Jason altimetry and NOAA's Sea Level Climate Data Record

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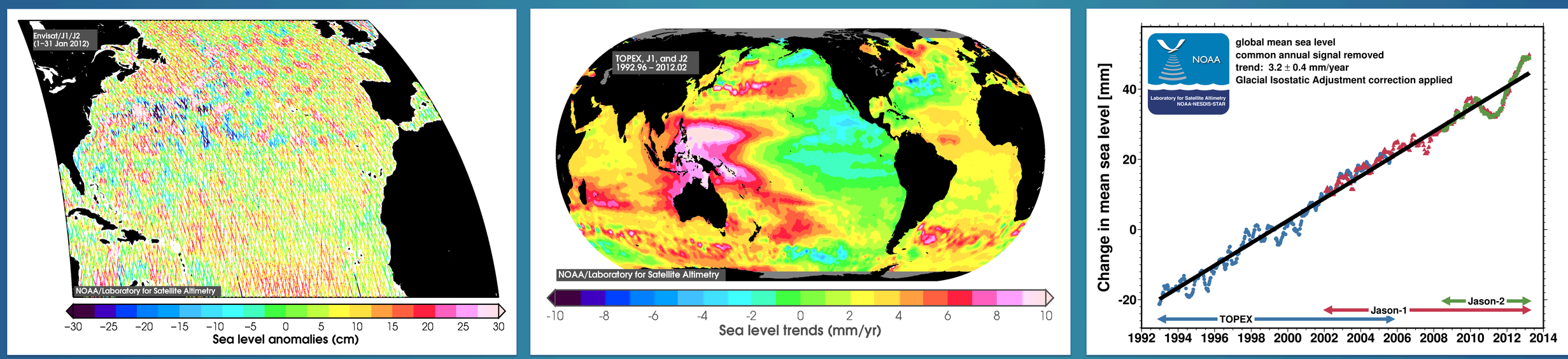


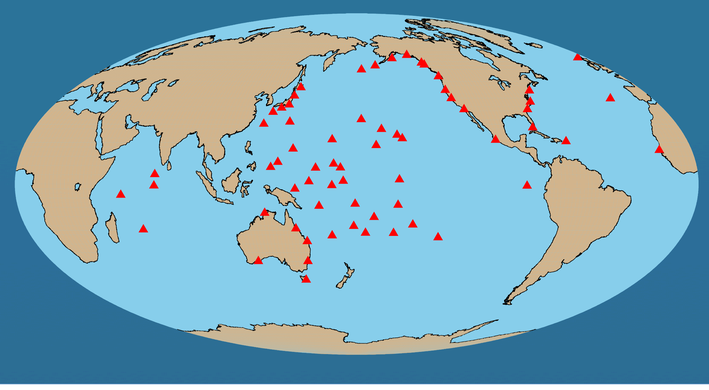
Figure 1: a (left) Multi-platform alongtrack (L2) sea level anomaly from RADS. b (center) Linear trends in regional sea level rise. c) (right) Global mean sea level rise time series.

Mission (phase)	Data coverage years
Geosat	1986–1988
ERS-1	1992–1996
TOPEX/POSEIDON (reference)	1993–2005
ERS-2	1995–2002
GFO	2000–2006
Jason-1 (reference)	2001–
Envisat	2002–2012
Jason-2 (reference)	2008–
CryoSat	2009–
SARAL/AltiKa	2013–
Sentinel-3 A & B	2014, 2015
Jason-3 (reference)	2015–
Jason-CS (reference)	2019–
SWOT	2020–

As part of its Polar Satellite Program, NOAA operates the Jason-2 altimetry satellite. The Jason series began with TOPEX/Poseidon (1992-2005) and Jason-1 (2001-present) — a partnership between NASA and CNES. With the launch of Jason-2 in June 2008, the partnership was extended to include NOAA and EUMETSAT as the missions transitioned from research to operations. **Jason-3 will be launched in early 2015, with NOAA and EUMETSAT assuming primary roles. The series will continue in 2019 with the Jason-CS (Continuity of Service) missions, adding the European Space Agency as a new partner.**

Tide gauge calibration

The accuracy of the sea level CDR is constrained by comparisons to a global network of tide gauges. The estimated error of 0.4 mm/yr in the tide-gauge observations is due primarily to uncertainties in the vertical land motion of the gauges.



Sea Level Climate Data Record

Considering the tremendous social implications if an accelerated rate of sea level rise were to be sustained, evaluations and interpretations of the sea level will increasingly be needed to provide information relevant and useful to decision makers, stakeholders, and the public. **Because of their demonstrated stability and unique coverage, sea level observations from the Jason series of altimeters are essential to building a climate data record (CDR).** A key factor necessary to demonstrate the maturity of a climate data record is an observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation. For satellite radar altimetry, the observation strategy includes a rigorous inter-satellite calibration and calibration with a global network of tide gauges.

RADS: Radar Altimeter Database System

- provides a generalized platform for producing an altimetric CDR.
- allows the best geophysical corrections such as tides and wet tropospheric path delay to be applied across all platforms.
- RADS-4 provides an increased level of documentation of these corrections and the data sources used to better support CDR creation.
- RADS-4 supports CF-compliant NetCDF output.
- RADS will soon include the option of high frequency output to better support detailed analyses of coastal regions.

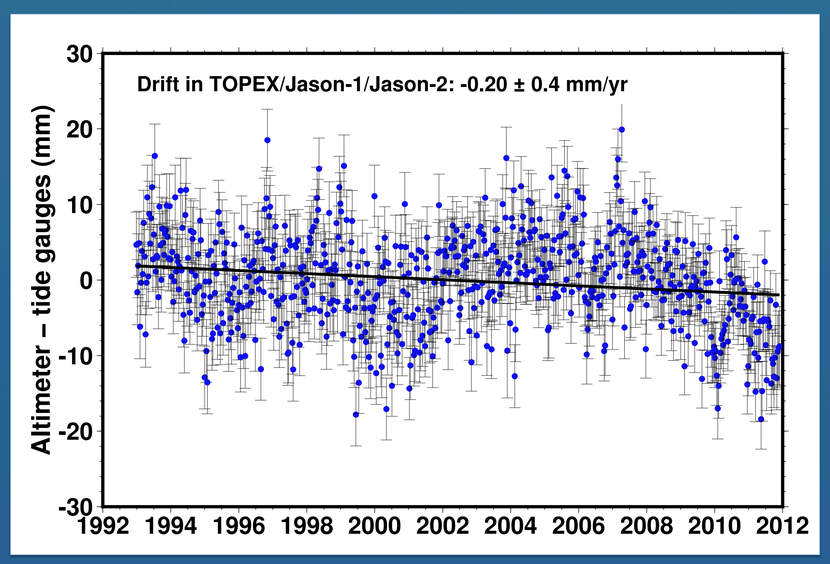


Figure 2: Drift in the mean sea level rise time series estimated by the tide gauge network.

Conclusions

Using output from RADS, NOAA's Laboratory for Satellite Altimetry has produced **three related prototype CDR products.** The first of these is a L2 product from RADS containing the sea level anomaly at observed (alongtrack) locations. The remaining two products, based on the L2 product, are a global mean sea level rise time series and regional (linear) trend estimates at 1°x1° horizontal resolution. These NOAA products are distinguished from other altimetric CDRs now in production in that they incorporate data from ***all*** of the missions that have flown to date, providing increased geographic coverage and resolution of regional trends. In the near future, all three of these datasets will be produced in CF 1.6-compliant NetCDF-3, documented by an Algorithm Theoretical Basis Document (ATBD), supported by collection-level ISO metadata, archived at NODC and provided to the community via a number of standard protocols, e.g., ftp, http, THREDDS and OPenDAP.

References: Leuliette, E. W., and R. Scharroo (2010). Integrating Jason-2 into a Multiple-Altimeter Climate Data Record. *Marine Geodesy*, 33(1), 504–517. doi:10.1080/01490419.2010.487795.
RADS User Manual and Format Specification (http://rads.tudelft.nl/rads/radsmanual.pdf)