ESM1.5 control and historical experiments - ocean and OBGC states

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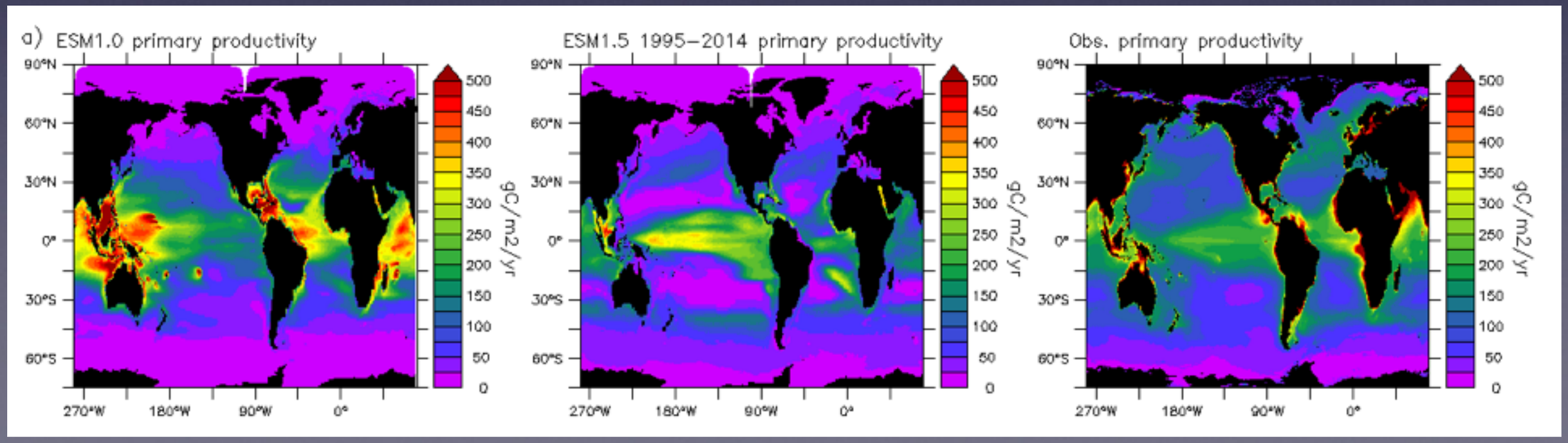
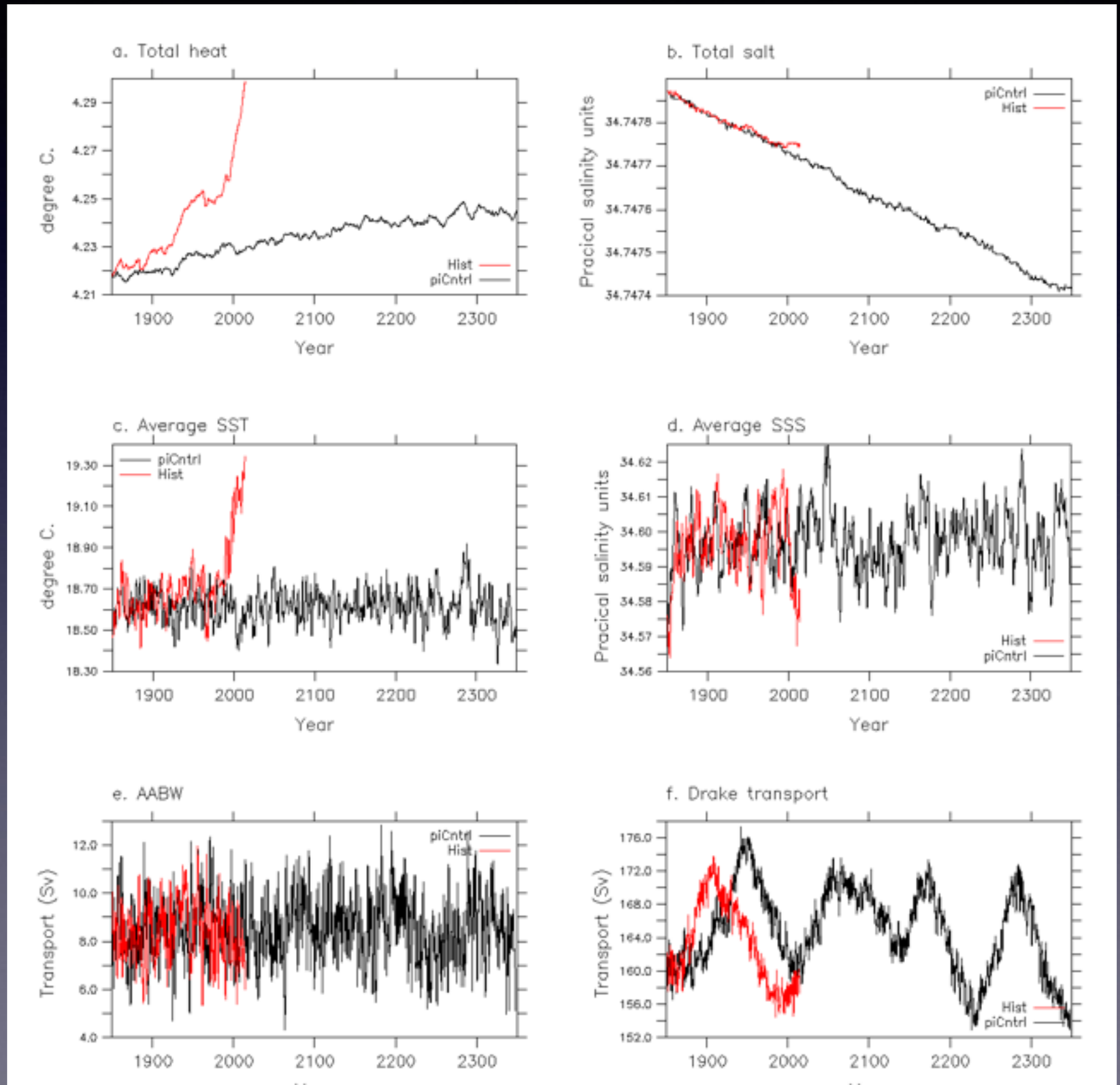


Summary

- State of ESM1.5 physical ocean, sea ice and ocean biogeochemistry is consistent with ESM1.0 and ACCESS1.3.
- Long spinup has reduced drift in climate state.
    - Allows anthropogenic response to stand out clearly in ocean and sea ice.
- ESM1.5 OBGC state is closer to observations relative to ESM1.0.

Trends in the physical ocean

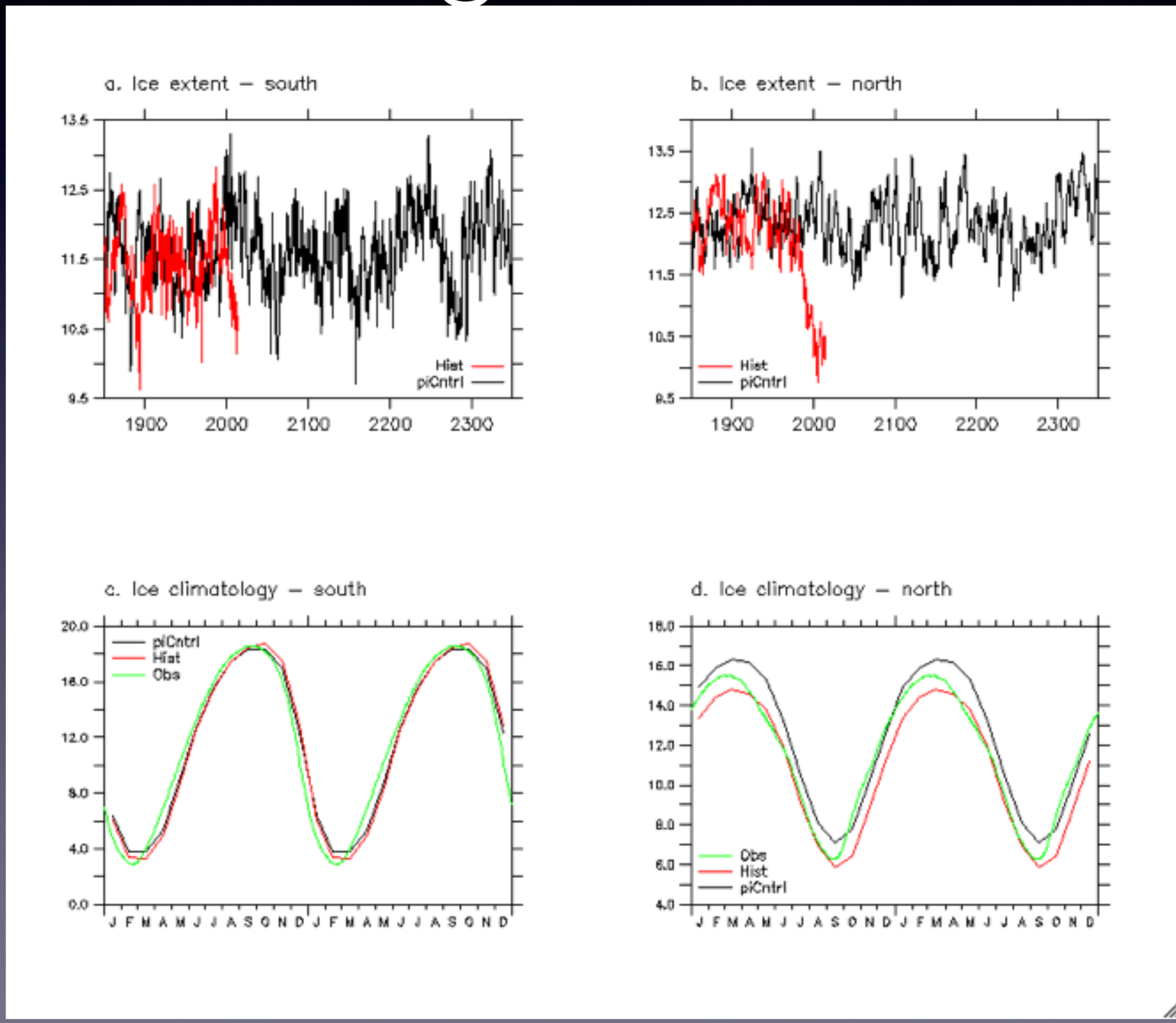
- Experiments shown: PIcontrol (black), historical (red).
- Long spinup -> smaller trends in total heat+salt (top row, 10x smaller cf. CMIP5).
- Surface trends << variability (middle).
- Decadal/centennial variability in circulation of deep ocean (bottom).



Sea Ice - trends and climatologies

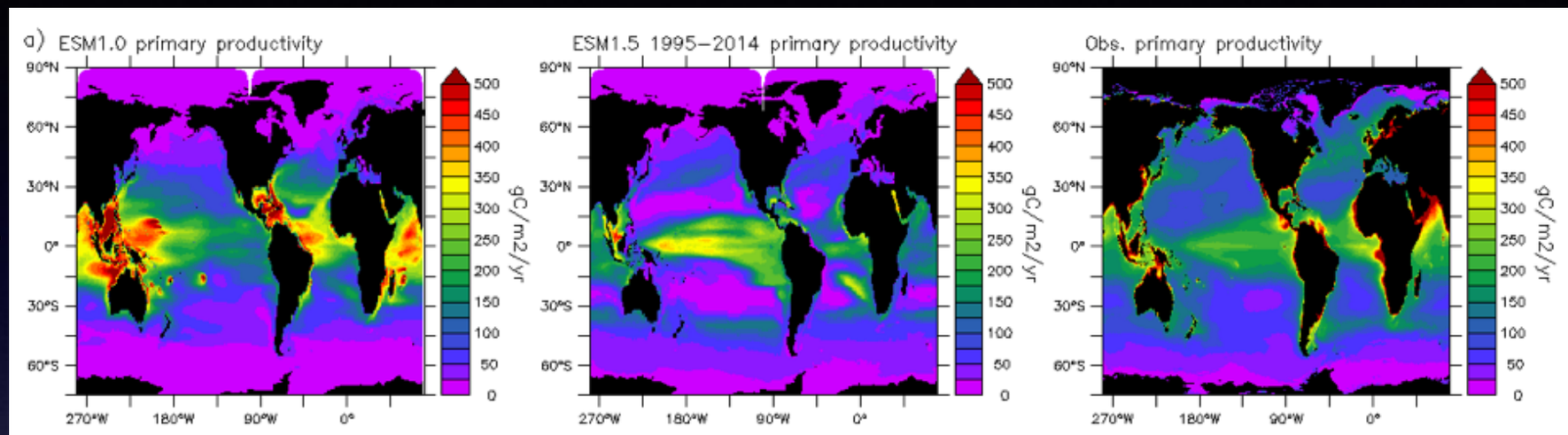
- Anthropogenic response seen in Arctic, response in south < variability.

- Seasonal sea ice extent close to observations (NSIDC, 1981-2010) in south.



Ocean biogeochemistry

- ESM1.0 left, ESM1.5 centre, observations right.
- OBGC parameters updated in ESM1.5 to increase nutrient export from upper ocean and increase background iron.
- Extent of nutrients (middle) at surface reduced and ocean productivity (top) closer to observations (ocean colour).
- Small affect on CO2 flux (bottom).



Deep ocean circulation

- Transport matrix constructed from ESM1.5; solved steady-state radiocarbon tracer field (~water age).

- Water in deep north Pacific (top row) more depleted cf. ACCESS1.3; Atlantic unchanged.

- AABW weaker in ESM1.5 (~60% of ACCESS1.3). NADW ~same.

- Effect also seen in OBGC state - higher build up of nutrients.