

European Pavilion
**Digital
Ocean**
Nice | France
2 - 13 JUNE 2025

Taking the Pulse of
the Ocean
*Satellite Missions to
Monitor Sea Level Rise*

11 June 2025

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sea level rise





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sea level rise



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EUMETSAT



How Do We Measure Sea Level?



Why care about sea level?

- I lived half my life below sea level
- A very large part of humanity and infrastructure is close to sea level

But how can we measure any change in sea level?



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We can install a tide gauge

- When taking all the harmonic variation out, a trend remains
- But how do we separate that from land motion (subsidence)?

We need to monitor that with GPS

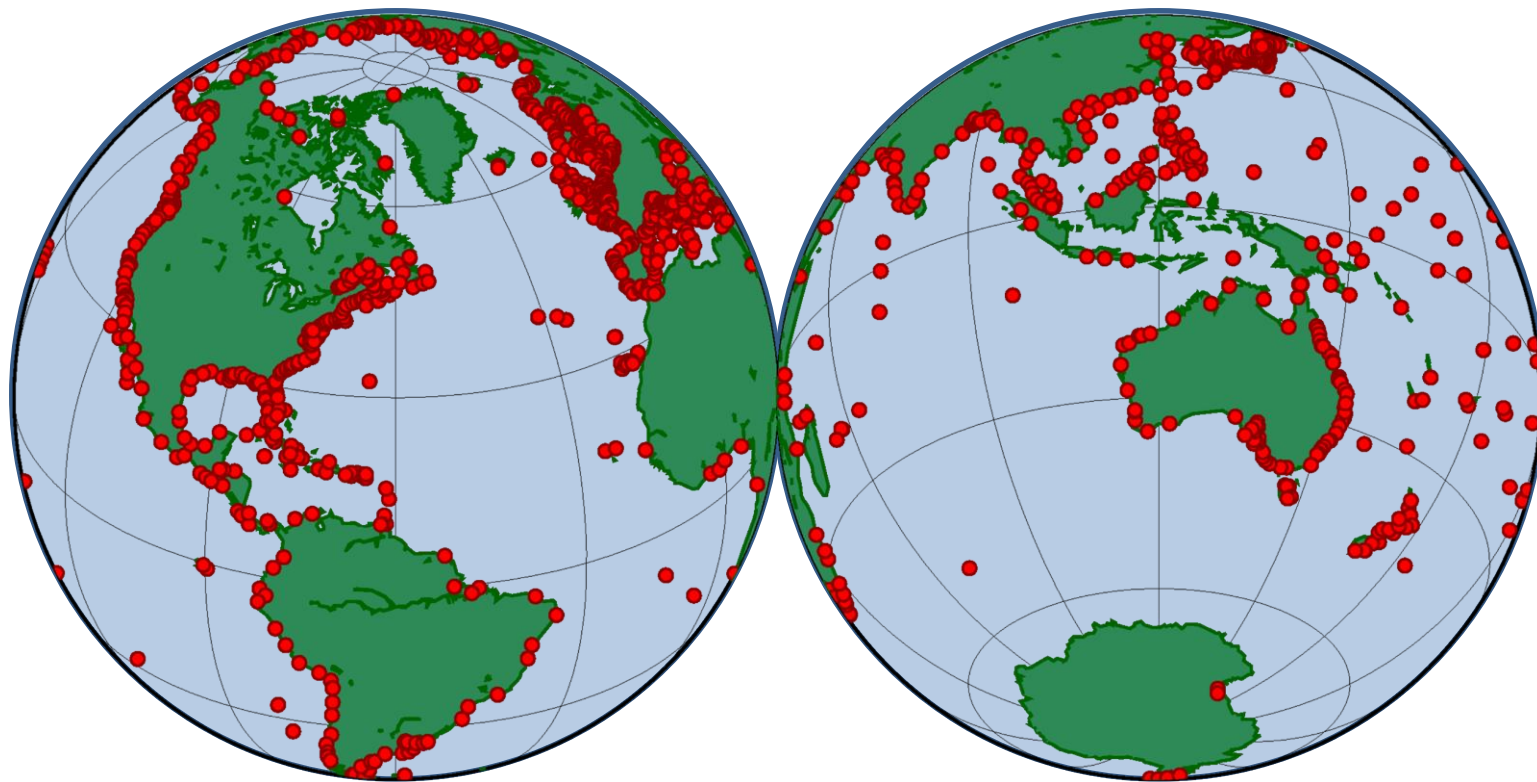


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Permanent tide gauges
across the globe



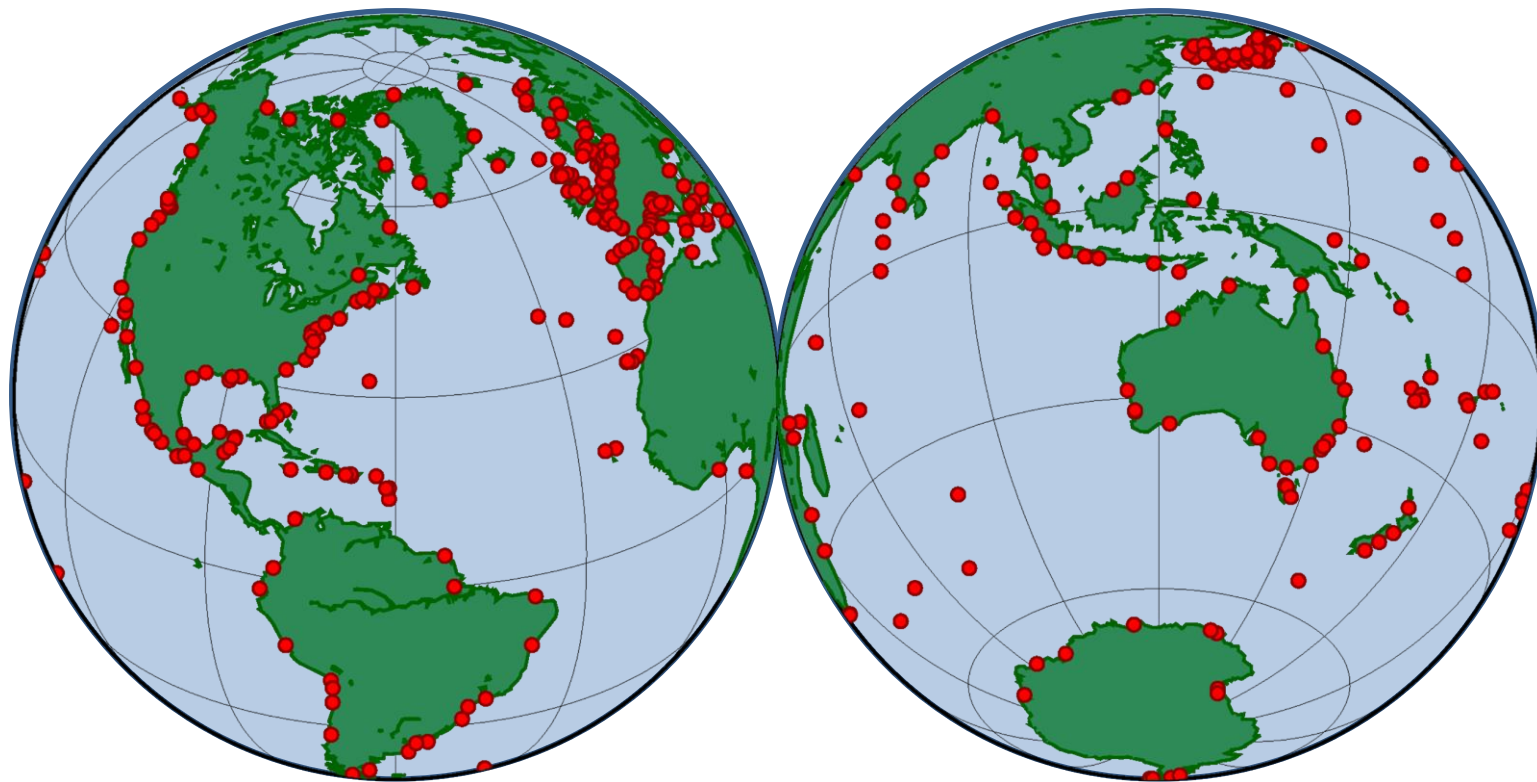


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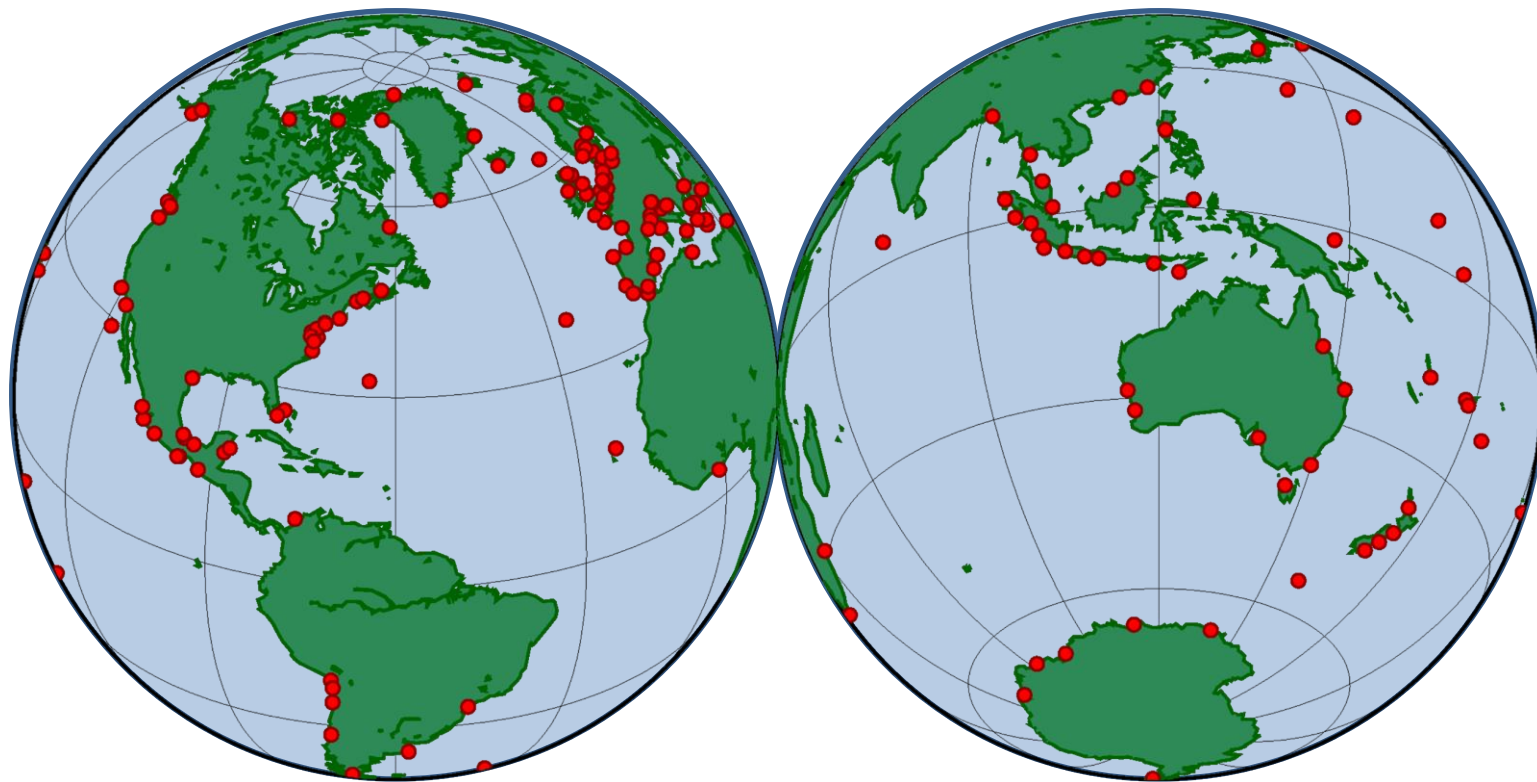


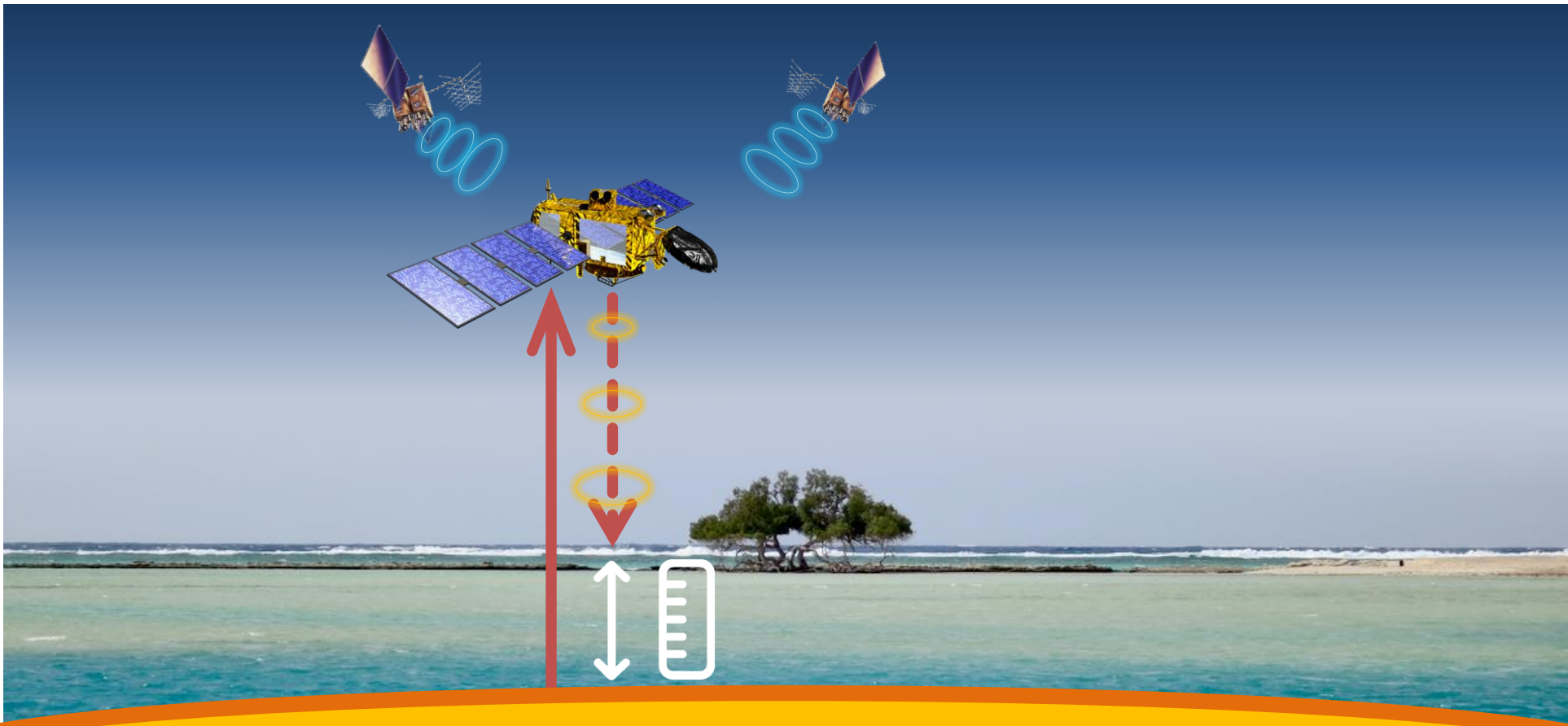
- ✓ Permanent tide gauges across the globe
- ✓ Having a GPS station within 2 km





- ✓ Permanent tide gauges across the globe
- ✓ Having a GPS station within 2 km
- ✓ And having a record of 25 years or longer
- ✓ That leaves an awfully sparse view of sea level change





Now we have put the tide gauge in space

- A radar replaces the string on the gauge
- GPS, DORIS, laser ranging determine the position of the satellite in space
- Sea level = satellite altitude — corrected radar range

Can we measure even small changes this way?



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Microwave radiometer

- Water vapour in the atmosphere
- Provides correction to altimeter measurement

Radar altimeter

- Sea level
- Wind speed, wave height

Solar panels

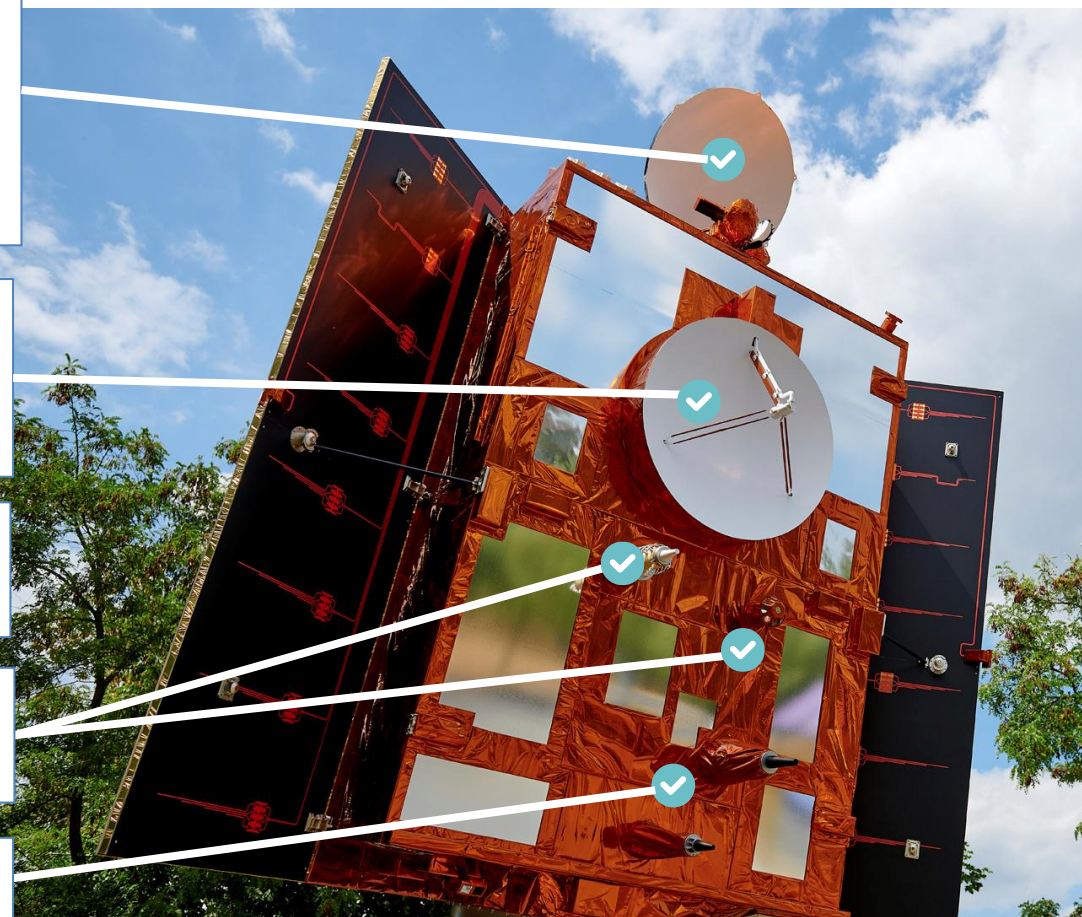
- Power satellite & payload

Orbit determination

- Laser, GPS, DORIS

Antennas

- Command/control
- Data downlink





Video: NASA/JPL

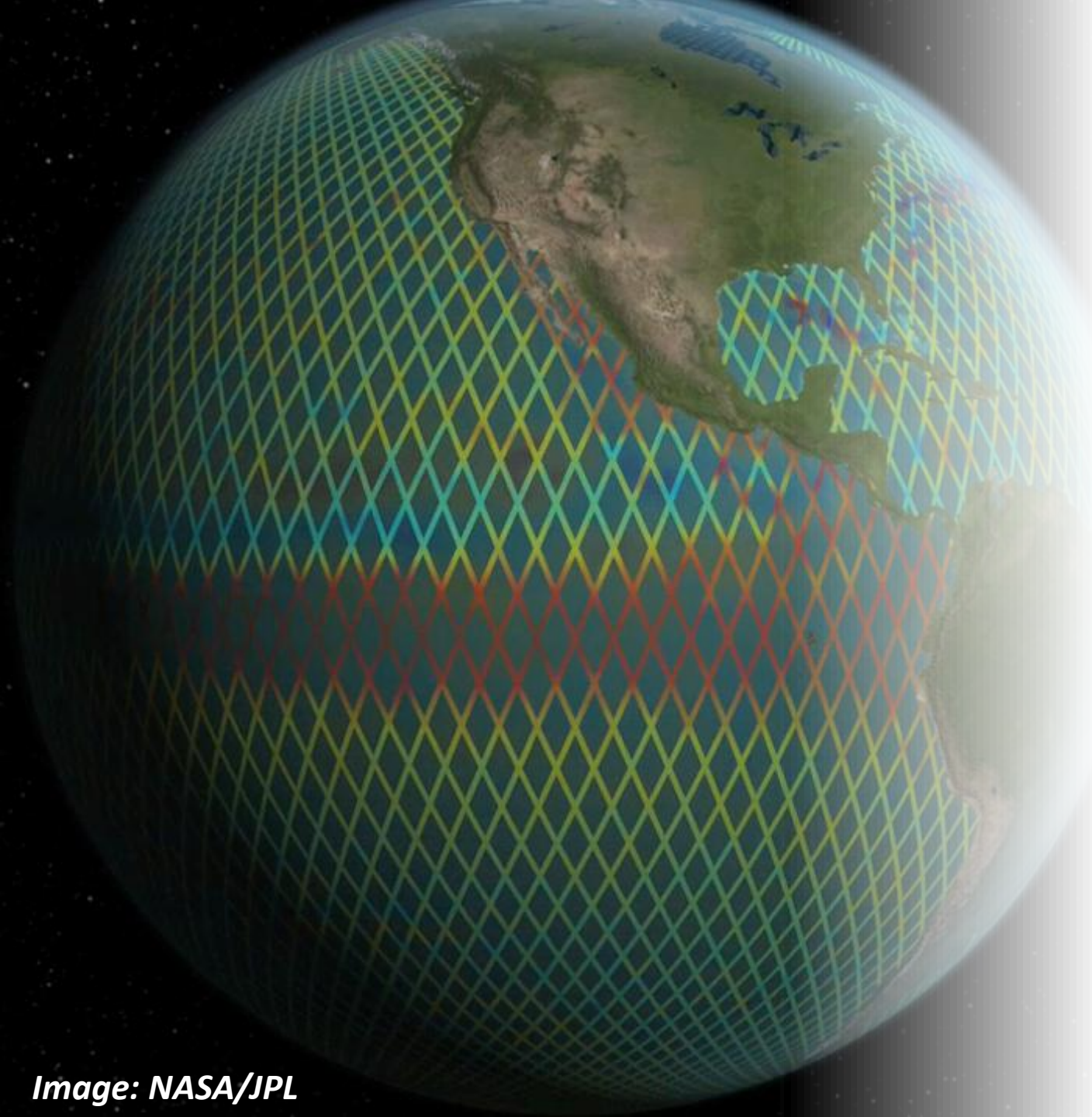


Image: NASA/JPL

Every 10 days

- We cover almost the entire globe.
- Deviations from the local mean are due to ocean currents, storms, El Niño / La Niña, etc.
- Averaged gives us the global mean sea level

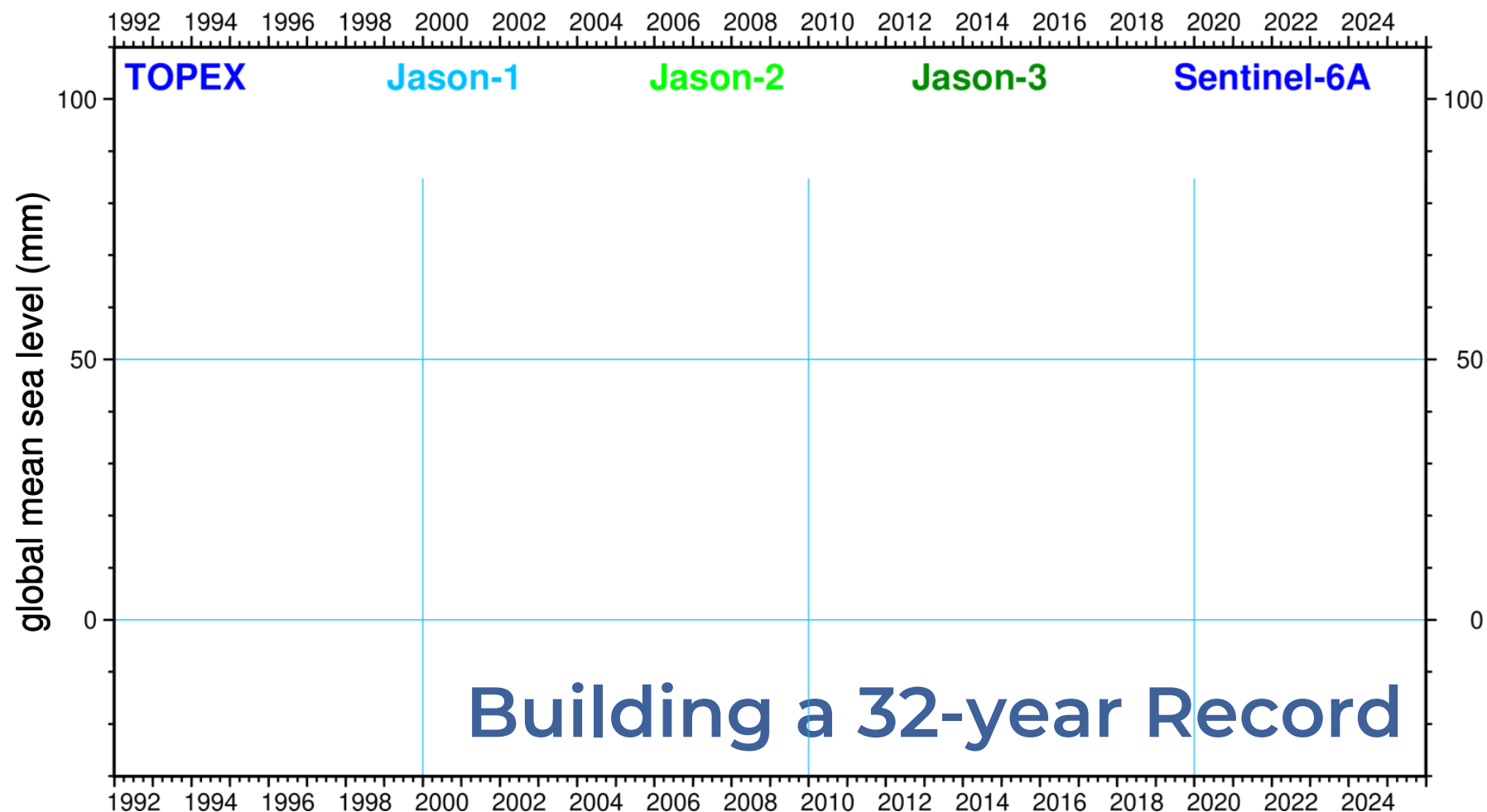


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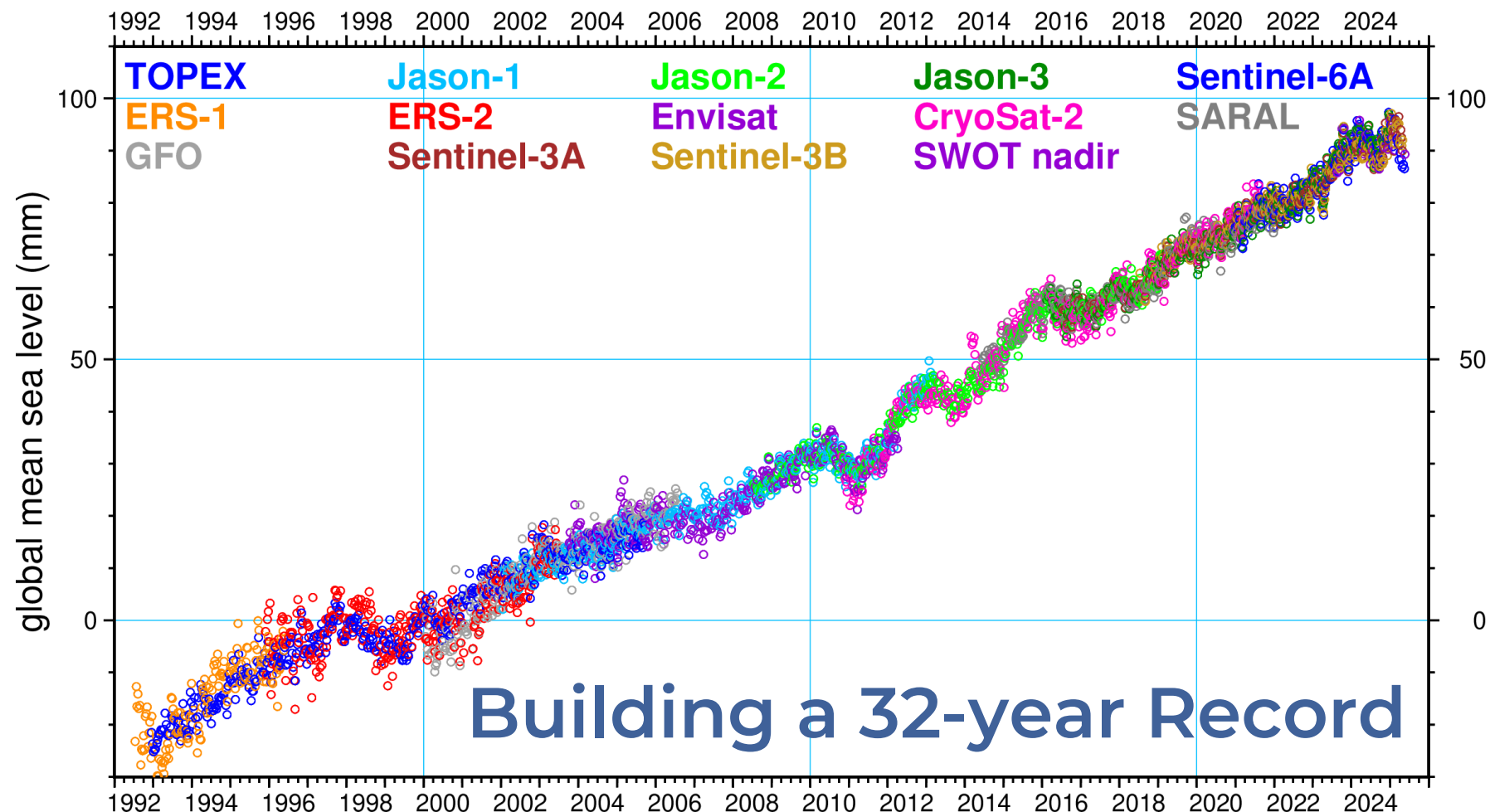


- ✓ Reference altimeters, cross-calibrated through overlaps
- ✓ Ever increasing precision and accuracy





- ✓ 14 Altimeter missions, cross-calibrated through overlaps
- ✓ Ever increasing precision and accuracy
- ✓ Copernicus (Sentinel) mission data by EUMETSAT
- ✓ Requires commitment to continue into the future with Copernicus Next Generation Missions





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Thank you for your attention!

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