



Celebrating 80 years of the PSMSL

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PSMSL 80th Anniversary Workshop
Liverpool, October 2013

What is the Permanent Service for Mean Sea Level?

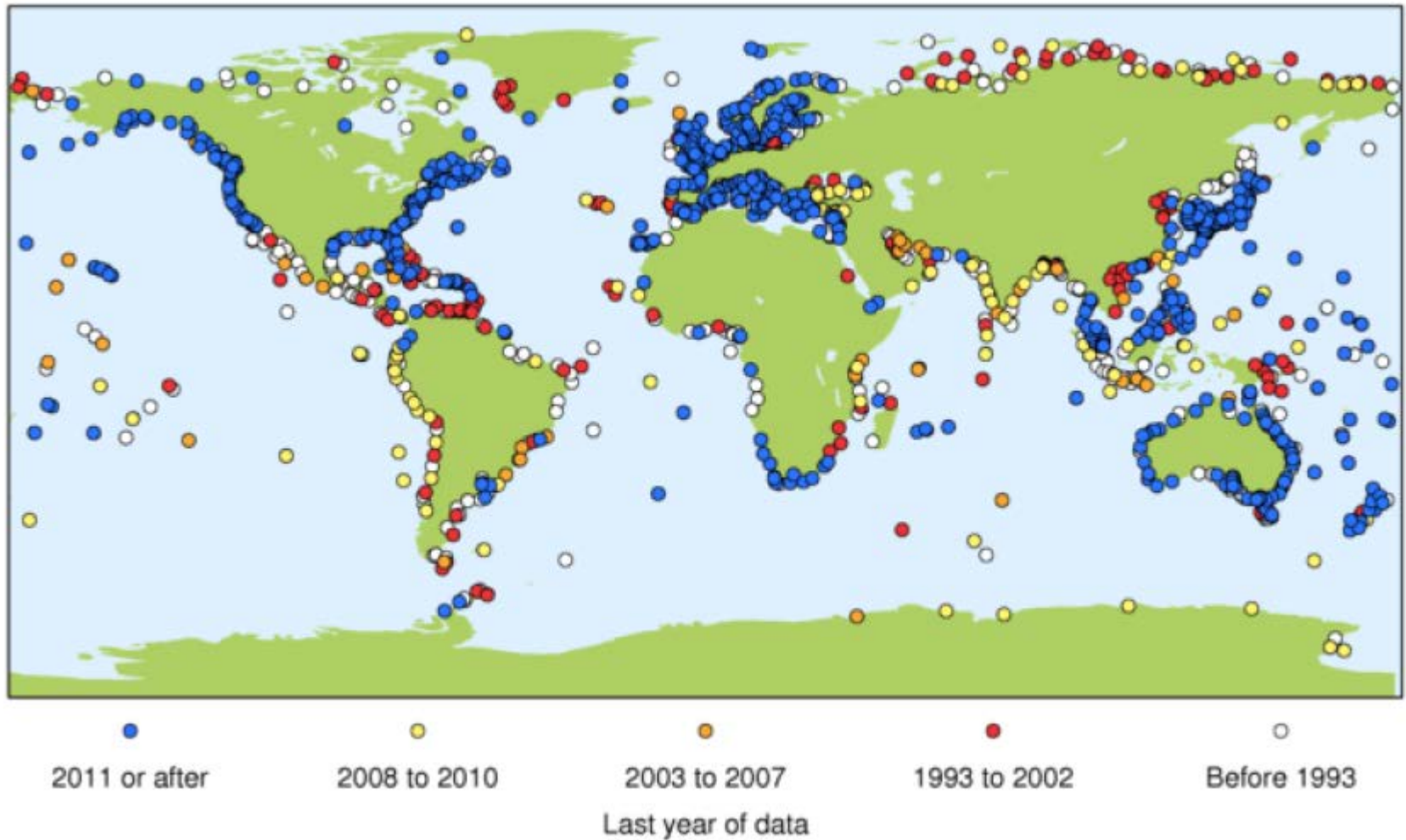
- Collects, publishes, analyses, and interprets information on sea level changes from a global network of tide gauges
- Main international data bank in this field of research, holding information on sea level changes over the past two centuries
- Operated under the auspices of ICSU since 1958; cooperation with IOC since early 1960s; funded by UK Natural Environment Research Council

PSMSL Activities

Responsible for:

- collection,
- analysis (including research as high level quality control and inputs to study groups e.g. IPCC),
- distribution of monthly and annual MSL data,
- distribution of high-frequency, delayed mode data from GLOSS sites
- production of products from the sea level data
- provision of a wider 'Service'

The PSMSL Data Set



PSMSL wider 'Service' aspects

- Technical advice to tide gauge operators
- Data processing advice to network operators and scientists
- Scientific advice to Governments, IOC/UNESCO GLOSS programme etc.
- General advice to members of the public
- Provide MSL data through web pages: 60000 station-years of MSL data, also 5000 station-years higher-frequency, delayed mode data from GLOSS sites
- Provide web training and other information available *via* www.psmsl.org

Where did it all begin?

We have to go back to 1933

- 5th General Assembly of the International Union of Geodesy and Geophysics in Lisbon
- Meeting of the International Association of Physical Oceanography
- Setting up of a Mean Sea Level Committee



Professor Rolf Witting (1879–1944)

- Renowned oceanographer
- First Director Finnish Institute of Marine Research
- Finland-Swedish politician
- Member of four of Finland's cabinets 1926–1943
- Secretary of the International Association of Physical Oceanography (IAPO) in 1930



Professor Joseph Proudman (1888-1975)

- Born near Bury, Lancashire
- Lecturer in mathematics, Liverpool University, 1913
- Formed Liverpool Tidal Institute in 1919
- Appointed Secretary of the Mean Sea Level Committee
- Began data compilation with assistance from the International Hydrographic Organisation



Why were they doing this?

“For the study of the tides and tidal currents, of other movements of the sea surface and currents of different origin, continual observations of sea level are the sole or a most valuable basis. For the solution of a complex of geophysical problems, data regarding sea level and its changes are of great importance.”

from a paper prepared by Witting for IAPCO, 1933

Why were they doing this?

- Rolf Witting had interests in both Glacial Isostatic Adjustment and oceanography
- Joseph Proudman had wide ranging interests in ocean dynamics (e.g. long period tides)
- Sea level rise was not on the agenda
- First publication on 'global' rate of sea level rise by Gutenberg (1941) based on the first (1940) compilation. He found 11 cm/century

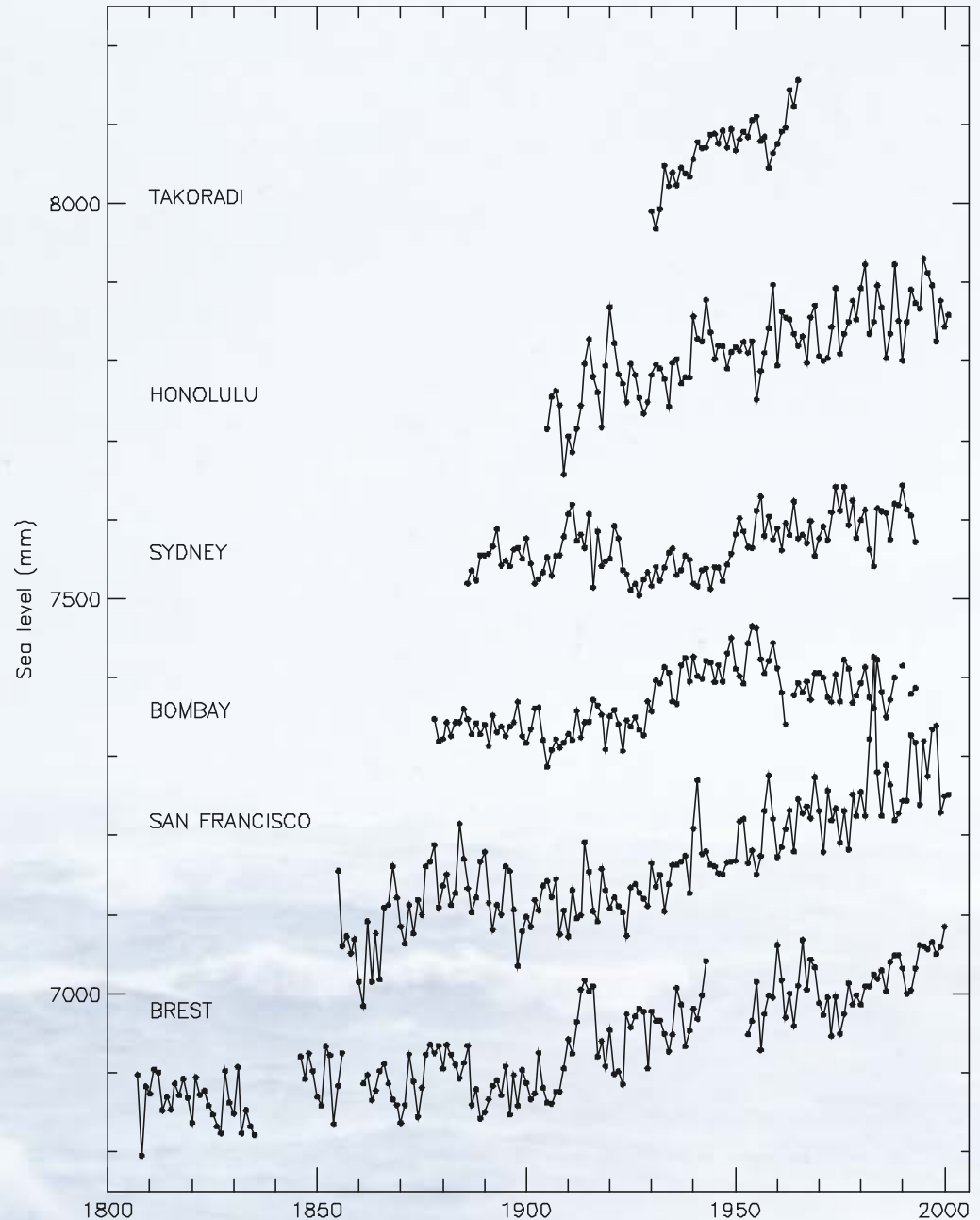
Some data publication aspects

- First mean sea level compilation by Proudman as Publication Scientifique of IAPO No. 5 (1940)
- Thereafter regular (~3 yearly) IAPO Publications Scientifiques (to 1968)
- Late 1960's Rossiter devised the 'Revised Local Reference'
- Mean sea level published on paper by the PSMSL itself up to 1980
- Magnetic tapes and floppy disks (1980 and 1990s)
- Now *via* web www.psmsl.org

Global Sea Level Change:

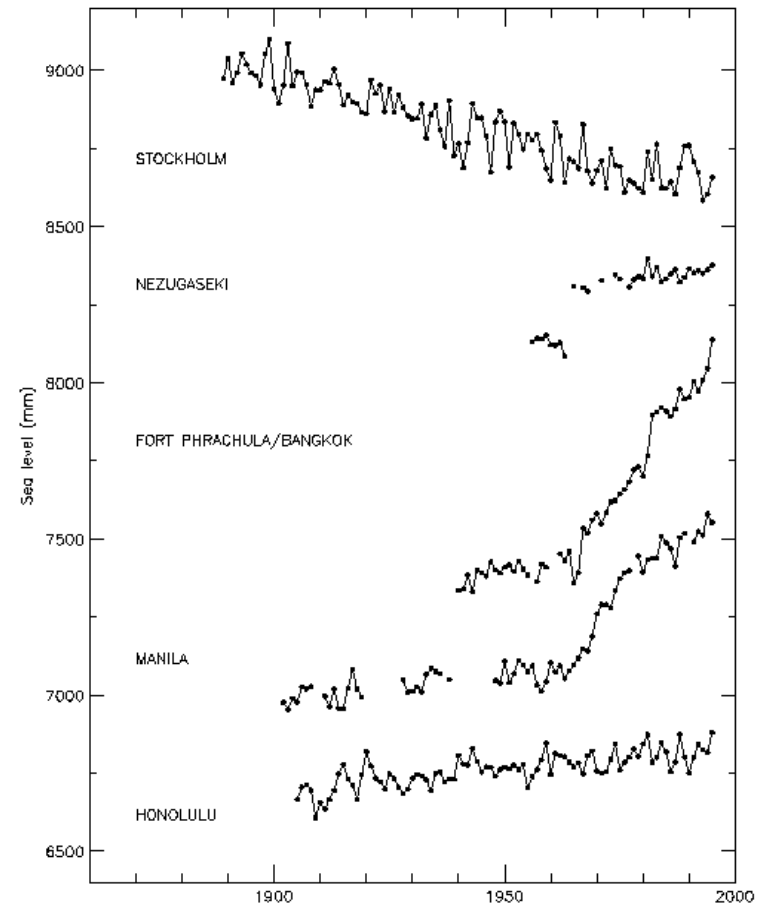
Long records from each continent from PSMSL data bank

Most records show evidence for rising sea levels during the past century



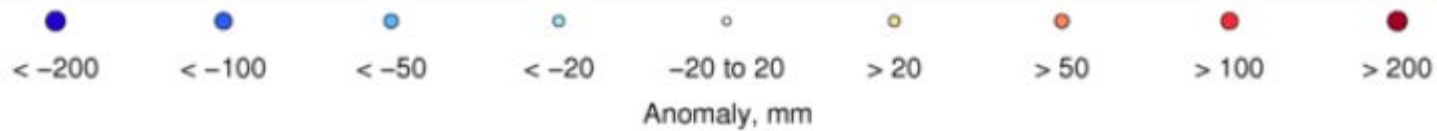
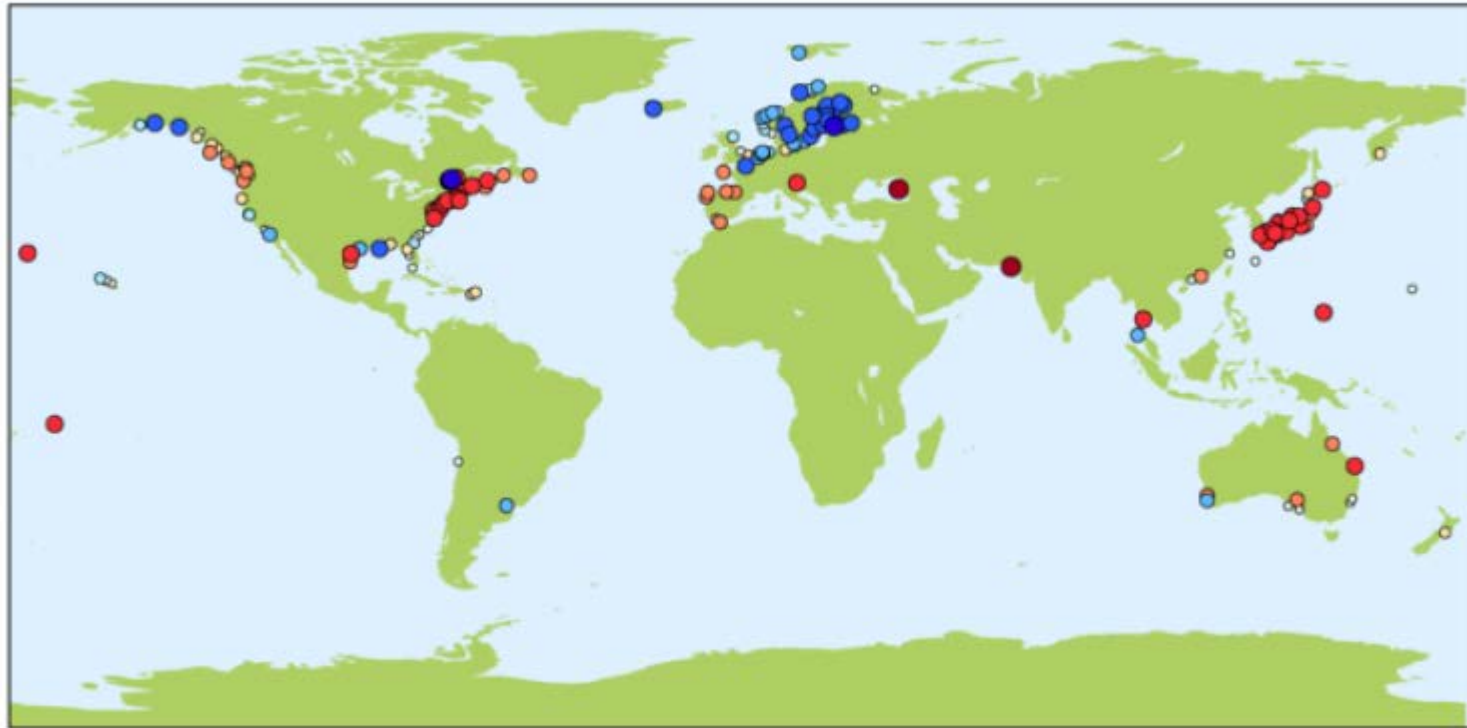
Vertical land movements

- Stockholm, Sweden
fall due to Glacial Isostatic Adjustment
- Nezugaseki, Japan
abrupt jump following earthquake in 1964
- Fort Phrachula Bangkok, Thailand
rise due to increased groundwater extraction since about 1960
- Manila, Philippines
recent deposit from river discharges and reclamation works
- Honolulu, Hawaii
secular trend 1.5 mm/year



Products: Anomalies and Trends

Level for 2010 relative to 1960–1990 (detrended)

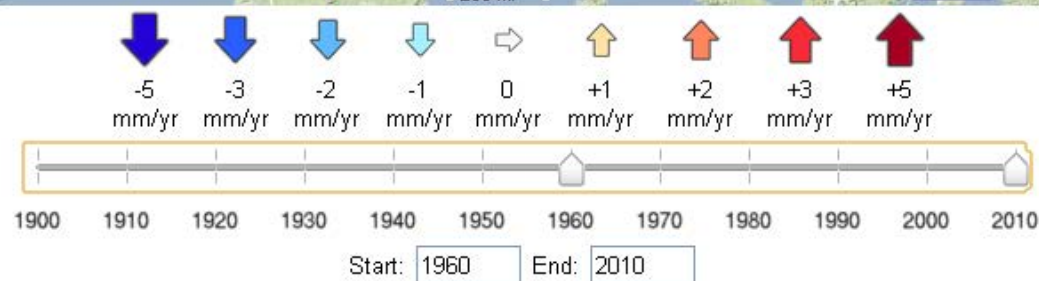
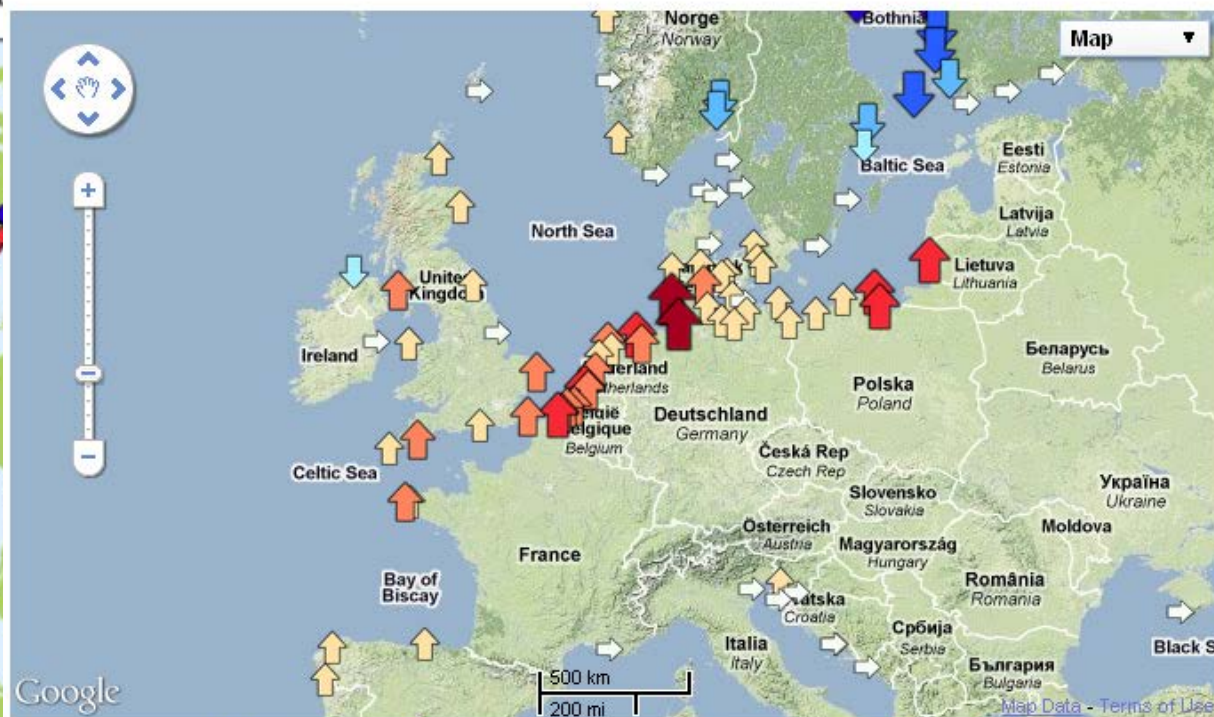


Products: Anomalies and Trends



 < -200  < -100  < -50

Relative Sea Level Trends



Jack Rossiter “The work of the PSMSL” (1962)

“One common factor can be distinguished throughout these varied topics. It is the need for more permanent gauges efficiently maintained, producing records which are accurately processed to give mean levels. As a personal ambition for the Permanent Service I shall be more than pleased, if during the next 25 years, we build up an adequate network of such stations so that our successors will have the data to work with which we are at present denied.”

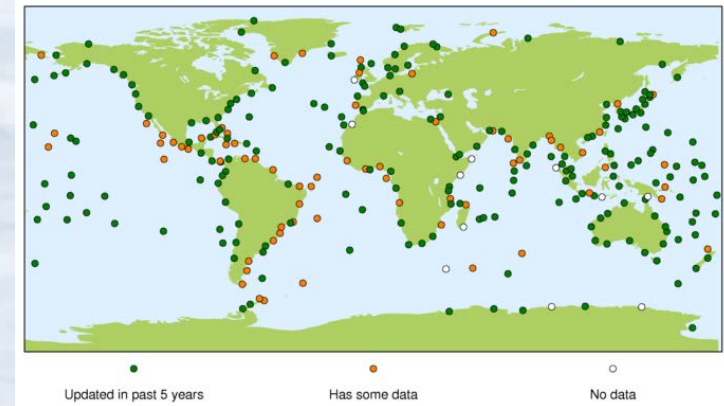
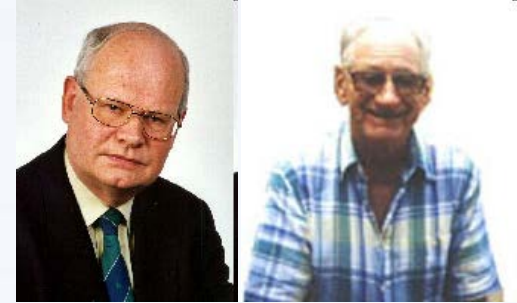


Global Sea Level Observing System (GLOSS)



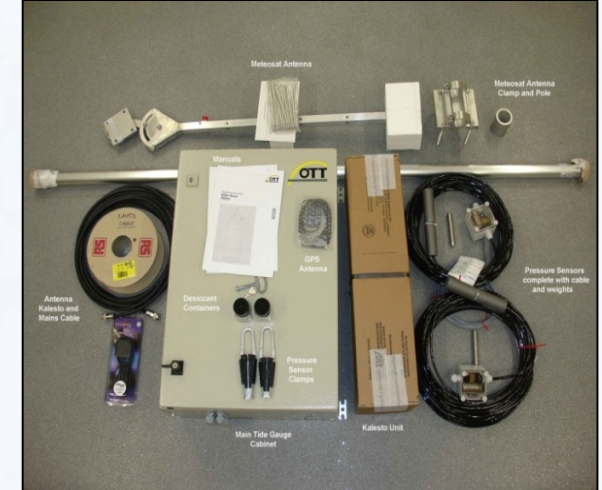
Aim:

- Establish a Core Network of approximately 300 stations around the world
- Related regional networks
- Networks for:
 - altimeter calibration
 - ocean circulation
 - long term trends
- Serve scientific research in oceanography and climate change
- Provide a 'global baseline' for a range of coastal studies

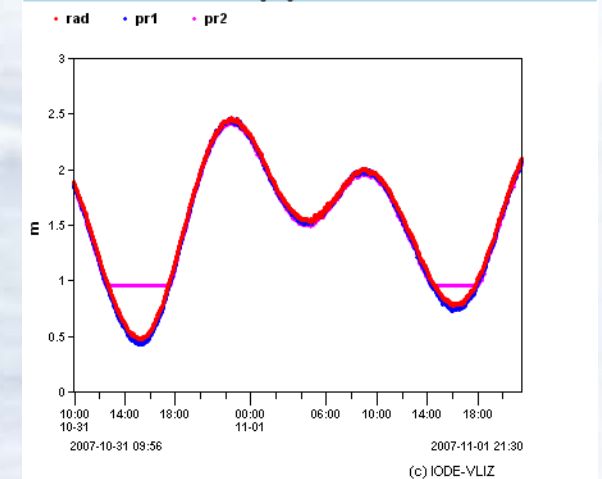


GLOSS and ODINAFRICA

- Delivery of sea level hardware for Africa and the western Indian Ocean
- Technical training course for specialists from Iran, Egypt and Germany
- IOC Indian Ocean Tsunami Warning System (IOTWS) fellowships
- Training courses for tide gauge operators

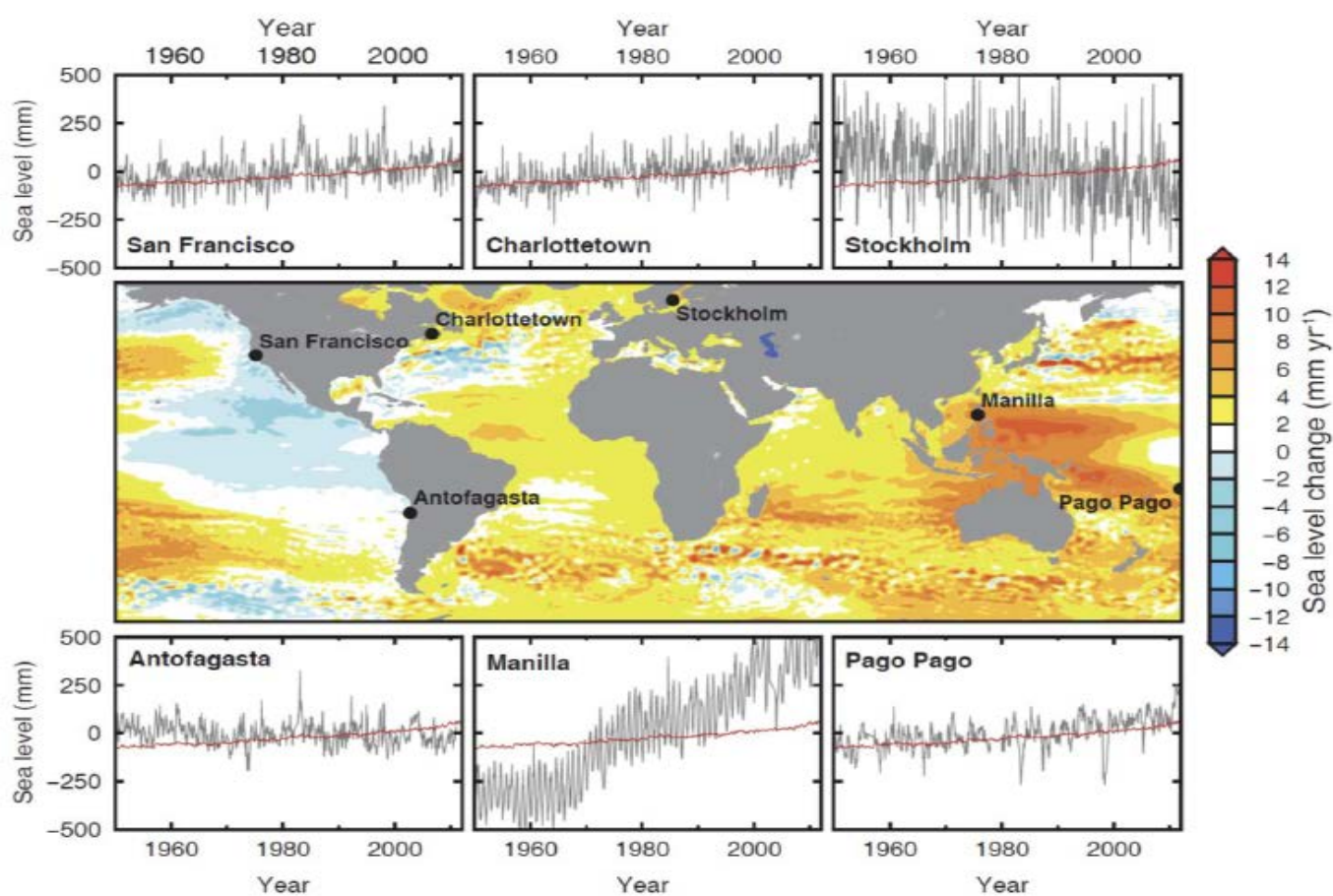


Tide gauge at Chabahar

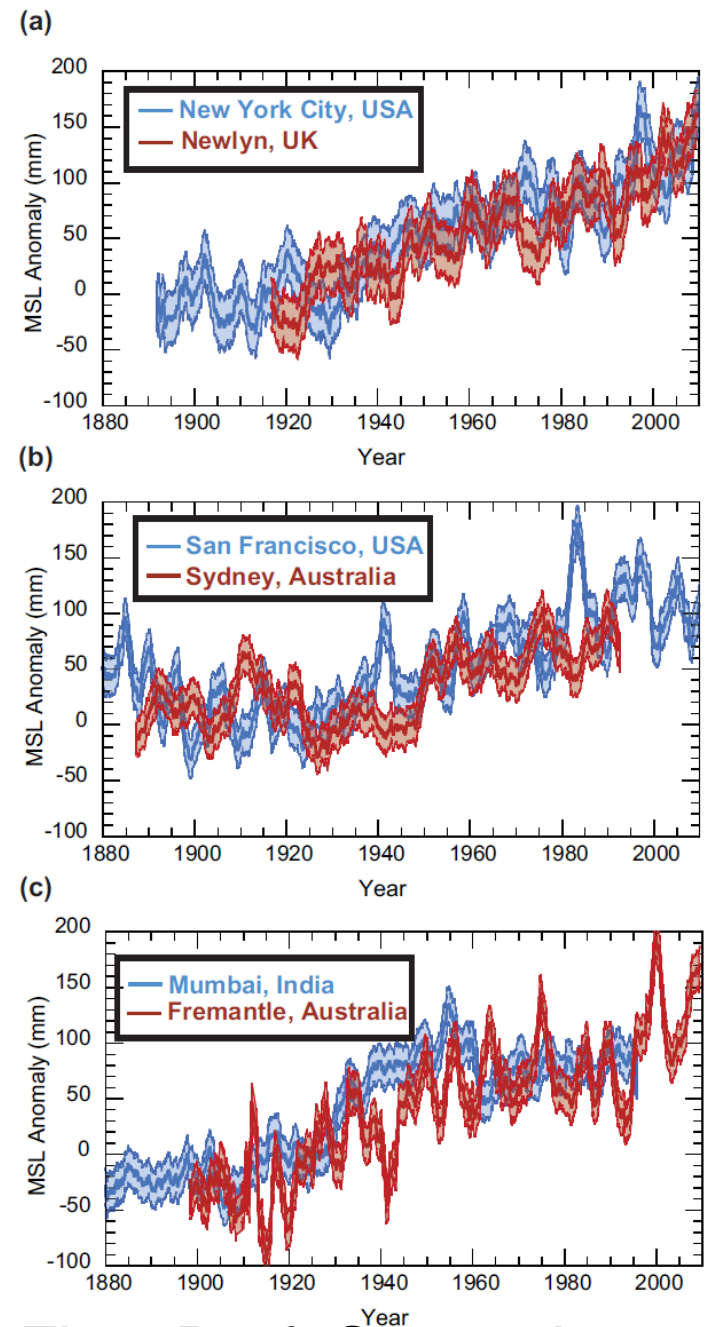
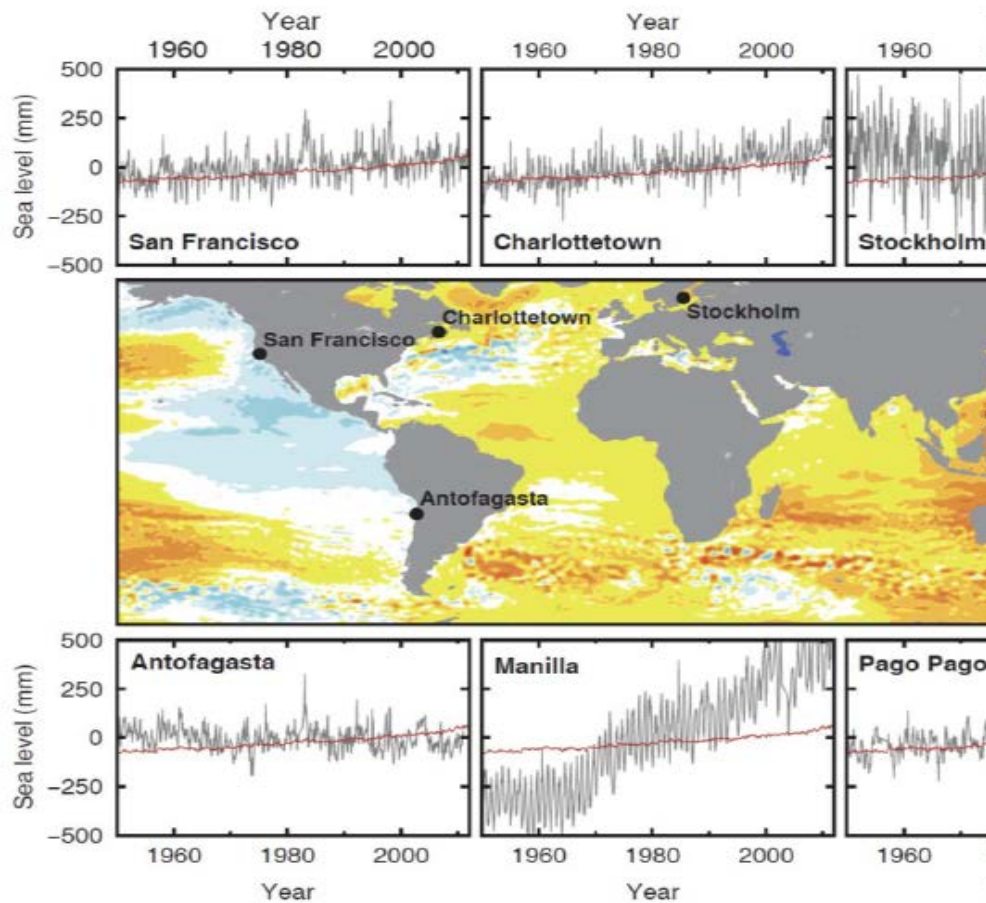


Usage of PSMSL data set

- Search of the scientific literature carried out for 2012
- Result: 61 papers have been published which used the PSMSL data set
- PSMSL has also contributed to the IPCC Fifth Assessment Report with Dr Svetlana Jevrejeva a lead author for Working Group I, Prof. Philip Woodworth a review editor and other past and present PSMSL staff also contributing
- PSMSL data set widely referenced



From Chapter 13. Sea Level Change. FAQ13.1 Figure 1: Relative sea level changes (grey lines) from selected tide gauge stations from the period 1950-2012. An estimate of global sea level change (red lines) is also shown.



From Chapter 13. Sea Level Change. FAQ13.1 Figure 1 shows sea level changes (grey lines) from selected tide gauges from the period 1950-2012. An estimate of global sea level (red lines) is also shown.

Figure 3.12: 3-year running mean sea level anomalies (in mm) relative to 1900–1905 from long tide gauge records representing each ocean basin from the Permanent Service for Mean Sea Level (PSMSL) (<http://www.psmsl.org>)

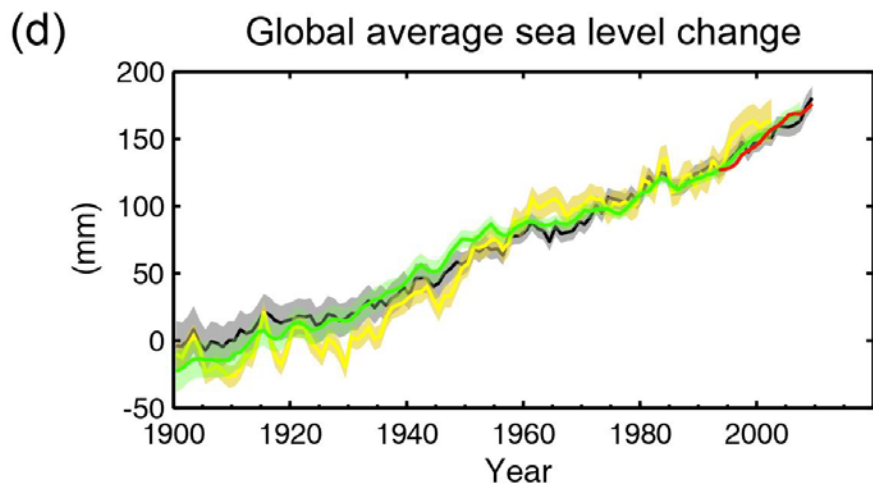
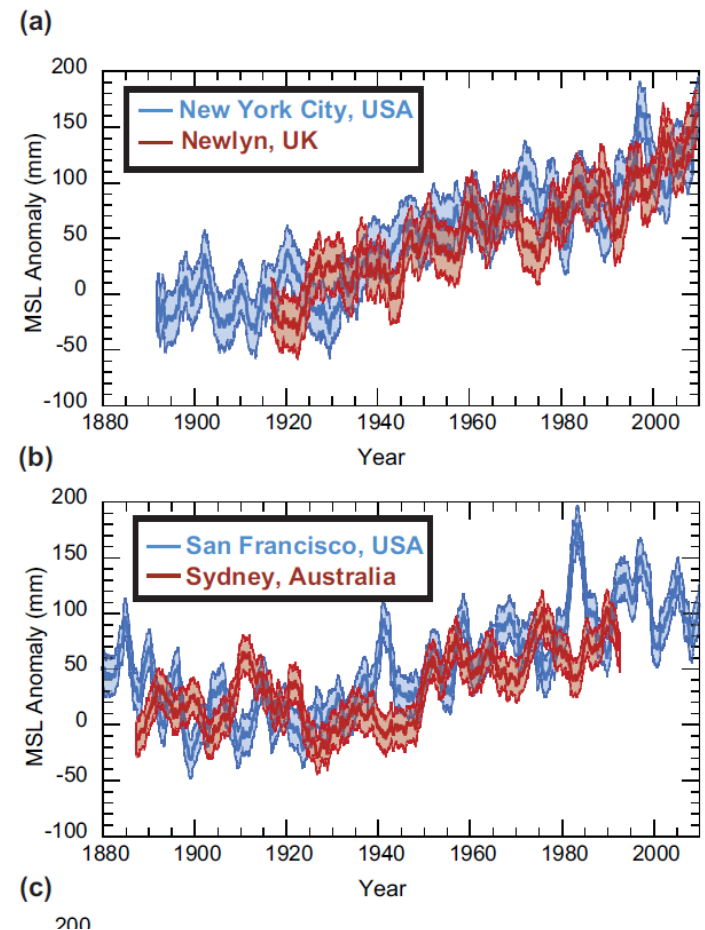
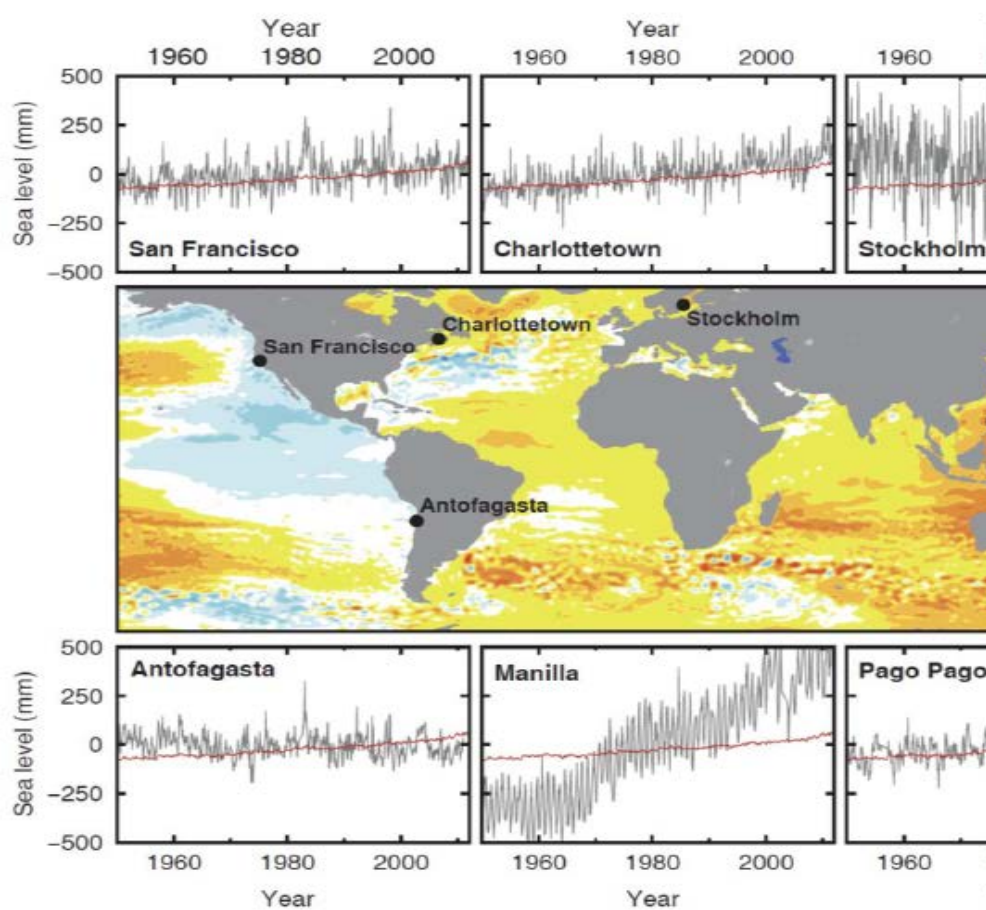


Figure SPM.3: Global mean sea level relative to the 1900–1905 mean of the longest running dataset, and with all datasets aligned to have the same value in 1993, the first year of satellite altimetry data. All time-series (coloured lines indicating different data sets) show annual values, and where assessed, uncertainties are indicated by coloured shading.

PSMSL future plans include:

- Improved integration of the MSL data set with higher frequency data and improving the quality of accompanying metadata
- Keeping in contact with data suppliers
- Ensuring that data made available in real-time are also contributed to PSMSL
- Inclusion of information on uncertainties/errors in the tide gauge data
- Addition of bottom pressure record section and data to the web
- Redevelopment of capacity building/training material

Summary

- PSMSL continues to be active in workshops/ conferences and with data acquisition and analysis
- Provides mean sea level data to users
- Generates of wide range of scientific and practical products
- Collaborates and advises the community:
 - scientific input to IPCC, governments, IOC/UNESCO, etc.,
 - knowledge transfer to the public
- Technical advice to tide gauge operators; data processing advice to network operators/scientists
- Provides training and other information