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Our changing view on Earth: New perspectives and chances through GRACE, GRACE-FO, and beyond

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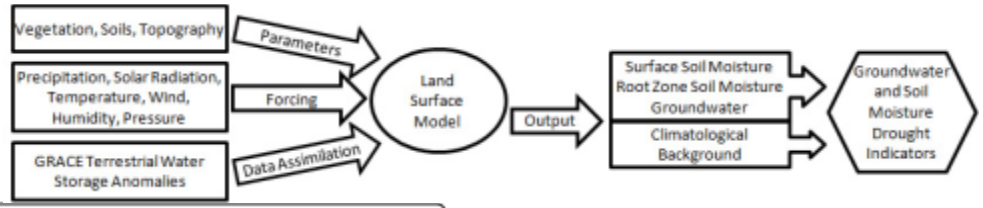
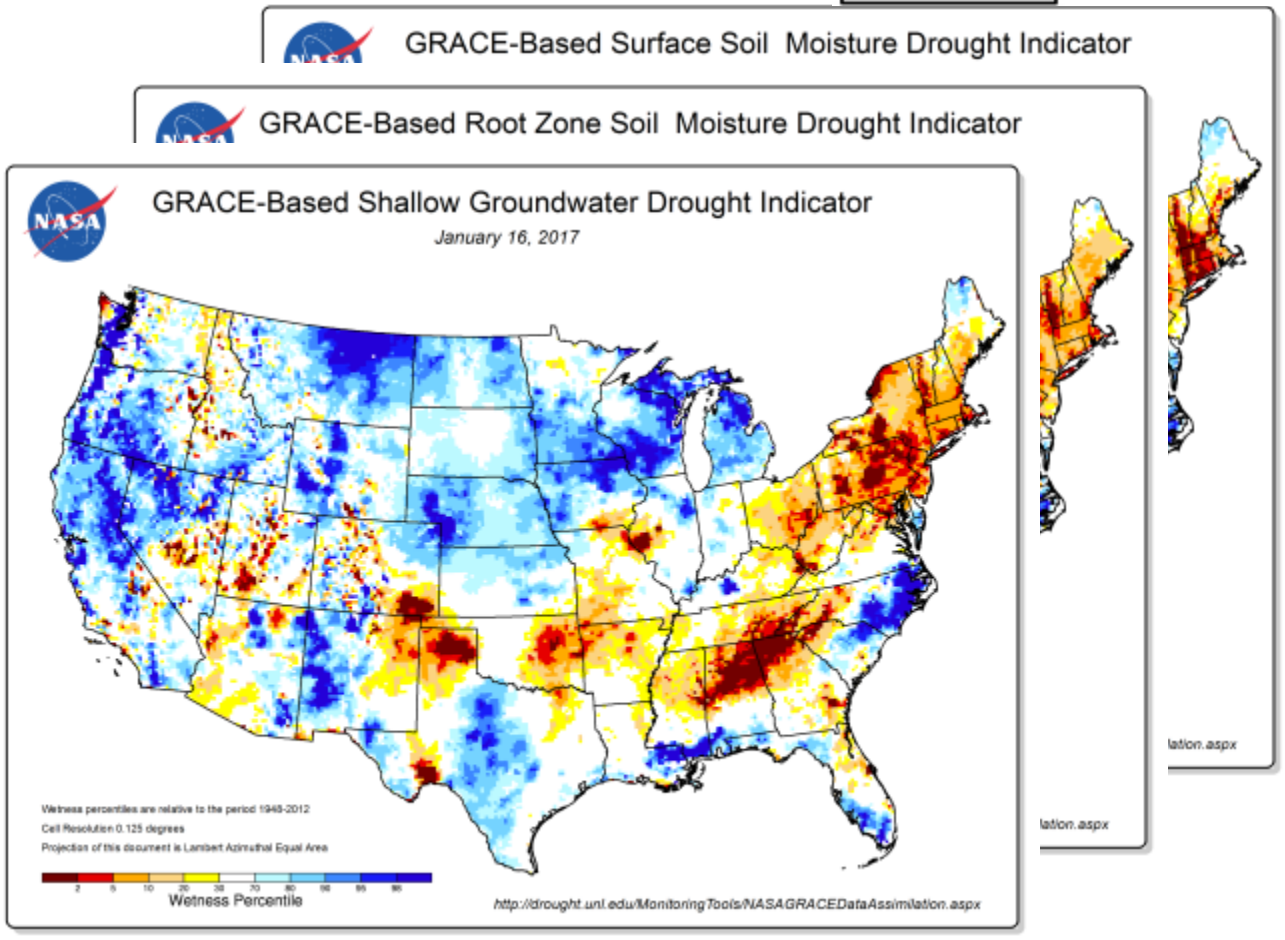
National Drought Monitor





Weekly GRACE data assimilation for Soil Moisture and Groundwater Drought Indicators

Integral water storage provides insights into below-surface water reservoirs

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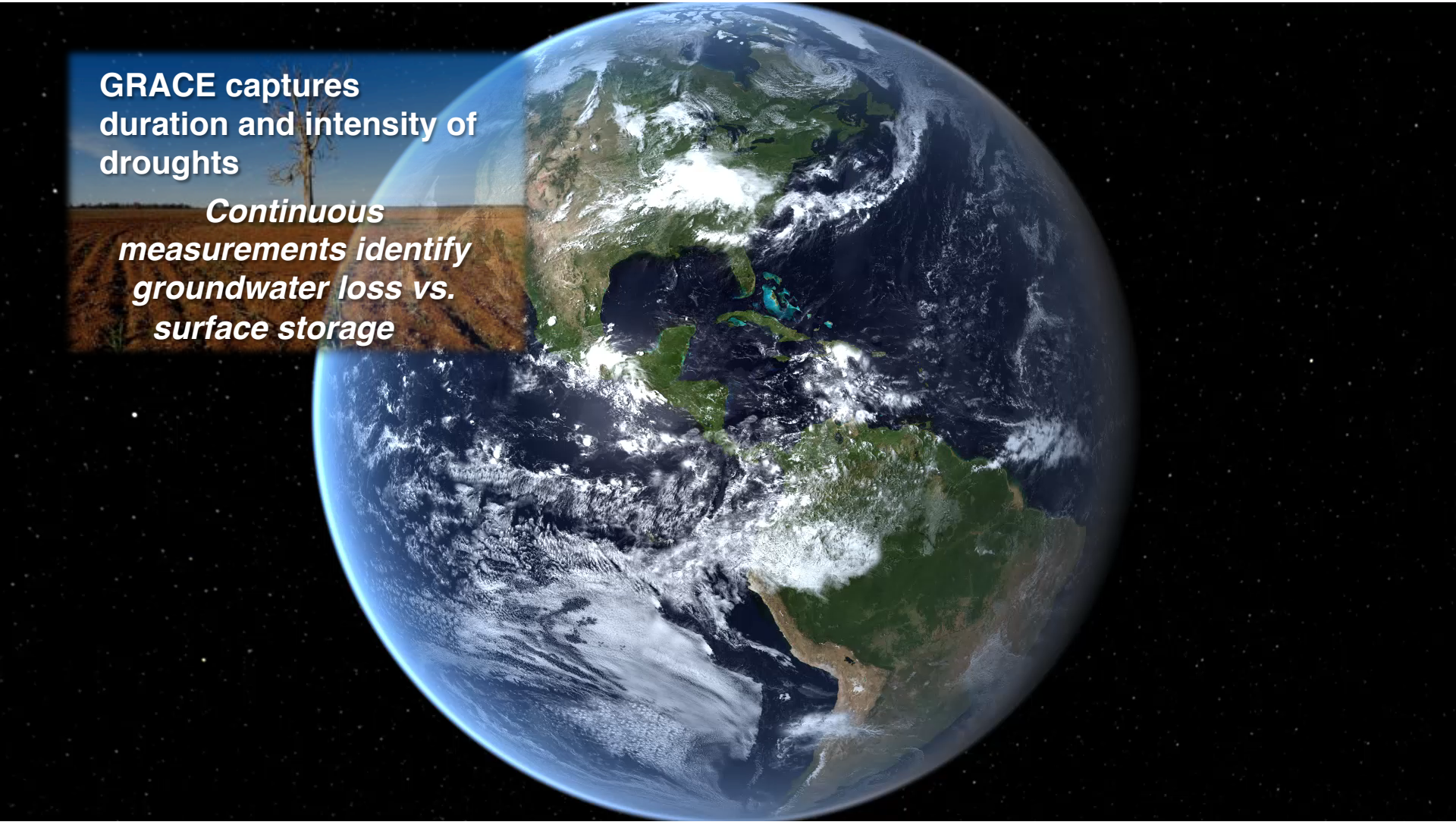
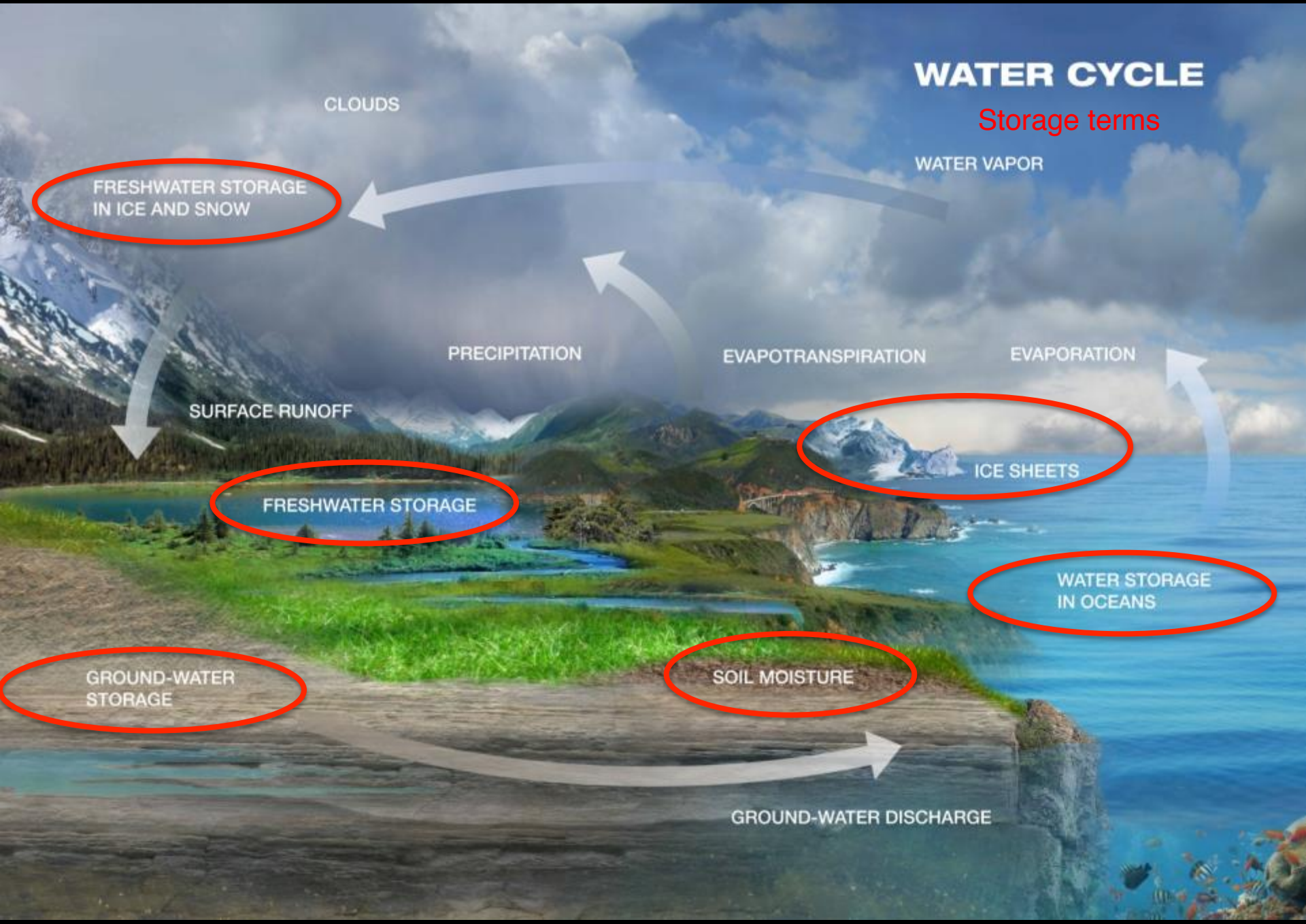
California drought




WATER CYCLE
Storage terms
CLOUDS
WATER VAPOR
FRESHWATER STORAGE IN ICE AND SNOW
PRECIPITATION
EVAPOTRANSPIRATION
EVAPORATION
SURFACE RUNOFF
ICE SHEETS
FRESHWATER STORAGE
WATER STORAGE IN OCEANS
GROUND-WATER STORAGE
SOIL MOISTURE
GROUND-WATER DISCHARGE

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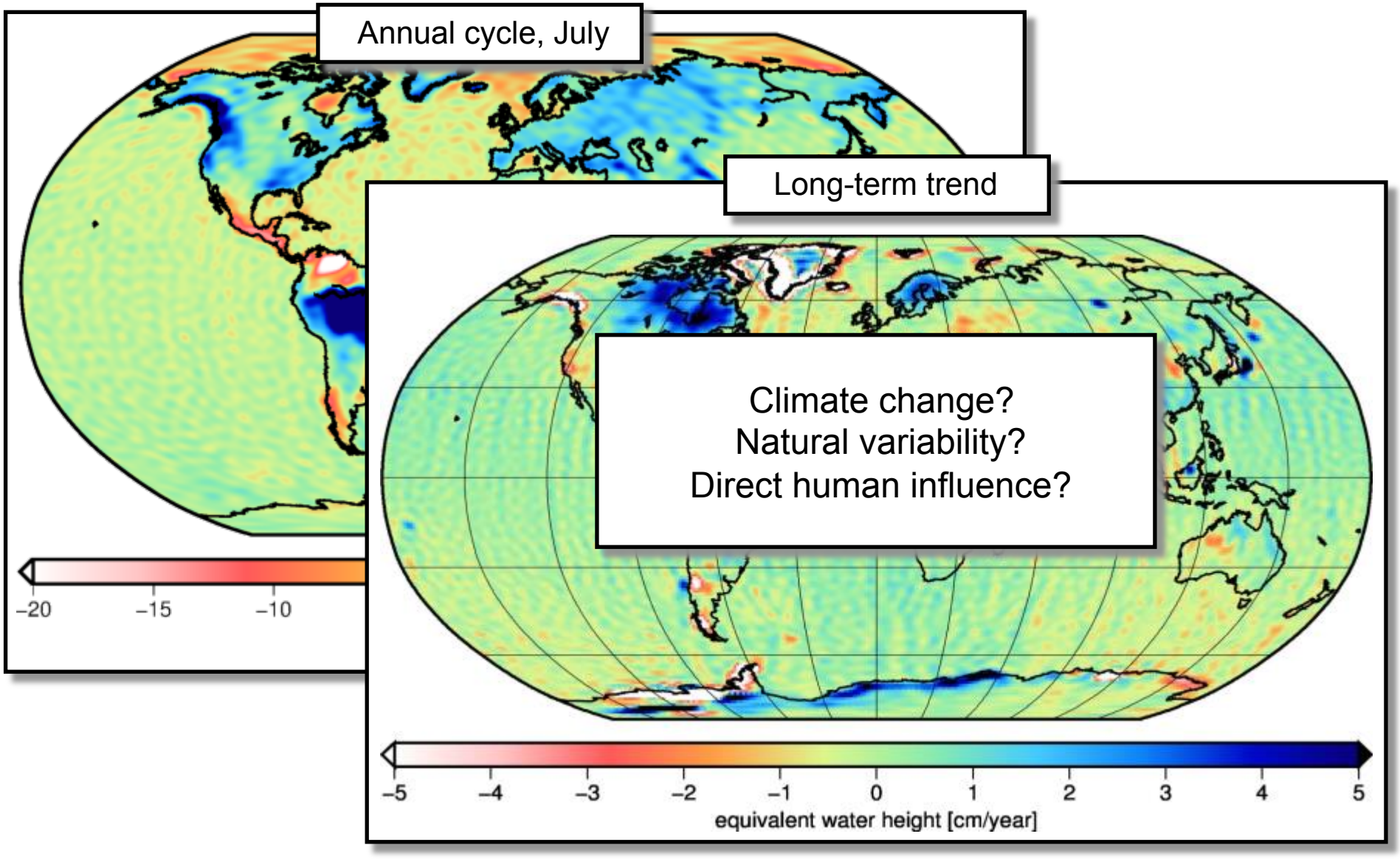
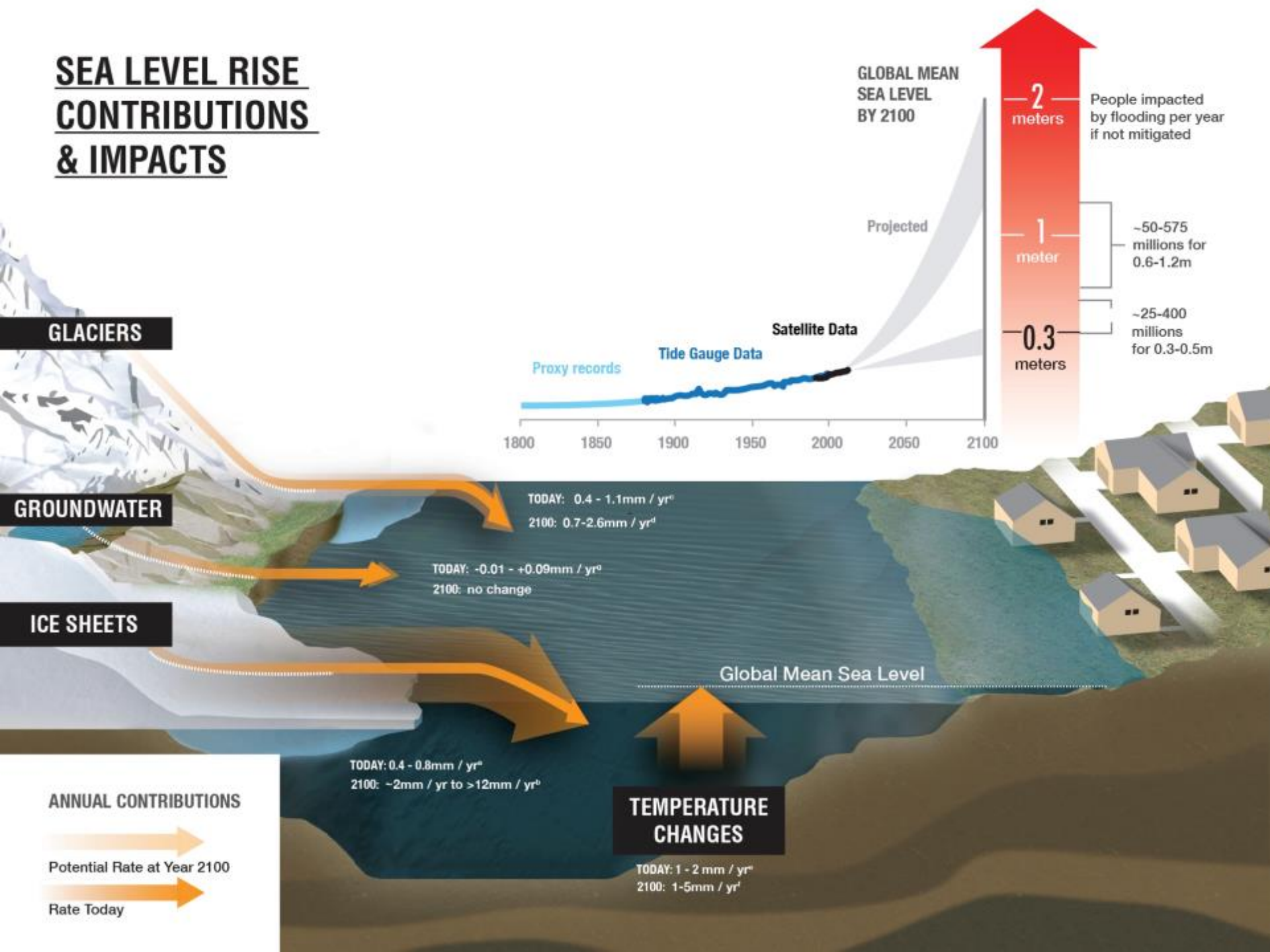
Changes in water mass



SEA LEVEL RISE CONTRIBUTIONS & IMPACTS



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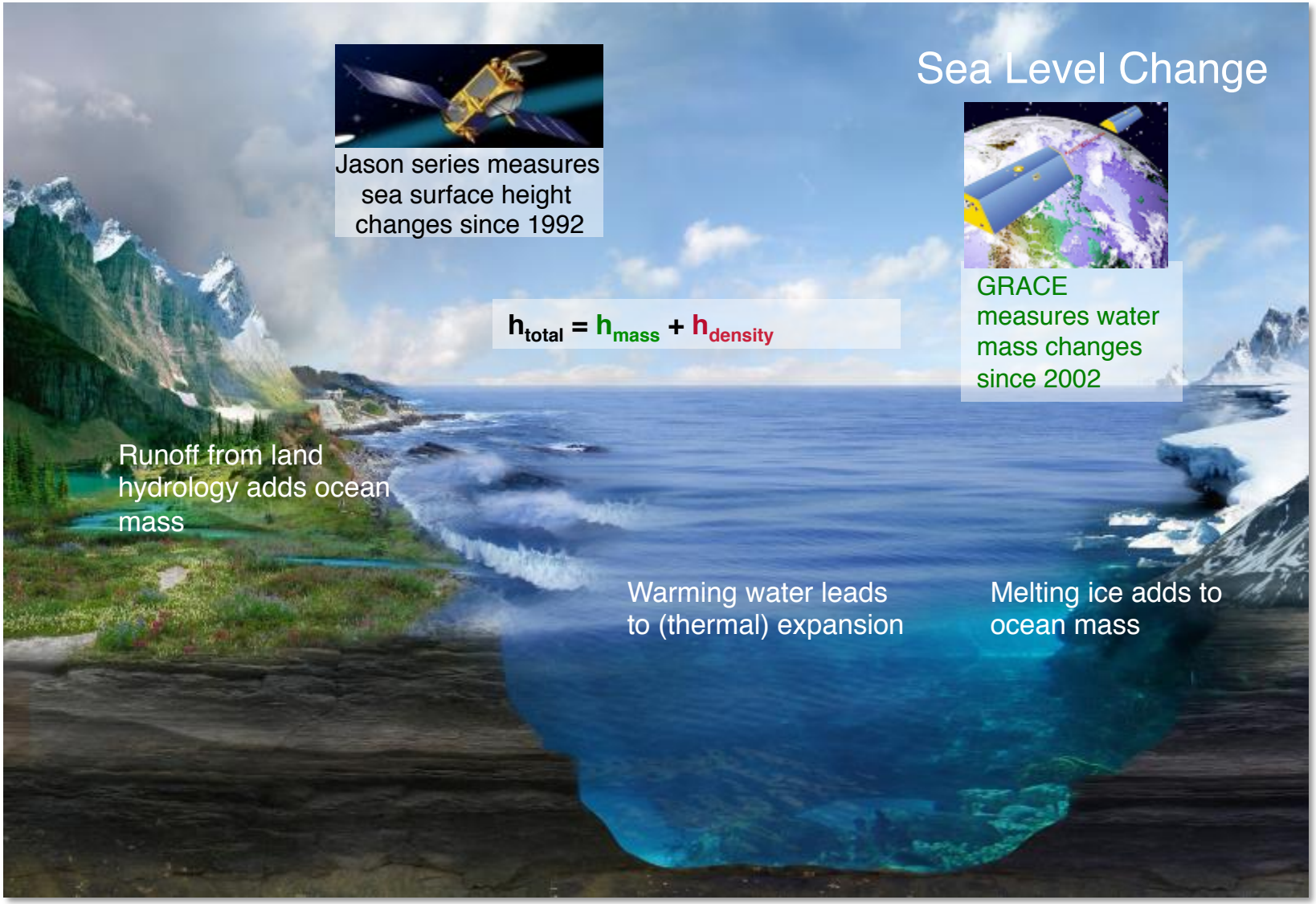
Causes and Observations of Sea Level Change



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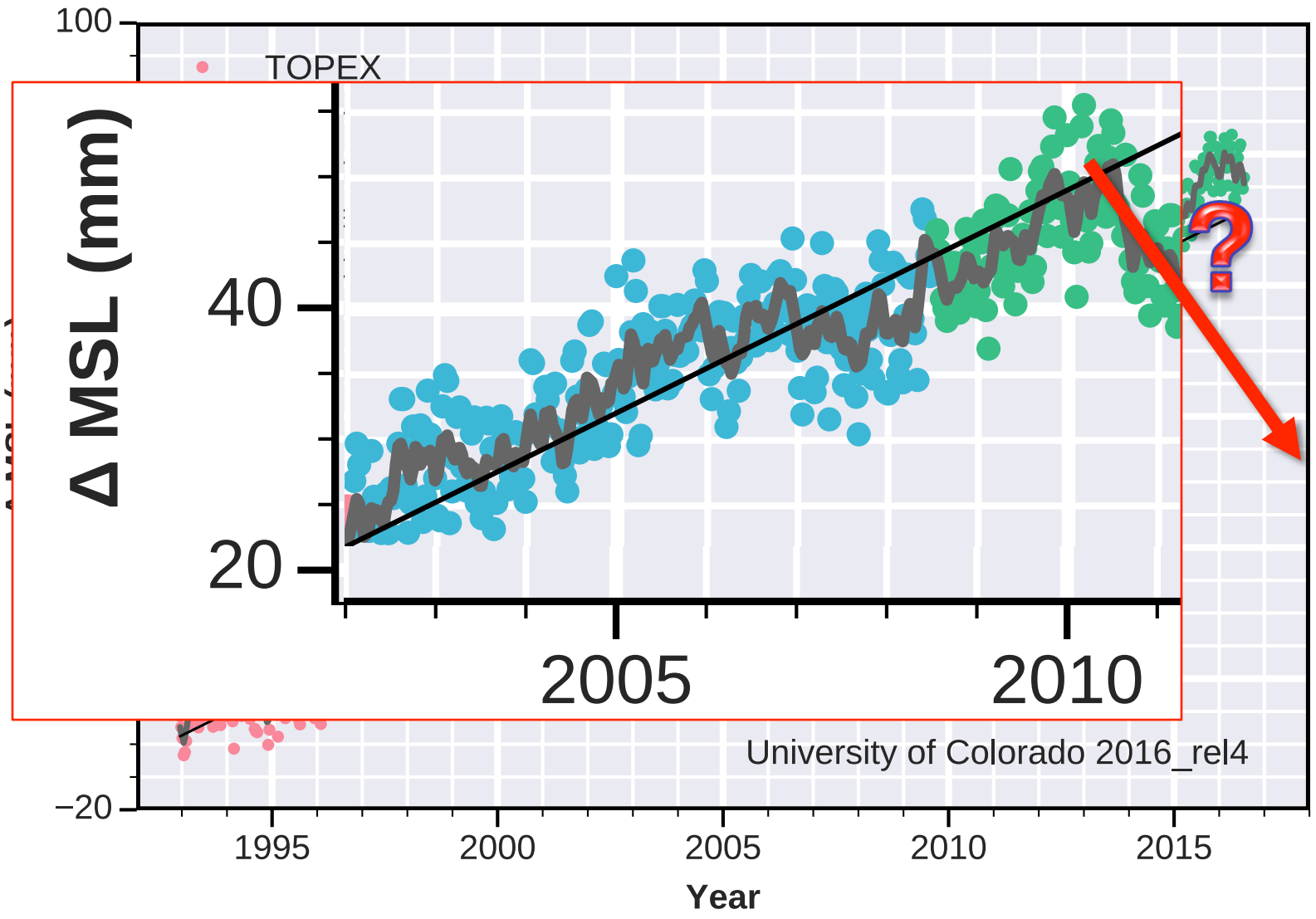
Records of sea level change since 1992



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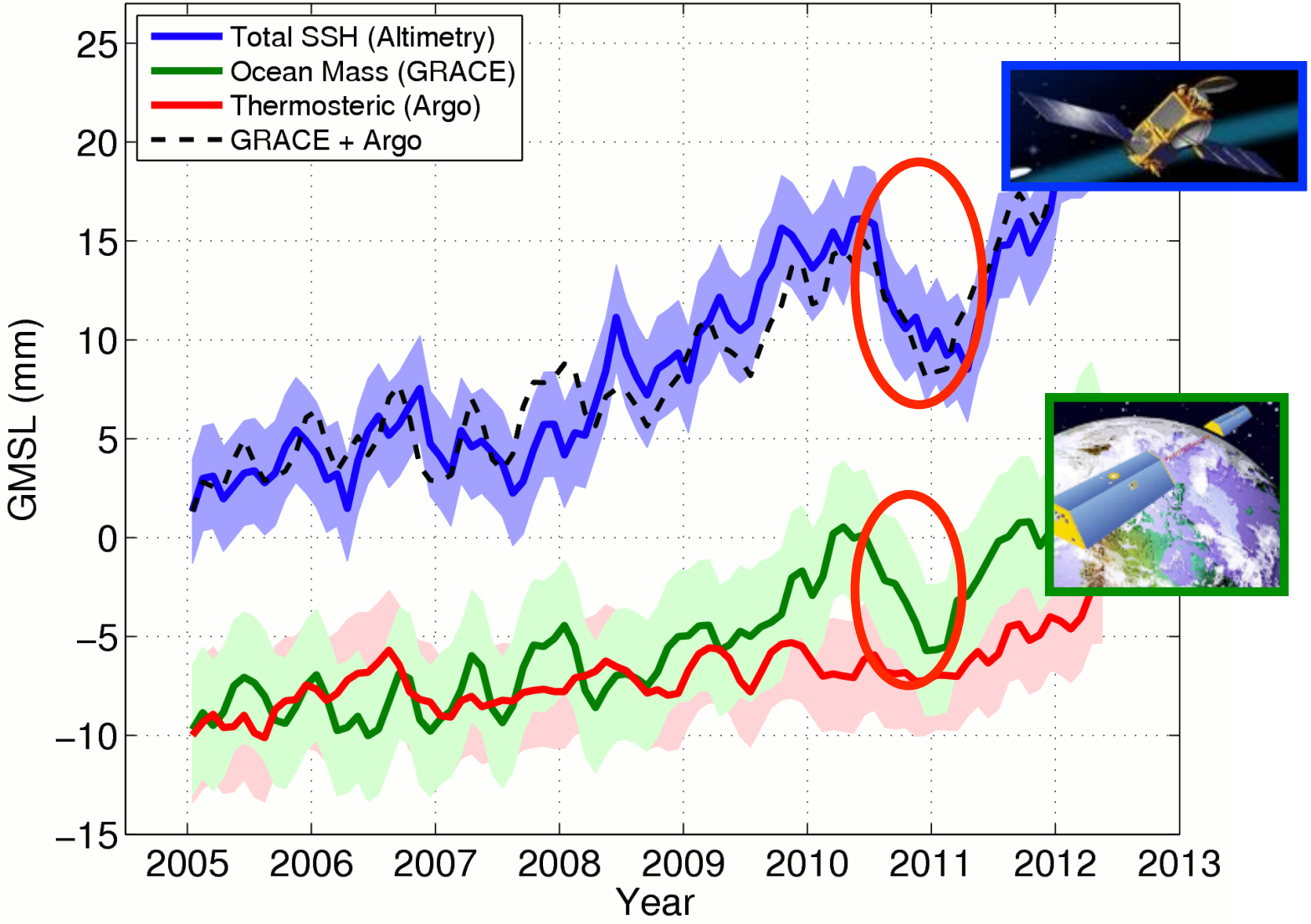
Using Multiple Satellites to "Track" Water



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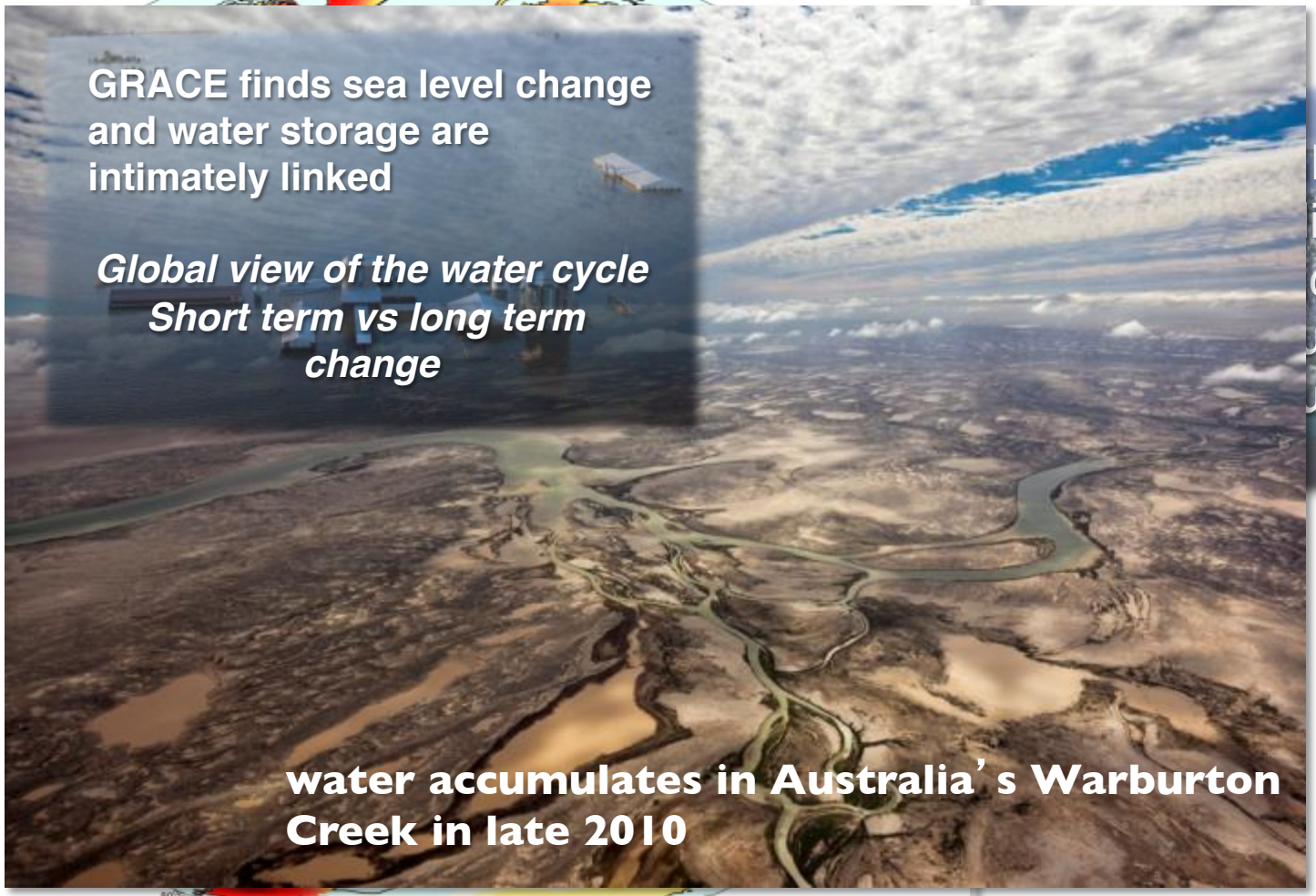
Terrestrial Water Storage in 2010 and 2011



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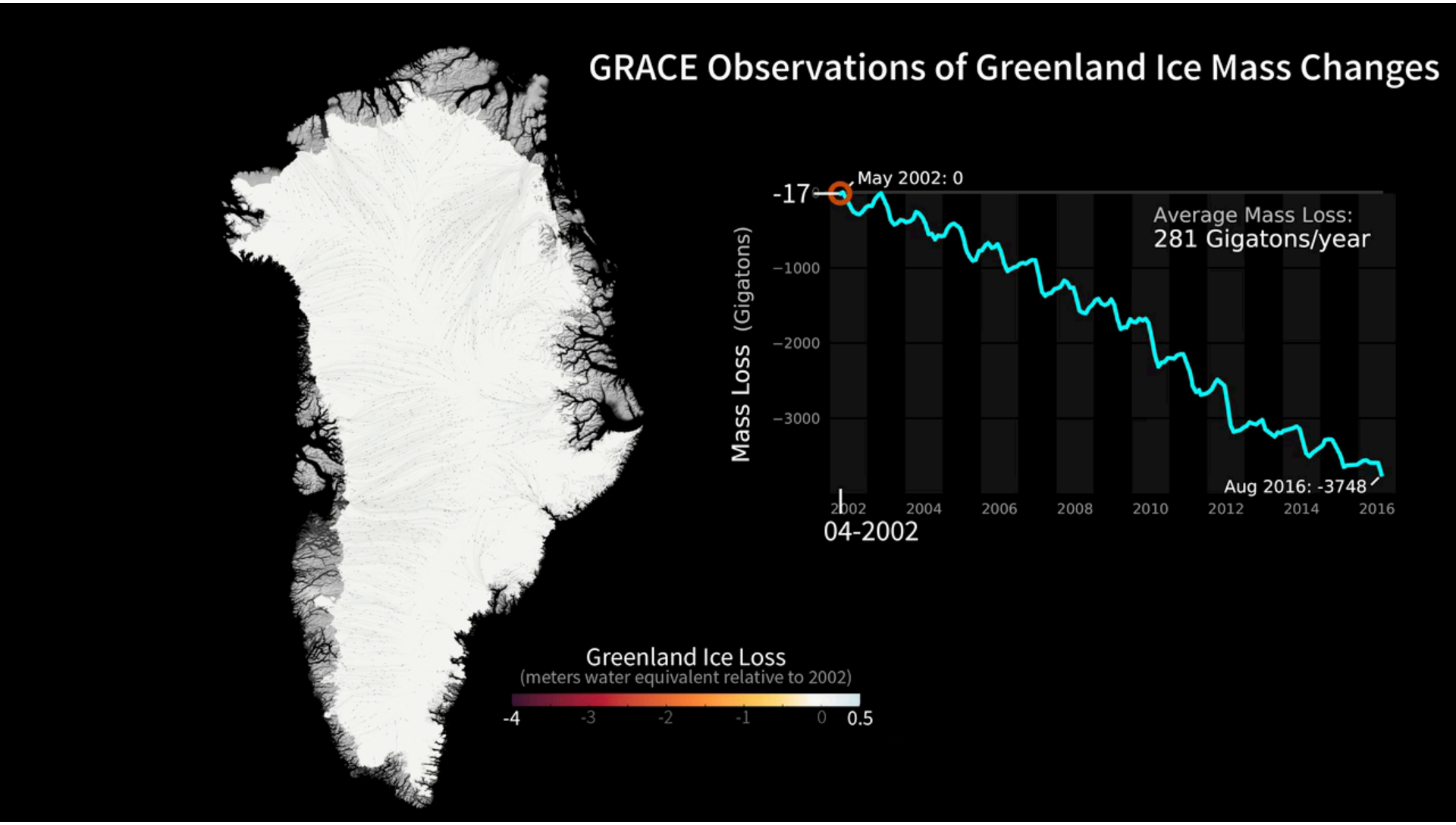
Ice Sheet Loss affecting sea level



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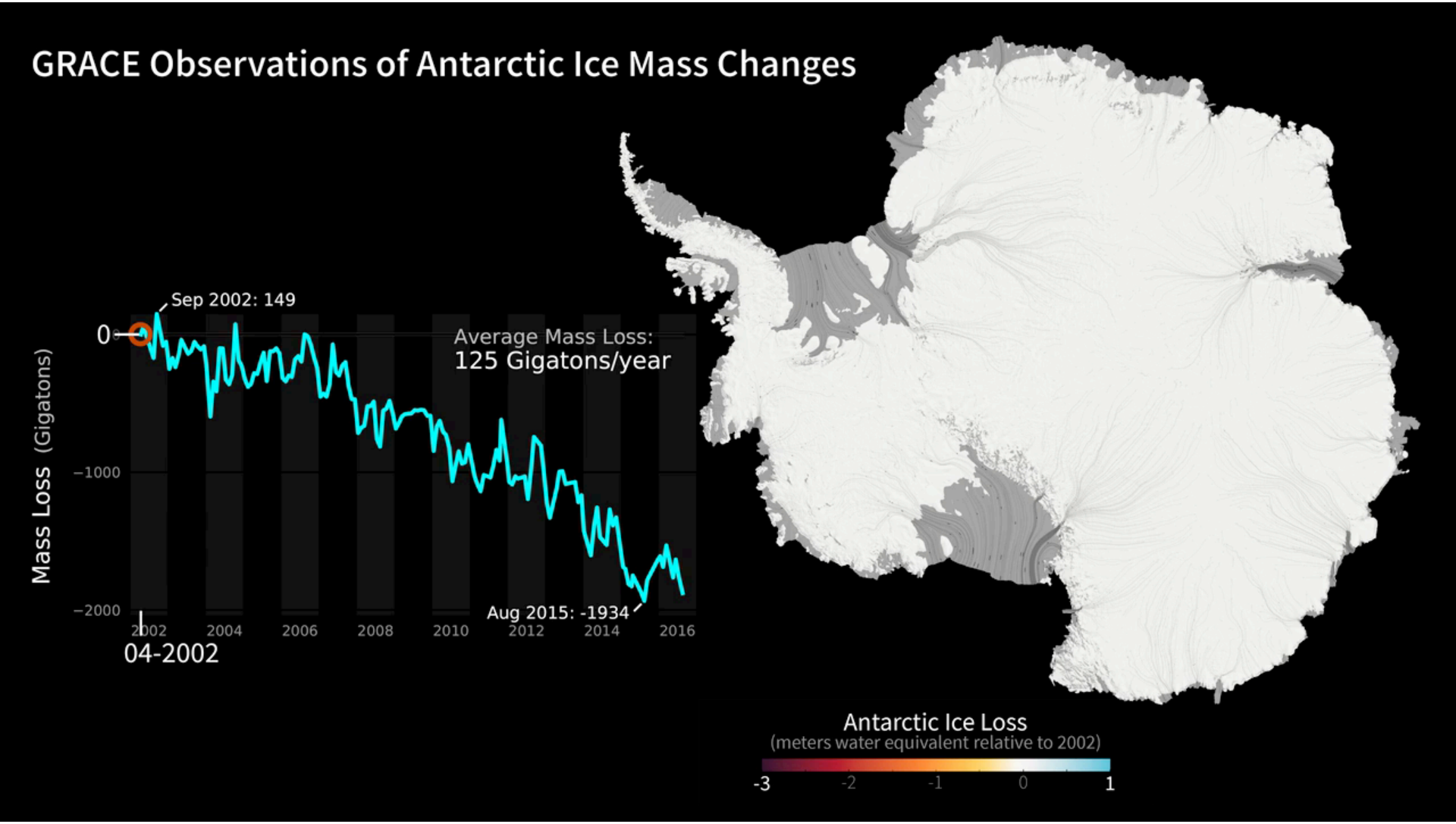

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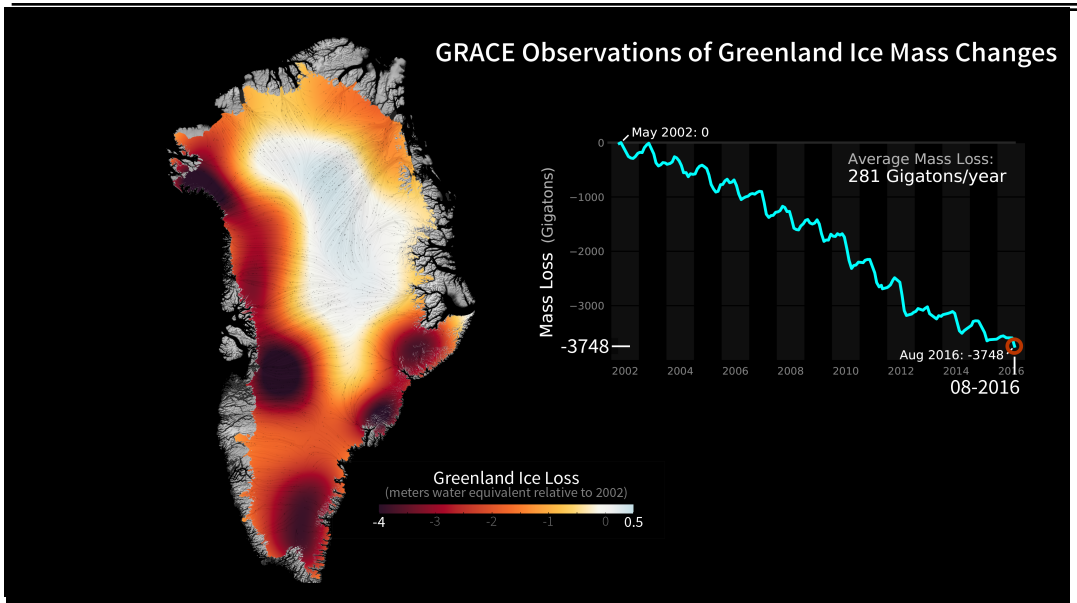

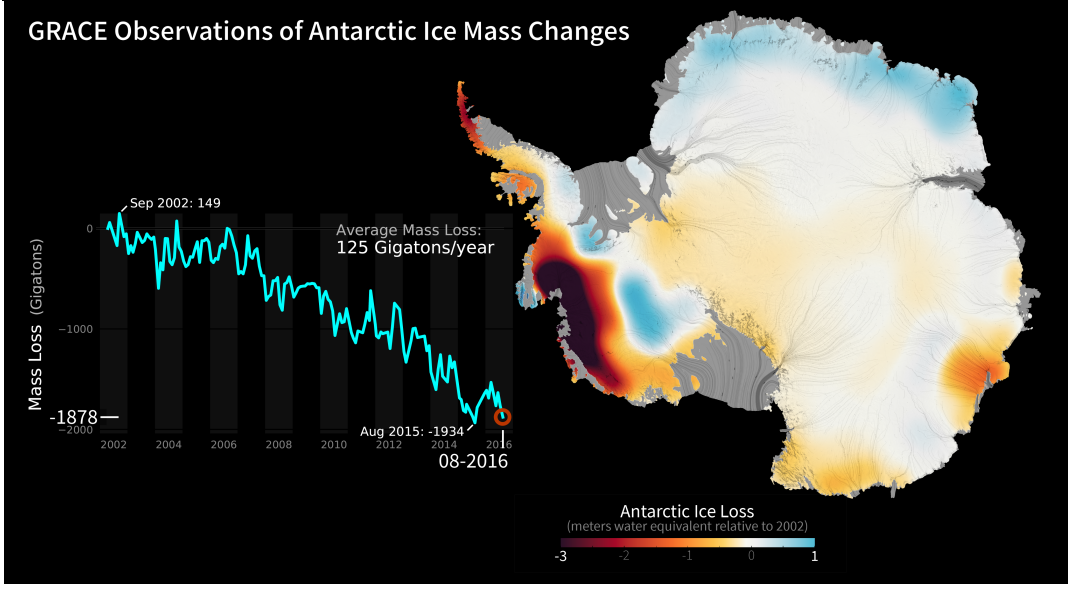

Greenland: ~7 m sea level eqv.
Antarctica: ~60 m sea level eqv.

GRACE weighs the ice sheets and identifies loss and gain on regional level

Continuous measurements ensure we identify regional change and long term vs short term variations which ensures an "early warning system"

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The Demonstrated Value of GRACE Data

- *Demonstrated to be essential to providing reliable estimates of climate variability and global change*
- *Key climate continuity observation*
  - *Water cycle*
  - *Sea level rise*
  - *Ocean heat content and circulation*
  - *Ice sheets*
- *Demonstrated to be essential for near real time use for water resource management*
  - *National Drought Monitor*
- *Requires extension of the time series as well as increased spatial and temporal resolution*
  - *30+ year record (extension of the existing 15 yr record)*
  - *2 pairs allow for better spatial and temporal coverage*

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GRACE Follow-on Project Overview

Salient Features

- *Implemented under US-German partnership*
- *Tech-Demo Laser Ranging Interferometer is Class D*
- *Follow-on to original GRACE Mission launched 2002*
- *Launch:* ***December 2017 on SpaceX Falcon 9***
- *Orbit: Near-circular Polar Orbit, 495 km altitude, 89° inclination*

Science

- *Will* ***continue and expand*** *upon the measurements initiated by the pathfinder GRACE Mission*
- *Will provide estimates of the* ***global high-resolution models of the Earth's gravity field for a period of up to five years*** *at a precision and temporal sampling equivalent to that achieved with GRACE.*
- *Will provide* ***QuickLook (<24h) products for enhanced operational use*** *for water resource management.*
- *Will demonstrate satellite-to-satellite interferometry in low Earth orbit for future gravity missions*