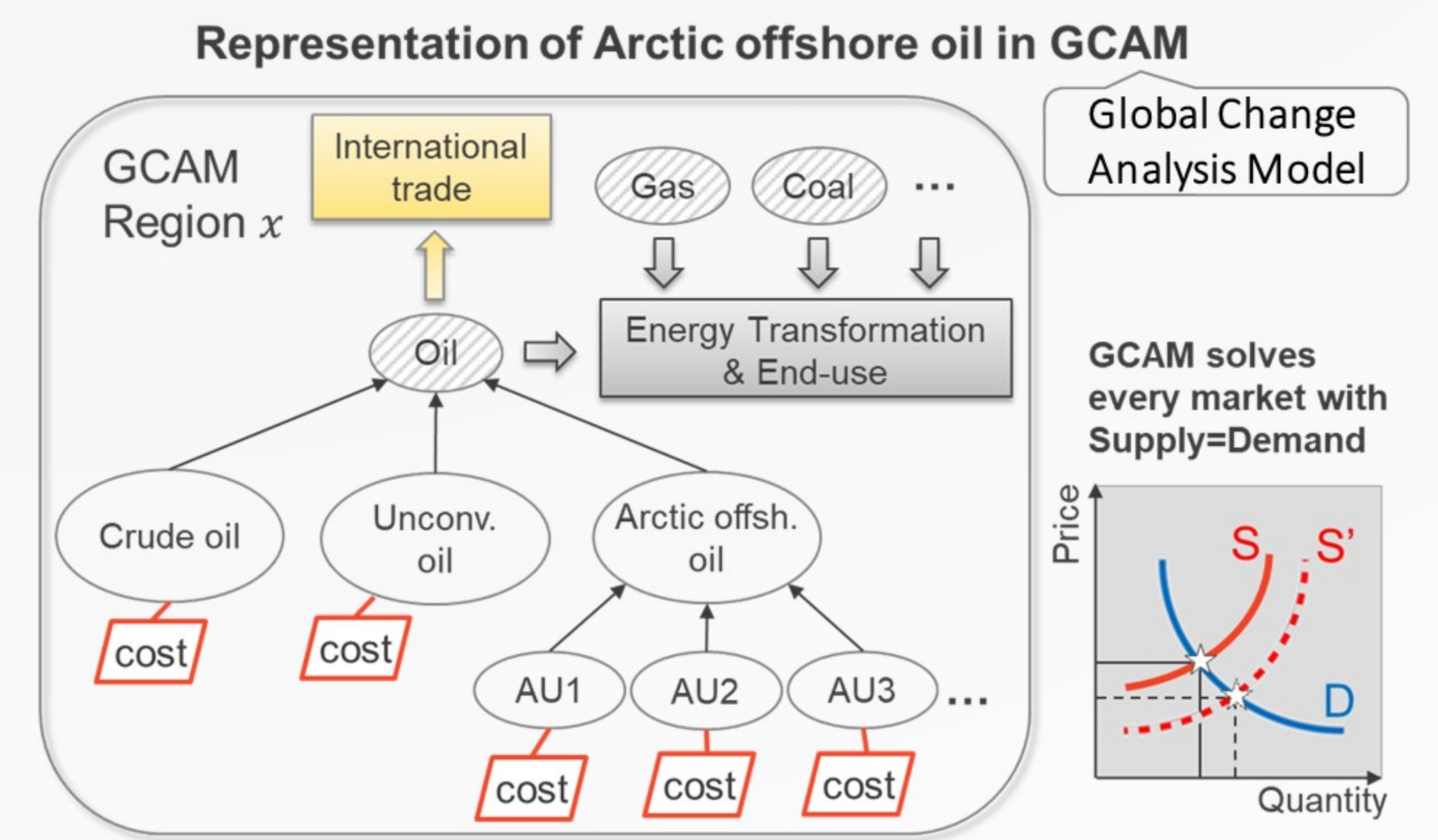
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Background

Climate change has led to sea ice loss in the Arctic, opening access to the resources beneath the ocean. The United States Geological Survey has assessed the undiscovered oil and gas in the Arctic to be 500 and 1850 EJ, respectively¹. Approximately 84% of the assessed Arctic oil and gas potential is offshore. However, the future of oil and gas extraction in the Arctic is unclear given uncertainties in sea ice loss and demand.

Method

We differentiate the costs for Arctic offshore oil and gas production technologies in an integrated assessment model to explore the spatial and temporal patterns of future Arctic offshore oil and gas production under climate change and changes in demand due to human efforts to reach a low-carbon future.



Mean estimated undiscovered oil and gas by Assessment Units (AU) in the Arctic¹ is used.

We derive the costs of future oil and gas extraction based on annual mean and seasonality of sea ice thickness using projections from CMIP6².

Climate change will have a relatively large impact on Arctic offshore **oil** production, especially in the **Alaskan Platform**, with a smaller effect on natural gas production*. The impacts vary greatly by region in **timing** and **production rates** due to differences in the spatial and temporal patterns of sea ice loss.

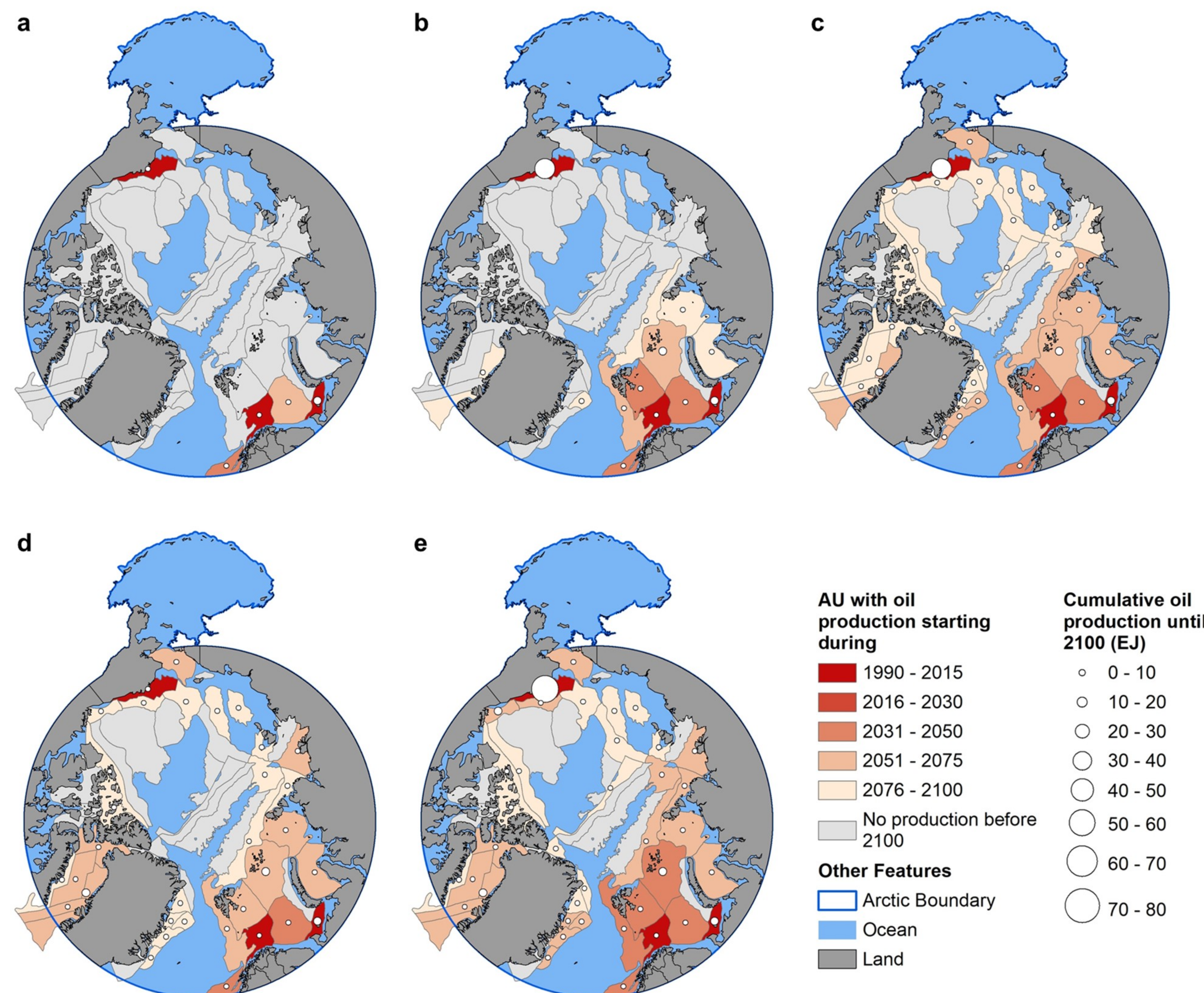
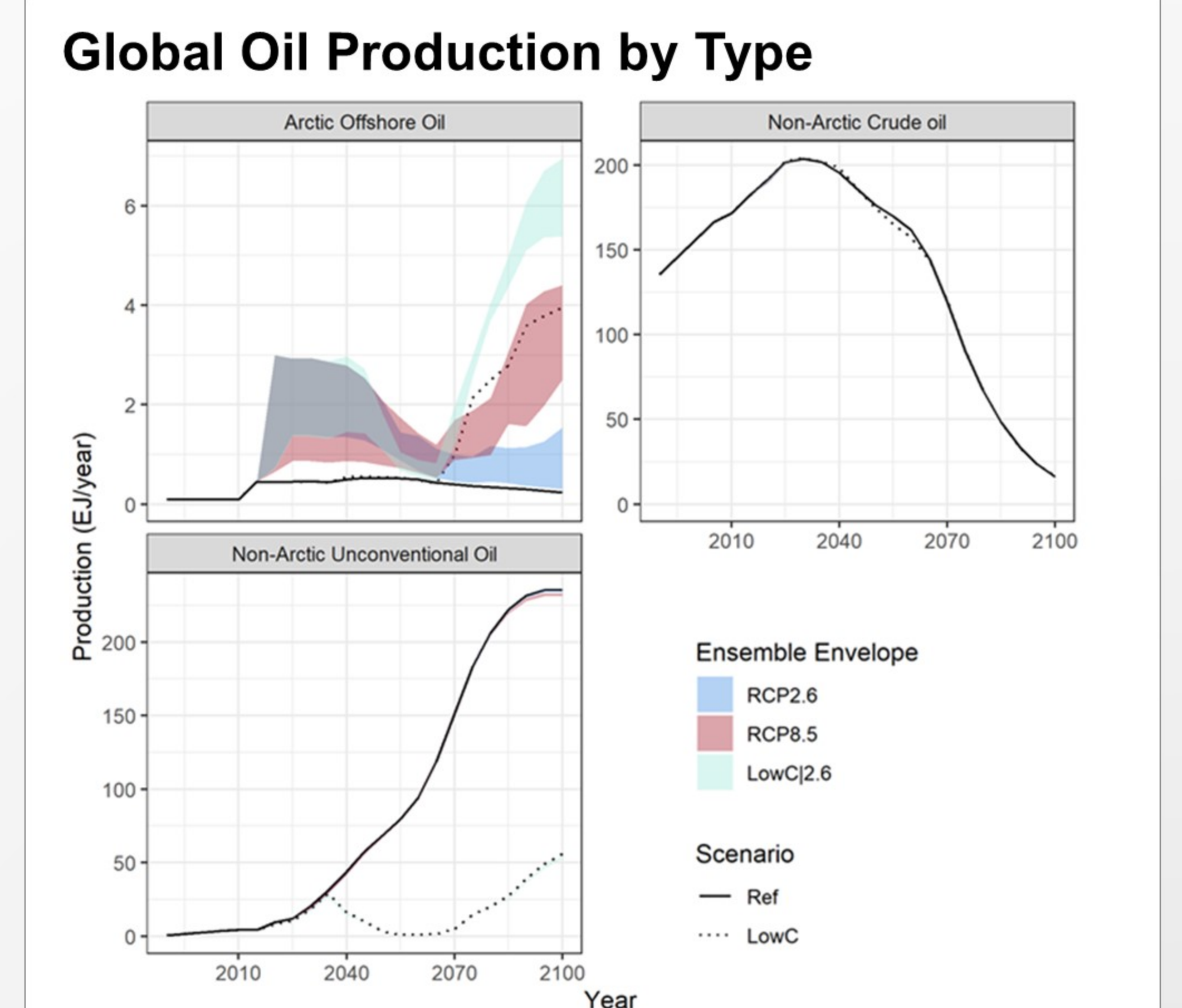


Fig. Arctic offshore oil production at the Assessment Unit (AU) level under a) Ref, b) RCP2.6, c) RCP8.5, d) LowC, and e) LowC|2.6.

*Results of natural gas production are not shown due to limited space of this poster.

Scenarios and Results

	Climate Change	Low-Carbon Future
Ref	No change of sea ice conditions in the future	No emission pathway target
RCP2.6	Change of sea ice conditions under RCP2.6	Pathway target of RCP2.6 in 2100
RCP8.5	Change of sea ice conditions under RCP8.5	
LowC	No change of sea ice conditions in the future	
LowC 2.6	Change of sea ice conditions under RCP2.6	



Climate change impacts on Arctic sea-ice thickness will increase Arctic offshore oil production, though it is likely to remain a small portion of total global oil production. The LowC scenarios cause an increase in Arctic offshore oil production because Arctic offshore oil is relatively clean and can replace the “higher emissions” unconventional oil production to meet the overall oil demand. Overall, under the explored scenarios, future Arctic offshore oil and gas extraction is not likely to affect the global oil and gas markets.

References

- Gautier, D. L. *et al.* Assessment of Undiscovered Oil and Gas in the Arctic. *Science* **324**, 1175-1179, doi:10.1126/science.1169467 (2009).
- Eyring, V. *et al.* Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization. *Geosci. Model Dev.* **9**, 1937-1958, doi:10.5194/gmd-9-1937-2016 (2016).