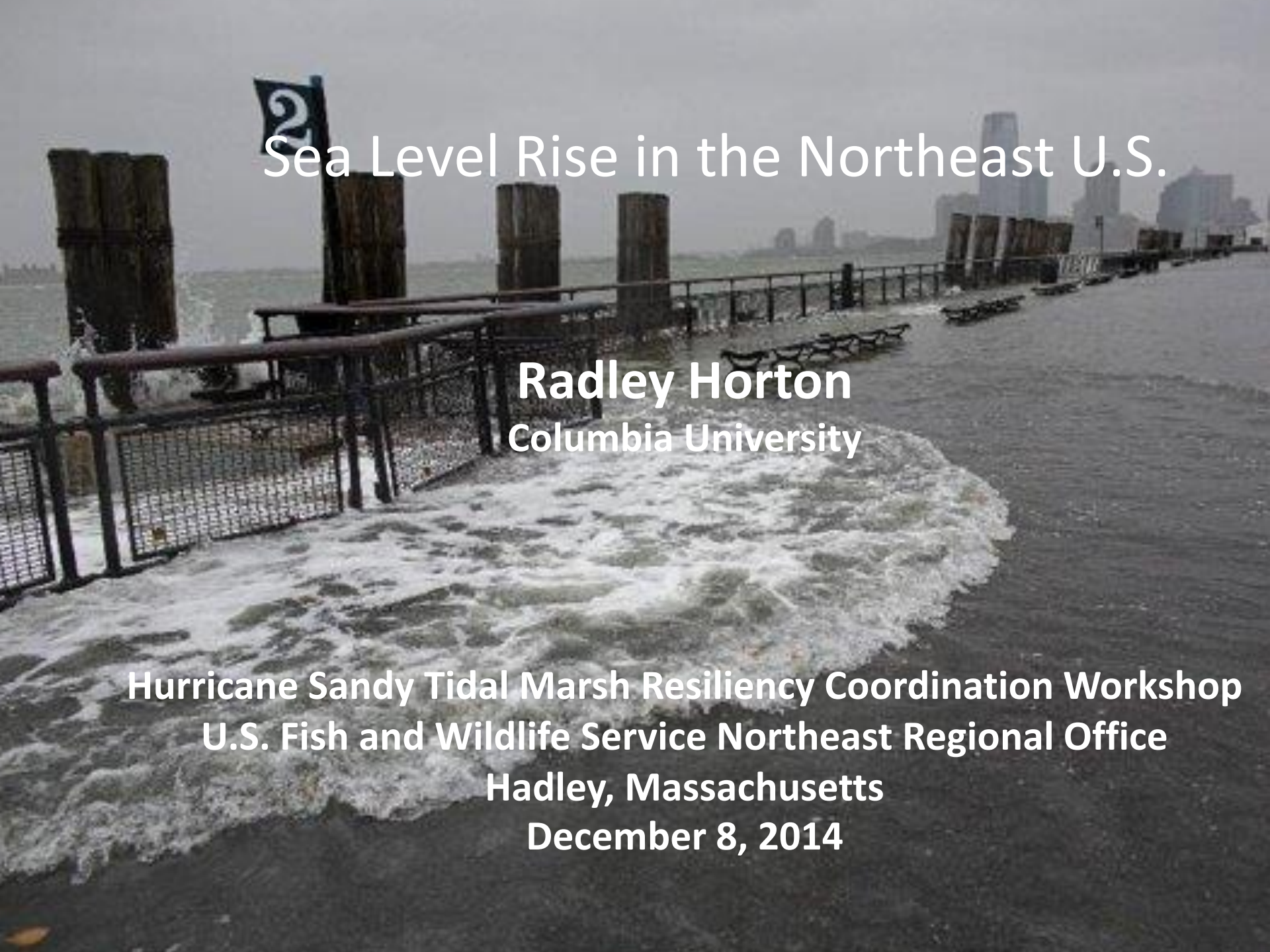

Sea Level Rise in the Northeast U.S.

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Hurricane Sandy Tidal Marsh Resiliency Coordination Workshop
U.S. Fish and Wildlife Service Northeast Regional Office
Hadley, Massachusetts
December 8, 2014

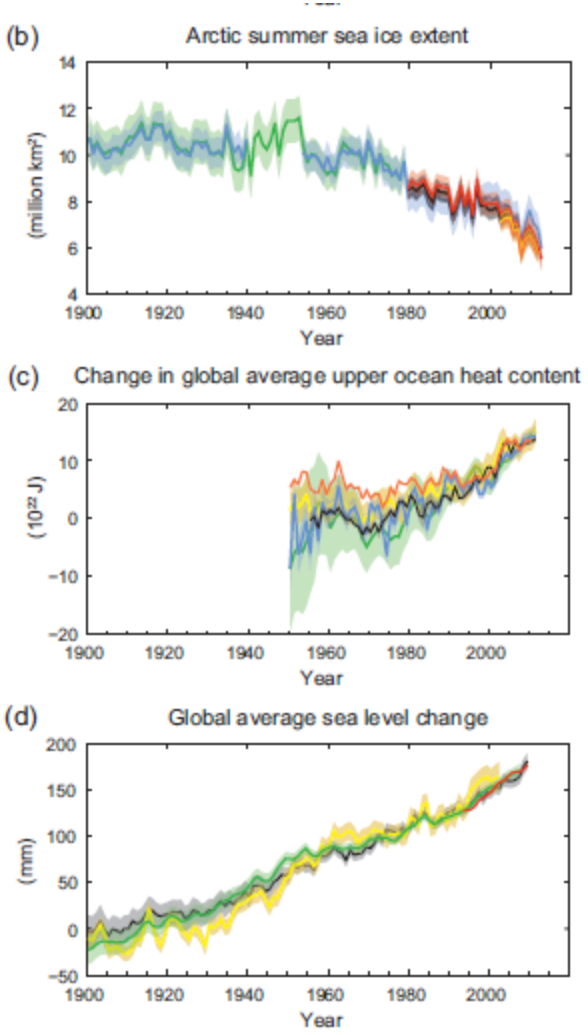
Sea Level Rise
Key Findings from IPCC AR5

- Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent

- It is virtually certain that the upper ocean (0-700 m) warmed from 1971 to 2010 and it likely warmed between the 1870s and 1971.

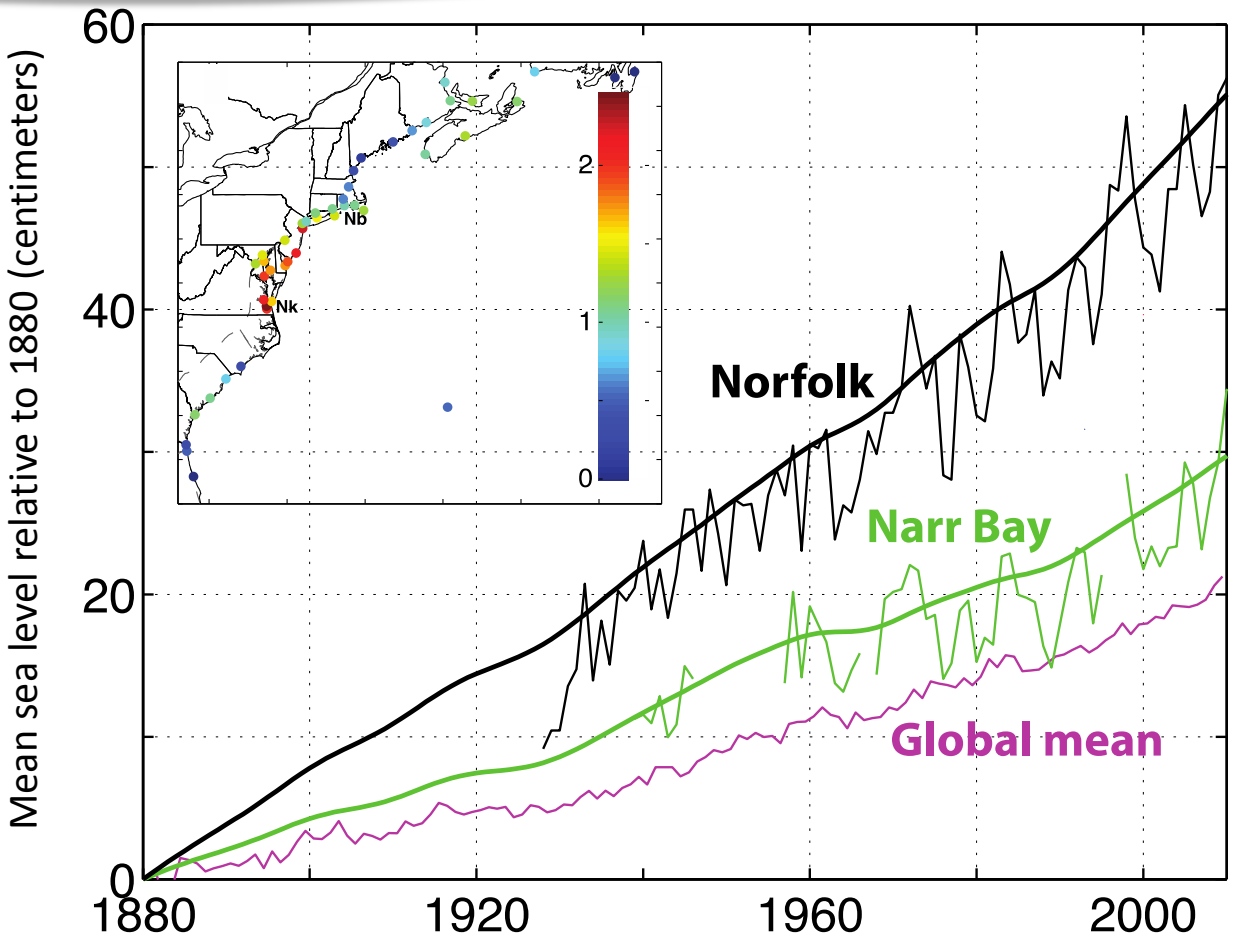
- The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia.

- Over the period 1901 to 2010, global mean sea level rose by ~8 inches.



From 2014 IPCC WG1 SPM

Mean Sea Level Change
Historical Perspective



Norfolk
~ 4.3 mm/yr

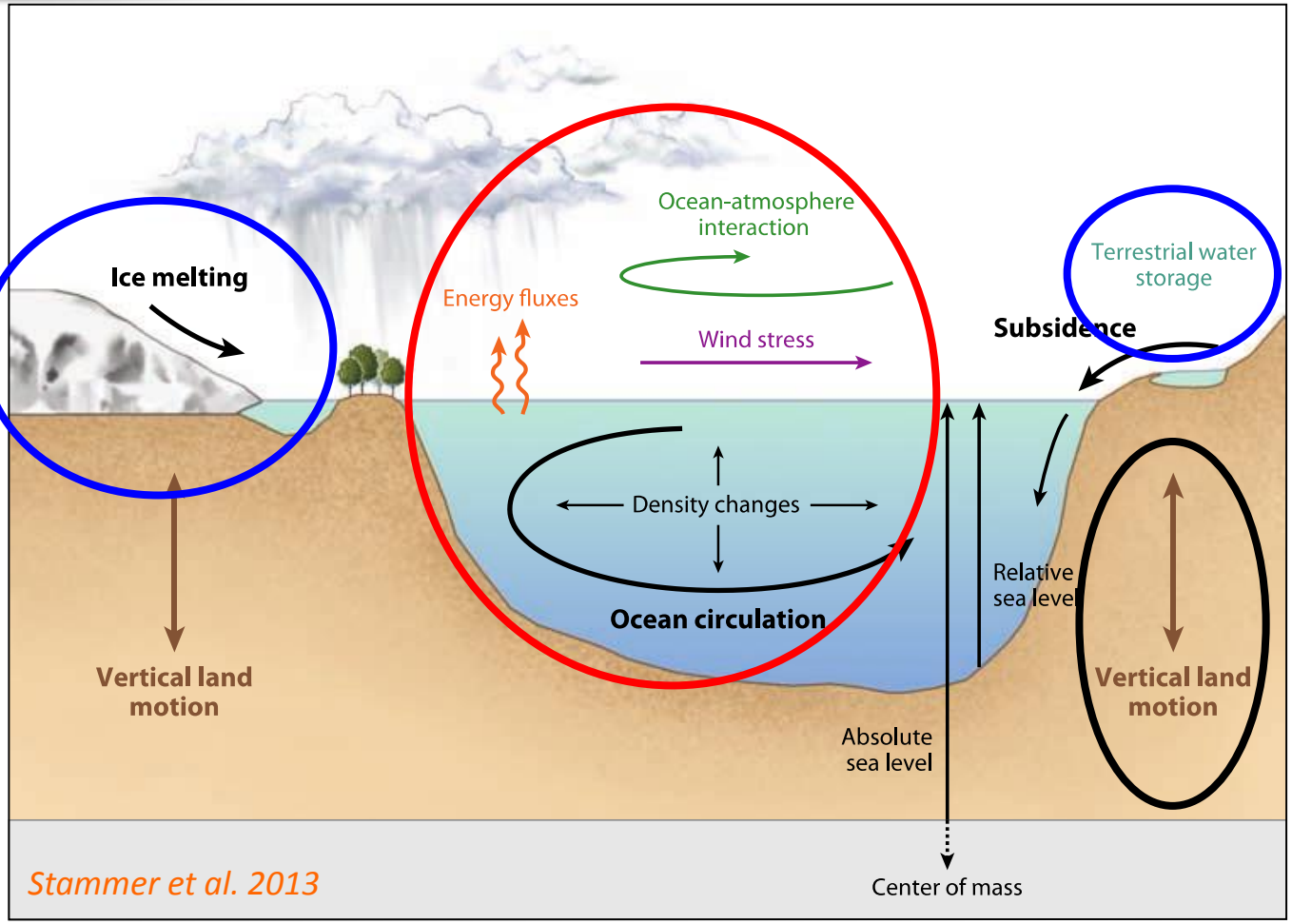
Narragansett Bay
~ 2.5 mm/yr

Global mean
~ 1.7 mm/yr

- Ongoing subsidence (will continue)
- Ongoing dynamic sea level rise (likely to continue)

Modified from Kopp 2013

Processes Influencing Mean Sea Level



- Additions of mass (water)
- Changes in sea surface height
- Vertical land motion

Future Climate Projections
New York City

Sea Level Rise Baseline (2000 – 2004)	Low-estimate (10th percentile)	Middle range (25th to 75th percentile)	High-estimate (90th percentile)
2020s	+ 2 in	+ 4 in to 8 in	+ 10 in
2050s	+ 8 in	+ 11 in to 21 in	+ 30 in
2080s	+ 13 in	+ 18 in to 39 in	+ 58 in
2100	+ 15 in	+ 22 in to 50 in	+ 75 in

Based on 24 GCMs and two Representative Concentration Pathways. Shown are the low-estimate (10th percentile), middle range (25th percentile to 75th percentile), and high-estimate (90th percentile).

Higher sea levels are extremely likely for New York City

Projections broadly consistent with IPCC AR5 global projections, with the NPCC high end slightly higher

Source: NPCC 2013

Coastal Flood Heights and Recurrence

			2020s			2050s		
		Baseline	Low-estimate	Middle range	High-estimate	Low-estimate	Middle range	High-estimate
Coastal Floods at the Battery	Annual chance of today's 100-year-flood	**1.0 %**	**1.1 %**	**1.2 to 1.5 %**	**1.7 %**	**1.4 %**	**1.7 to 3.2 %**	**5.0 %**
	Flood heights associated with 100-year flood (stillwater + wave heights)	15.0 feet	15.2 feet	15.3 to 15.7 feet	15.8 feet	15.6 feet	15.9 to 17 feet	17.6 feet
	Stillwater flood heights associated with 100-year flood	10.8 feet	11.0 feet	11.1 to 11.5 feet	11.7 feet	11.4 feet	11.7 to 12.8 feet	13.4 feet

Estimates in the top row refer to the values for projected sea level rise. Low-estimate indicates 10th percentile, middle range indicates 25th to 75th percentile, and high-estimate indicates 90th percentile. Flood heights for the 2020s and 2050s are derived by adding the sea level rise projections for the corresponding percentiles to the baseline values. Baseline flood heights associated with the 100-year flood are based on the stillwater elevation levels (SWELs). For 100-year flood, height is also given for stillwater plus wave heights. Flood heights are referenced to the NAVD88 datum.

Coastal flooding is very likely to increase in frequency, extent, and height as a result of increased sea levels

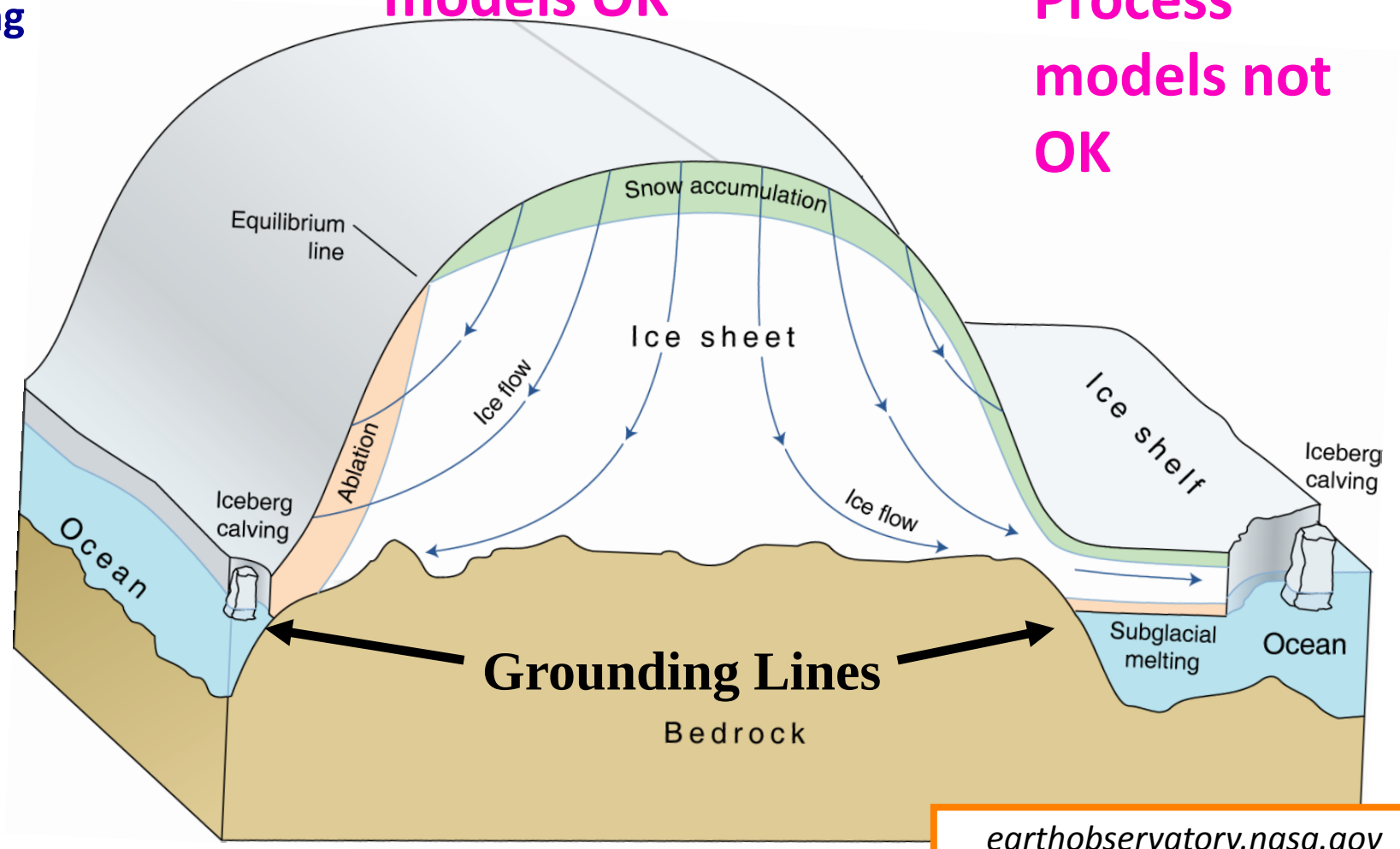
Additions on Mass

"Surface mass balance" = snowfall and surface melting

Process models OK

"Dynamic" = change in ice flux across grounding line

Process models not OK



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