GLOSS Data Rescue status report:

The importance of preserving long-term sea level data

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NATURAL ENVIRONMENT RESEARCH COUNCIL

PSMSL

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Data Rescue and GLOSS

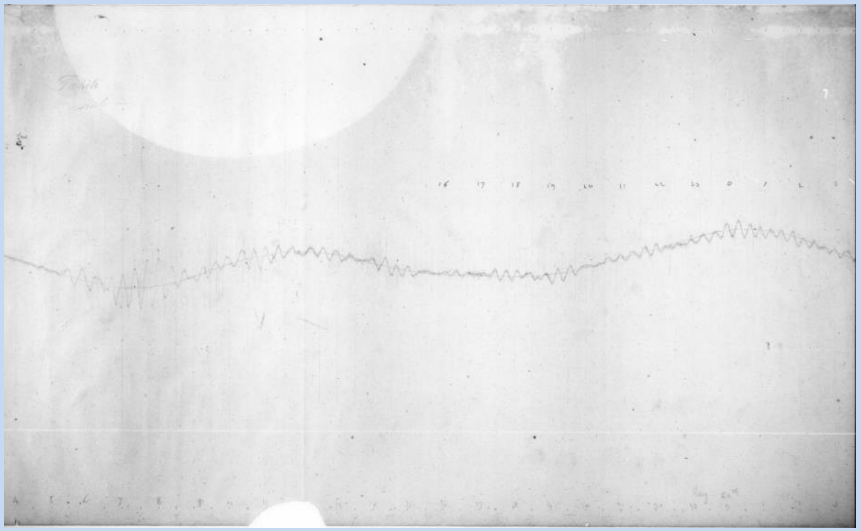
- Initiated by the GLOSS in 2001
- Sea Level Futures conference (Liverpool, UK, 2-4 July 2018) recommended

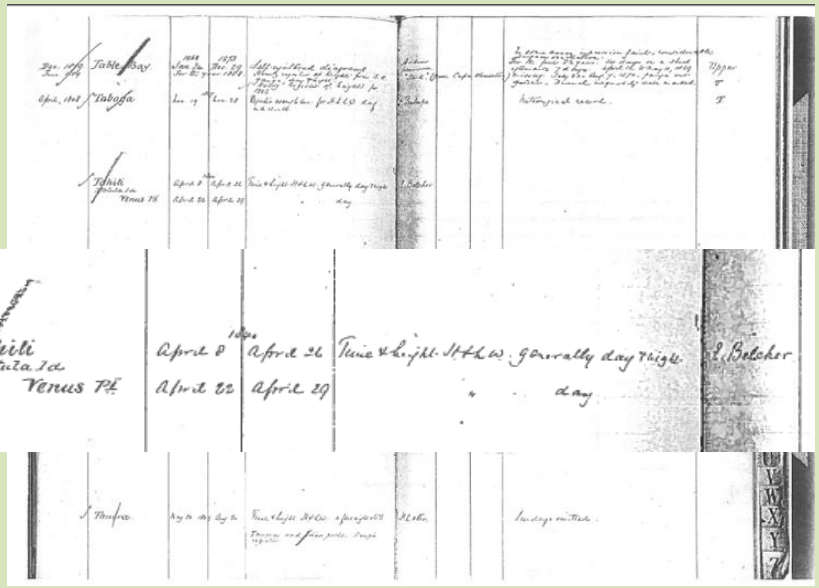
  "Commitment to extend the historical sea level record through data rescue, digitisation and the accurate detailed integration of historic tide gauge data into international repositories to improve wide spatial and temporal gaps in the climate record and validate process-understanding and climate models."
- Carried through to the OceanObs19 paper "Towards comprehensive observing and modeling systems for monitoring and predicting regional to coastal sea level"

Meetings attended

- Research Data Alliance (RDA) 10th Plenary Meeting (Sept 2017), Data Rescue Interest Group session
- Cross discipline UK data rescue workshop (May 2018), including lessons learned from projects
- 11th International Atmospheric Circulation Reconstructions over the Earth (ACRE) workshop (Nov 2018)
  - Steve Penny (Univ. of Maryland (USA): presentation on "Machine Learning for Reading Handwritten Logs or Printed Materials".
  - Used a Document Layout Analysis approach, Optical Character Recognition and Google's TensorFlow as an artificial neural network

Tsunami event 23rd August 1856 (NCEI)





Tide Observations.

Otaheite. Motouta Island. April 1840.

Date.	Moon's age.	Mean Time.	Tide-gauge.	Tide-batten.	Wind. Direction.	Wind. Force.	Weather.	Remarks.
	h m	h m	ft. in.	ft. in.				
☿ April 8.	5 9	9 15 A.M.	3 10½	.....	S.W.	3	b.c.	
		37	3 10½	1 6½				
		10 4	3 10	1 7½	S.W.	3-4	b.c.	
		19	3 10	1 8				
		11 05	3 10	1 8	S.W.	3-5	b.c.	
		29	3 10	1 8½				
		45	3 10	1 8½	S.W.	3-5	b.c.	
		Noon.	3 9½	1 9½				
		0 35 P.M.	3 9½	1 9	S.W.	3-5	b.c.	
		1 05	3 9½	1 9½				
		40	3 8½	1 10	S.W.	4	b.c.m.	
		2 4	3 8½	1 11½				
		27	3 8½	1 11½	.....	.....	.....	High Water 2h 24m.
		3 00	3 8	1 11	S.W.	4	b.c.m.	
		15	3 8	1 11				
		30	3 8½	1 10		3		
		50	3 8½	1 9½	S.W.	2	b.c.m.	
		4 02	3 8½	1 9½				
		25	3 8½	1 10	Calm.	.....	.....	Breeze outside strong N.W.
		45	3 8½	1 10				
		5 5	3 8½	1 10	.....	.....	b.c.m.	
		25	3 8½	1 10				
		40	3 8½	1 10				
		50	3 9	1 9½				
		59	3 9	1 9½	E.S.E.	1	.....	Land breeze.
		6 59	.....	1 9		1		
		50	.....	1 8½				
		7 20	.....	1 8½				
		51	.....	1 8				
		8 09	.....	1 7½	E.S.E.	3	b.c.	
		9 12	.....	1 8				
		27	.....	1 8½		3	.....	Low Water 8h 36m.
		10 40	.....	1 8½				
		50	.....	1 8½				
		11 40	.....	1 8½	N.N.E.	2		
		26	.....	1 8				
		55	.....	1 9		2		
		0 25 A.M.	.....	1 9	N.N.E.			
☽ 9.	.....	1 00	.....	1 8½	.....	3	b.c.	
		20	.....	1 9				
		50	.....	1 9				
		2 26	.....	1 9	.....	.....	.....	Tide irregular.
		3 00	.....	1 9				
		35	.....	1 8½	.....	2		
		4 10	.....	1 9				
		35	.....	1 9½				
		5 00	.....	1 9½				
		32	.....	1 9½				
		5 50	3	.....				
		6 11						
		36						
		44						
		52	3					

VOYAGE

ROUND THE WORLD.

CHAPTER I.

HAVING so lately quitted the American continent, and particularly Nuhuhiva, the scenery of Tahiti did not so much interest us, as the assistance we looked for in refitting, added to the rest and amusement after our late fatigues.

I landed on Point Venus, perhaps with feelings totally incomprehensible to any on board. Fourteen years before, on the very spot where Cook was encamped, I had bivouacked for several days. I was then a lieutenant, now a captain; and I looked forward to my labours, which were there to be resumed, with an anxiety only to be experienced by those charged with similar duties. The question as to the increase of the Dolphin shoal since 1826 was my hobby. Next came the determination by actual experiment of the tidal question; Kotzebue and

B 2

hobby. Next came the determination by actual experiment of the tidal question; Kotzebue and

B 2

- UKHO: tidal observations - 1840 voyage
- Month of observational data from April to May 1840 (Belcher, E. and Beaufort, F., 1843)
- Wind force and direction and Beaufort letters
- Diagram of the instrumentation installed to measure the tide
- No mention of any benchmarks or fixed reference points

Sea level data rescue questionnaire (Oct 2018)

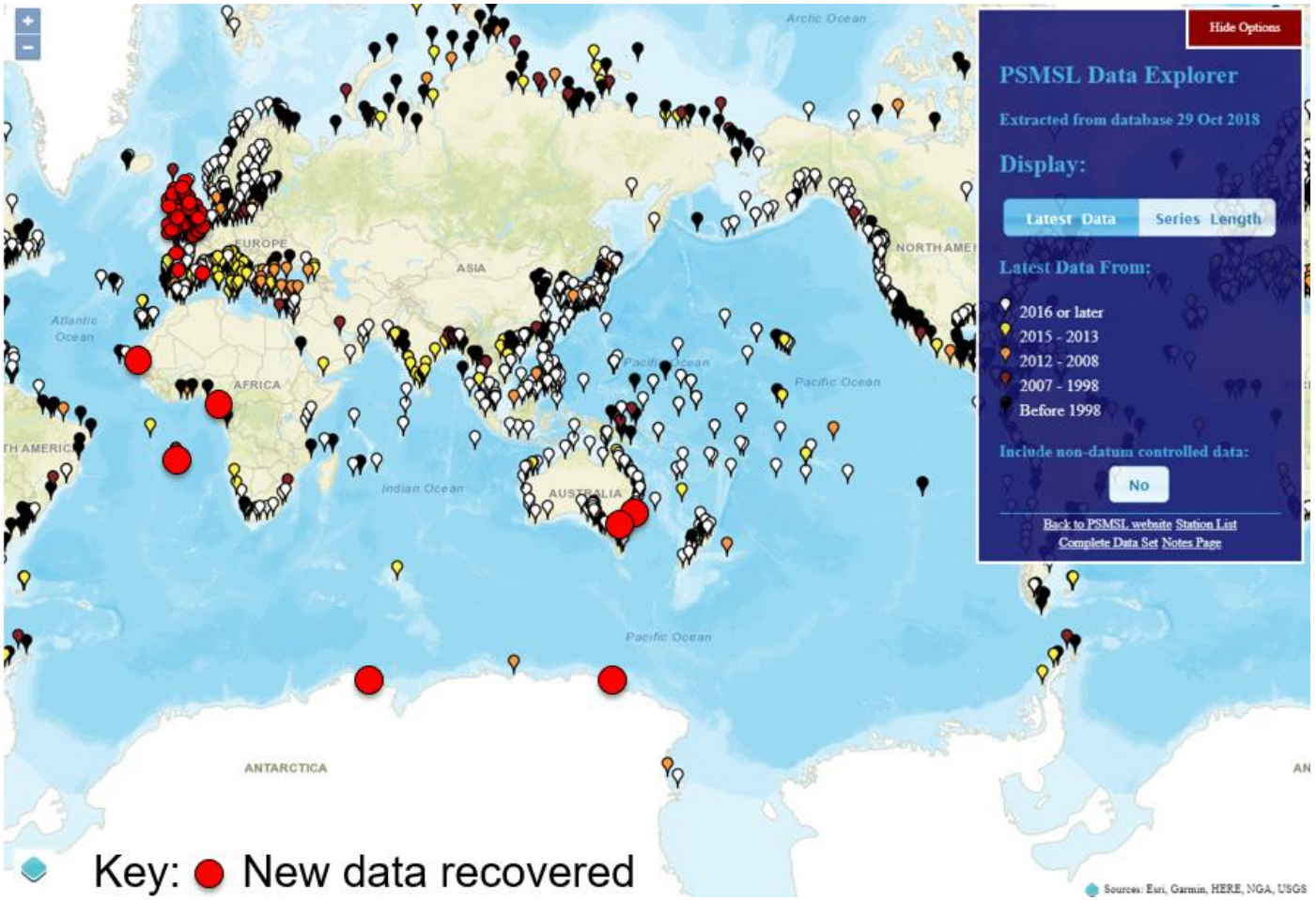
- How many data rescue projects have you carried out in the past 5 years?
- Was the funding source internal, external or other?
- How much data did you recover? (site years, no. of images, GB/TB?, any other useful metric?)
- What was the original format was the data you recovered e.g. paper charts, handwritten ledgers, punch cards?
- What challenges did you face?
- What went right?
- What would you do differently next time?
- Have the data been deposited in an international data centre? Have you used C3S Data Rescue Service?
- Did you use social media to promote your project? Was it effective?
- Have you any upcoming projects planned?

Sea level data rescue questionnaire (Oct 2018)

- Sent to contacts in the global sea level community
- Input from the community about priorities / focus for next 5 years

- Numerous records in Europe (including Porto Corsini/Marina di Ravenna, Italy)
- Newly digitised data from data sparse regions
  - Dakar in Africa (36 years starting in 1902)
  - St. Helena in the South Atlantic (1826 - 1827)
  - Newcastle and Williamstown in Australia
  - Mawson and Cape Denison in Antarctica (months in the form of paper charts)
  - Talke and Jay (2017) provides an update to the data rescue work carried out by Stefan Talke and team (not included on map)

New data recovered



Challenges faced - time consuming

- Digitised by hand
- Digitisation (by hand)
- Digitising ~20 station years
- Time consuming process to digitize all these paper documents
- Extreme time-consuming

Challenges faced - finding metadata

- Finding information that has been “forgotten” requires some detective skills
- Hard to find metadata
- Availability of metadata

Challenges faced - funding

- Ask for substantial resources, project. If not funded, no data rescue
- Paper was self-funded
- This project was not funded and was done on a voluntary basis
- Unfunded
- No funding for any of them
- No specific source of funding

What would you do differently next time?

Most teams are now looking in to automations as the biggest effort is in the digitising of the analogue records:

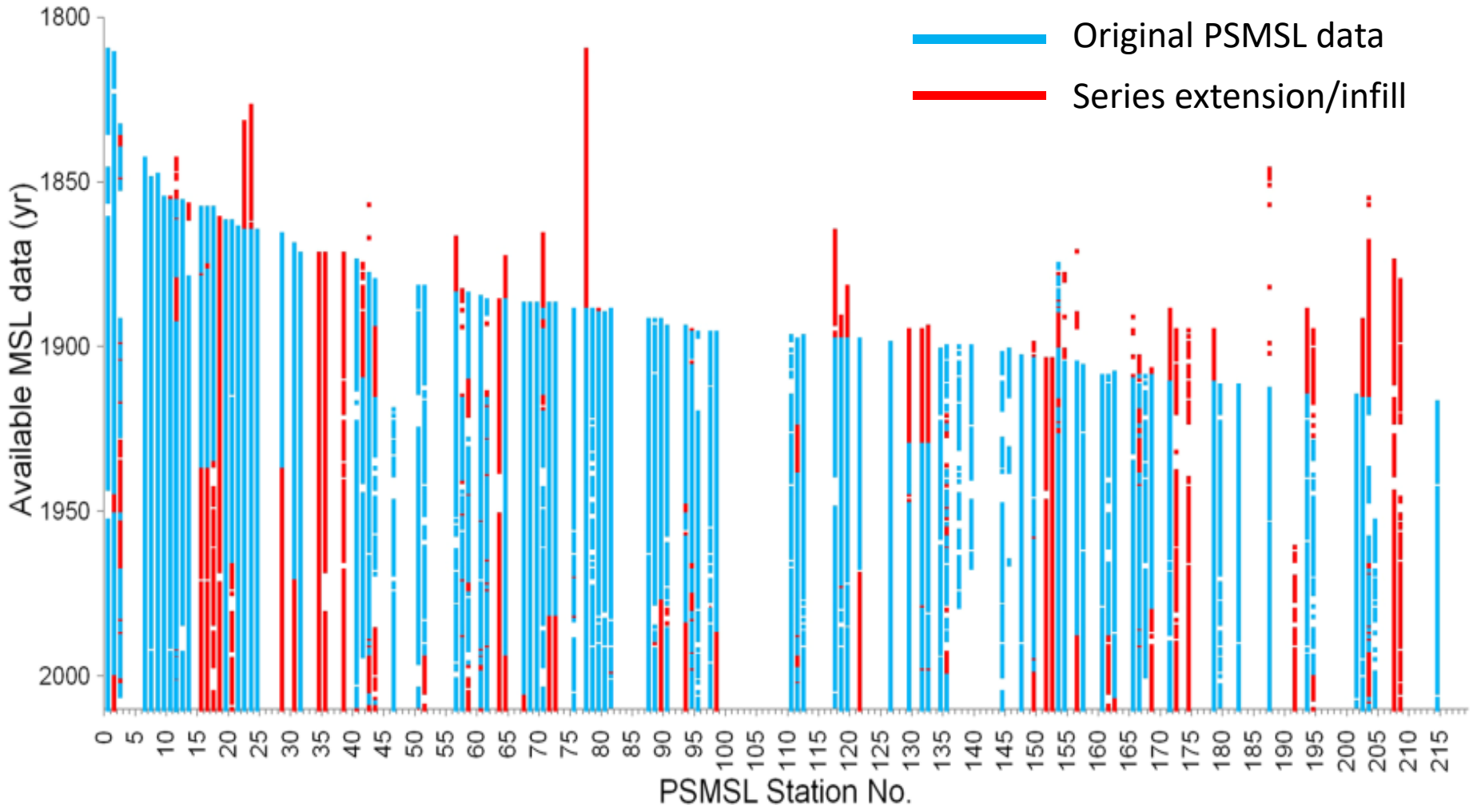
- Explore tools and software availability
- Automation is our next priority
- Improving automatic processing

What went right?

- Results showed how valuable it is to extend data series, and justified the effort
- Data were successfully recovered
- Nearly continuous series of mean sea level since 1876

- Peter Hogarth extended a large number of records in the PSMSL database
  - Finding metadata that enabling concatenation of existing series
  - Digitised data found in publications
  - Extension of the time series greatly reduced the variability in centennial scale sea level rise acceleration rates (Hogarth, P., 2014.)

Extended data series (Hogarth, P., 2014)



Other data rescue initiatives

- **Maynooth University, Ireland**
  - introduce sea level data rescue activities into undergraduate courses
  - “as has been done with meteorological data already”
  - students said it gave them better understanding of their subject
  - helped them to see the power of data rescue

- **CSIRO, Australia**
  - program to work with schoolchildren (14-16 year olds)
  - required to do a week’s worth of work experience
  - students digitise data and at the end of the week they are shown their data compared to the predicted tides
  - Students reported that they “feel like they did something useful and learnt something”

New data rescue projects

- Alicante with daily data starting in 1874
- 19thC Irish sea level changes/rescue more data from ports around Ireland
- Geelong 1960-1966, Georgetown 1956-1965, possibly also Albany 1900 to 1965, Australia
- Bourcefranc-le-Chapus (Middle of the French Atlantic coast), about 20 years of data (paper charts)
- Saint-Servan (Saint-Malo, Channel), long historical times-series (starting from 1850)
- Socoa (South of the French Atlantic coast), long historical times-series (starting from 1875)
- Cooperation with the Ivory Coast could take shape within the next month (sea level reconstruction at Abidjan)

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