ISSN : 0974 - 7451 Volume 9 Issue 5

Environmental Science
An Indian Journal
Current Research Paper

ESAIJ, 9(5), 2014 [186-192]

Realistic global sea level rise scenarios for the Finnish coast

A.Parker
Royal Melbourne Institute of Technology University, Bundoora, VIC 3083, (AUSTRALIA)
E-mail : albertparker@y7mail.com

ABSTRACT

Despite some authors calculate scenarios for the mean sea level on the Finnish coast driven by unrealistic large-scale sea level rise due to changes in ocean density and circulation and melting of land-based ice, a true representation of sea levels around the Finnish coastline inferred by considering the local and global results of tide gauge measurements and GPS data show stable sea level decreases for Finland without any component of acceleration similarly to the other tide gauges worldwide.

THE MILDLY WARMING TEMPERATURES AND SLOWLY RISING SEA LEVELS WITHOUT ACCELERATION COMPONENTS

With measured temperatures mostly naturally oscillating while biased by other anthropogenic factors not related to the changed composition of the atmosphere rather than by the carbon[1-6] and measured sea level records of good quality and length consistently all acceleration-free[7-10], not surprisingly more grounded analyses of what is actually measured is replaced by reconstructions and simulations.

The relative sea level is measured by tide gauges with good accuracy. This result has to cover a period of time long enough to clear the signal of the decadal and multi-decadal oscillations and detect the long term trend. Being measured temperatures and sea levels all oscillating with periodicities up to a quasi-60 years[1-6], more than 60 years of data are obviously requested. To be significant, a tide gauge record has to satisfy quality requirements in addition to the length requirement.

Missed data reduce the quality of the record. Any perturbation to the measure, from change to damage of the instrument to constructions about the location of the tide gauge, all reduce the quality of the record. From a recorded distribution x_i, y_i i=1,m where x_i is the time and y_i is the monthly average mean sea level, linear fitting returns the rate of rise of sea level SLR_m at time x_m. This parameter is then oscillating because the sea levels are oscillating[7]. To assess the presence (or absence) of acceleration, it is enough to compare the SLR_m with the rate of rise of sea level SLR_n computed at a previous time x_n, $SLA_m=(SLR_m-SLR_n)/(x_m-x_n)$. Because this parameter is oscillating, the time history of SLA_m more than a single value is of interest[7].

This analysis returns us the relative motion sea-land that is what concern coastal planning. To try understanding the "*absolute*" sea level position, not a great deal if not in the science of global warming, the tide gauge position may be surveyed and related to a GPS signal, that is however a result available only over the last few years and still subject to significant vertical inaccuracies.

TABLE 1 presents the rate of rise of sea levels (SLR) of PSMSL stations in Finland (from[12]). The SLR of stations in Finland is negative on average because of

TABLE 1 : Rate of rise of sea levels (SLR) in [mm/year] of PSMSL stations in Finland (data from[12], analysis from[12] and[11])

		PSMSL Survey 2001		PSMSL Survey 2005		PSMSL Survey 2007		PSMSL Survey 2012 (Year Start >1900)		PMSL Survey 2013		NOAA Survey 2012	
Station	**Year Start**	**Year End**	**SLR**	**Year End**	**SLR**	**Year End**	**SLR**	**Year End**	**SLR**	**Year End**	**SLR**	**Year End**	**SLR**
KEMI	1920	1997	-7.29	2001	-7.13	2004	-7.12	2010	-7	2011	-6.93	2010	-6.99
OULU/ULEABORG	1889	1997	-6.44	2001	-6.4	2004	-6.41	2010	-6.52	2011	-6.32	2010	-6.38
RAAHE/BRAHESTAD	1923	1997	-7	2001	-6.85	2004	-6.87	2010	-6.82	2011	-6.77	2010	-6.85
YKSPIHLAJA	1889	1924	-6.64	1924	-6.64	1924	-6.64			1924	-6.72		
PIETARSAARI/JAKOBSTAD	1915	1997	-7.51	2001	-7.37	2004	-7.35	2010	-7.27	2011	-7.21	2010	-7.29
VAASA/VASA	1884	1997	-7.33	2001	-7.34	2004	-7.33	2010	-7.11	2011	-7.2	2010	-7.33
RONNSKAR	1867	1936	-7.06	1936	-7.06	1936	-7.06	1936	-6.35	1936	-7.06		
KASKINEN/KASKO	1928	1997	-6.71	2001	-6.54	2004	-6.55	2010	-6.52	2011	-6.46	2010	-6.5
SALGRUND	1920	1928	-11.1	1928	-11.1	1928	-11.1						
REPOSAARI	1913	1926	-4.69	1926	-4.69	1926	-4.69						
MANTYLUOTO	1911	1997	-6.26	2001	-6.11	2004	-6.07	2010	-5.93	2011	-5.89	2010	-5.91
SAPPI	1921	1936	-10.39	1936	-10.39	1936	-10.39						
RAUMA/RAUMO	1933	1997	-4.88	2001	-4.74	2004	-4.77	2010	-4.66	2011	-4.61		
LYOKKI	1858	1936	-5.37	1936	-5.37	1936	-5.37						
LYPYRTTI	1858	1936	-5.05	1936	-5.05	1936	-5.05	1936	-4.79	1936	-5.04		
TURKU/ABO	1922	1997	-3.94	2001	-3.8	2004	-3.8	2010	-3.63	2011	-3.58	2010	-3.67
HELIGMAN	1921	1936	-8.99	1936	-8.99	1936	-8.99						
KOBBAKLINTAR	1911	1936	-7.15	1936	-7.15	1936	-7.15						
LEMSTROM	1889	1936	-4.51	1936	-4.51	1936	-4.51						
DEGERBY	1924	1997	-3.9	2001	-3.79	2004	-3.83						
UTO	1866	1936	-2.71	1936	-2.71	1936	-2.71	1936	-3.44	1936	-2.71		
LOHM	1921	1927	-11.89	1927	-11.89	1927	-11.89						
TVARMINNE	1921	1936	-8.72	1936	-8.72	1936	-8.72						
JUNGFRUSUND	1858	1934	-3.04	1934	-3.04	1934	-3.04	1934	-2.7	1934	-3.04		
RUSSARO	1866	1936	-2.92	1936	-2.92	1936	-2.92	1936	-3.01	1936	-2.9		
HANKO/HANGO	1889	1997	-2.78	1997	-2.78	1997	-2.78	2010	-2.57	2011	-2.59	2010	-2.67
SKURU	1900	1936	-0.78	1936	-0.78	1936	-0.78	1936	-0.78	1936	-0.78		
HELSINKI	1879	1997	-2.52	2001	-2.44	2004	-2.43	2010	-2.08	2011	-2.31	2010	-2.33
SODERSKAR	1866	1936	-1.81	1936	-1.81	1936	-1.81	1936	-2.44	1936	-1.82		
KOTKA	1908	1927	0.02	1927	0.02	1927	0.02						
HAMINA	1929	1997	-1.04	2001	-1	2001	-1	2010	-0.97	2011	-0.92	2010	-1.03

isostasy[14,15] and relatively stable. The average SLR of the 13 stations still being updated is -5.31 mm/year. This SLR is increasing over the last decade. This is clearly shown also by the time series of the SLR_m for Vaasa, of time span of data 1883 – 2012 and completeness (%) 95 (Figure 1), Helsinki, of time span of data 1879 – 2012 and completeness (%) 100 (Figure 2), Pietarsaari/Jakobstad, of time span of data 1914 – 2012 and completeness (%) 98 (Figure 3) and finally Mantyluoto, of time span of data 1910 – 2012 and completeness (%) 98 (Figure 4).

Vaasa has some substantial gaps. Rather than introducing further uncertainties by filling the gaps by using the data of neighbouring years or some other interpolation, only the measured data are considered. The SLR_m is always smaller than the values computed in the PSMSLsurveys[12]. The latest NOAA value[11] is close to the SLR_m value. The GPS near Vaasa indicates strong subsidy, with a velocity of 8.46 mm/year over the last decade. The latest SLR_m (relative) is -7.24 mm/year. Helsinki has practically no gaps. The SLR_m is very close to the values computed in the PSMSL surveys[12] and

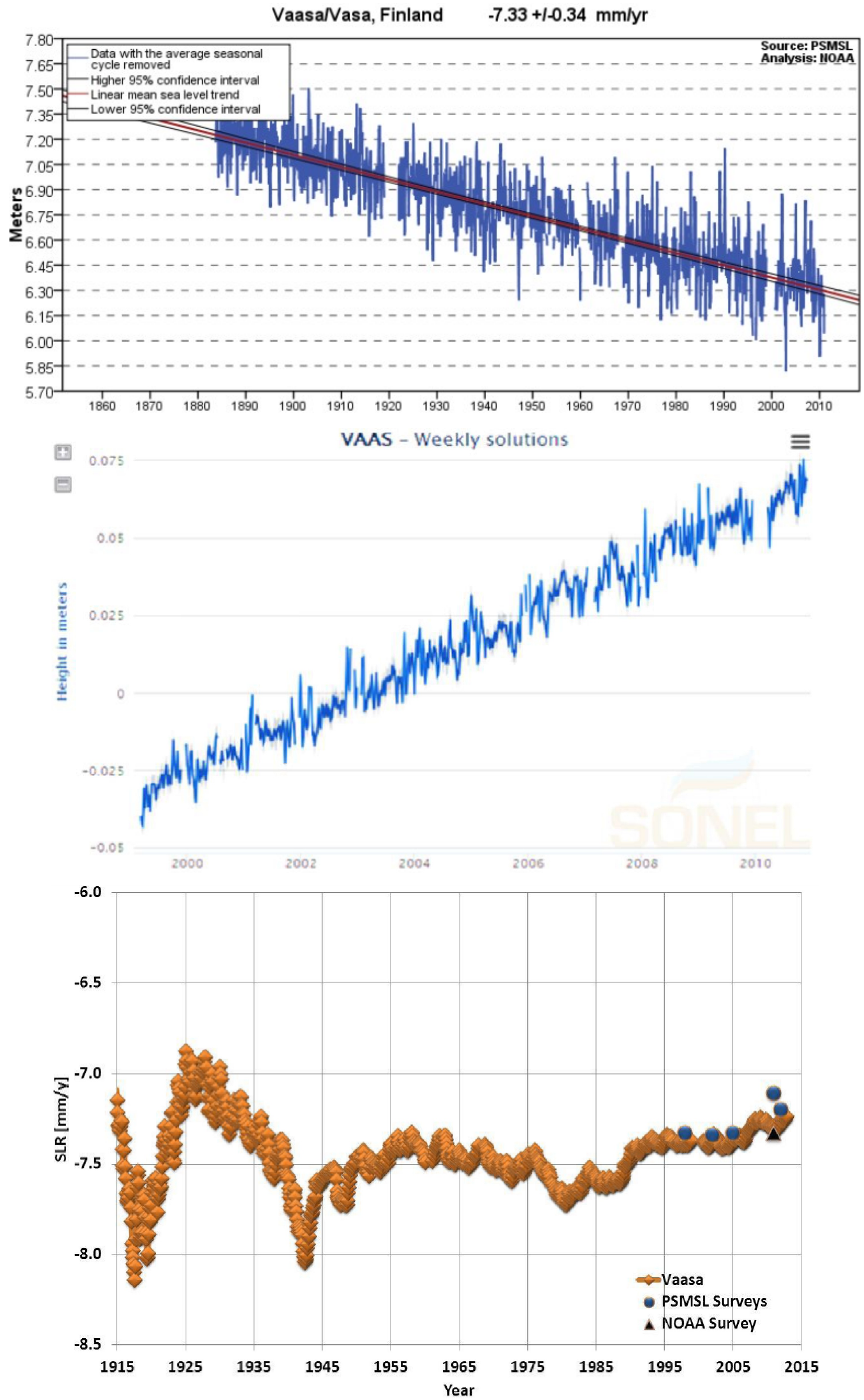

Figure 1 : SLR (from[11]), nearby GPS position (from[13]) and SLR_m distribution for Vaasa

the latest NOAA value[11] as well. The GPS near Helsinki indicates subsidy, with a velocity of 4.49 mm/year over the last decade. The latest SLR_m (relative) is -2.27 mm/year. For Pietarsaari/Jakobstad and Mantyluoto only the recorded data are considered similarly to Vaasa leaving empty the gaps. The latest SLR_m

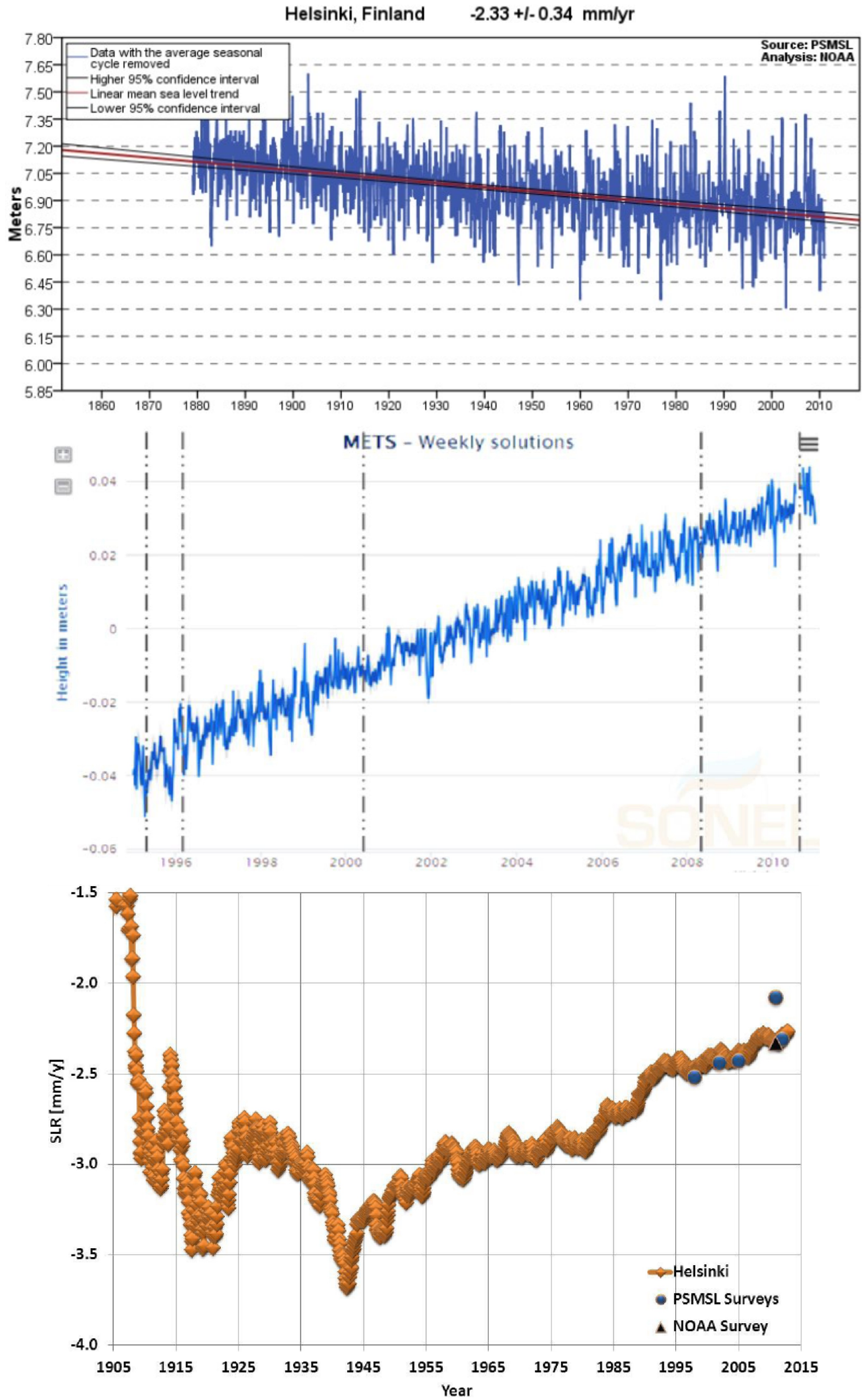

Figure 2 : SLR (from[11]), nearby GPS position (from[13]) and SLR_m distribution for Helsinki

(relative) are -7.18 and -5.80 mm/year respectively.

By comparing the SLR of subsequent surveys in TABLE 1, the average acceleration parameter SLA is 0.01-0.02 mm/year^2. Same valuesare obtained by computing the SLA as the time derivative of the SLR(y) of Figures 1 to 4 and averaging the result January 2000 to present. Helsinki has SLA of 0.0129 mm/year^2, Vaasa a SLA of 0.0113 mm/year^2, Pietarsaari/Jakobstad has

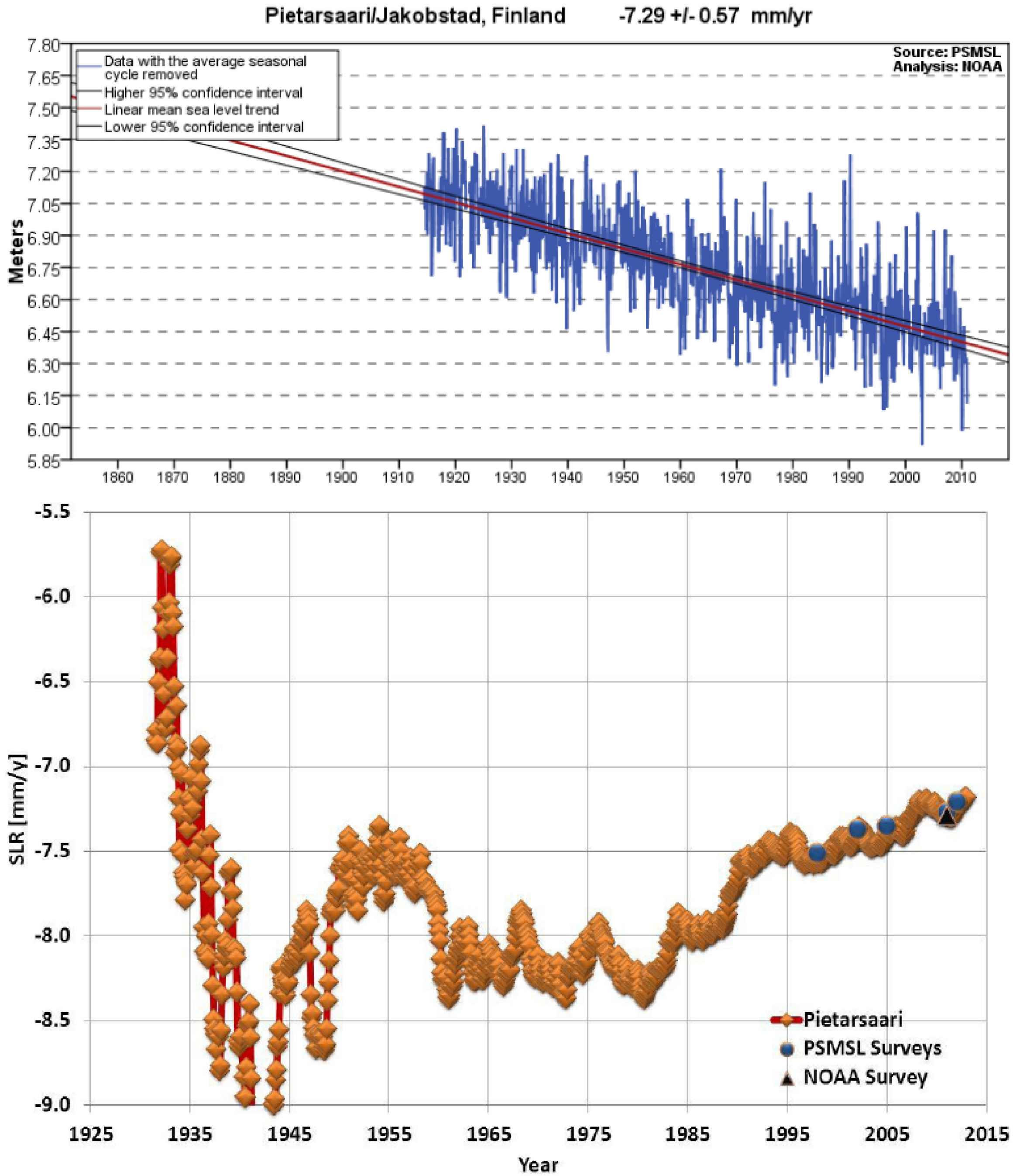

Figure 3 : SLR (from[11]), nearby GPS position (from[13]) and SLR_m distribution for Pietarsaari/Jakobstad

a SLA of 0.0233 mm/year^2 and Mantyluoto has a SLA of 0.0214 mm/year^2. This positive SLA may be the result of the oscillating behaviour of the oceans. The SLRare oscillating with peaks and valleys shifted from one geographical location to the other andwhile some location may have a positive acceleration some other may have a negative acceleration without representing any global positive or negative accelerating trend. For example the North Atlantic coast of the United States has "*hot spots*" when similar logic suggests the presence of "*cold spots*" along the Pacific coast of the United States[8,9]). The starting point from a peak or a valley has also its influence when the record length is not extending for too many relevant periodicities as it is unfortunately the general case. Areduction in the rate of isostasy may also be responsible for the positive acceleration result. The present mean overall apparent uplift rate for South West Finland is for example of the order

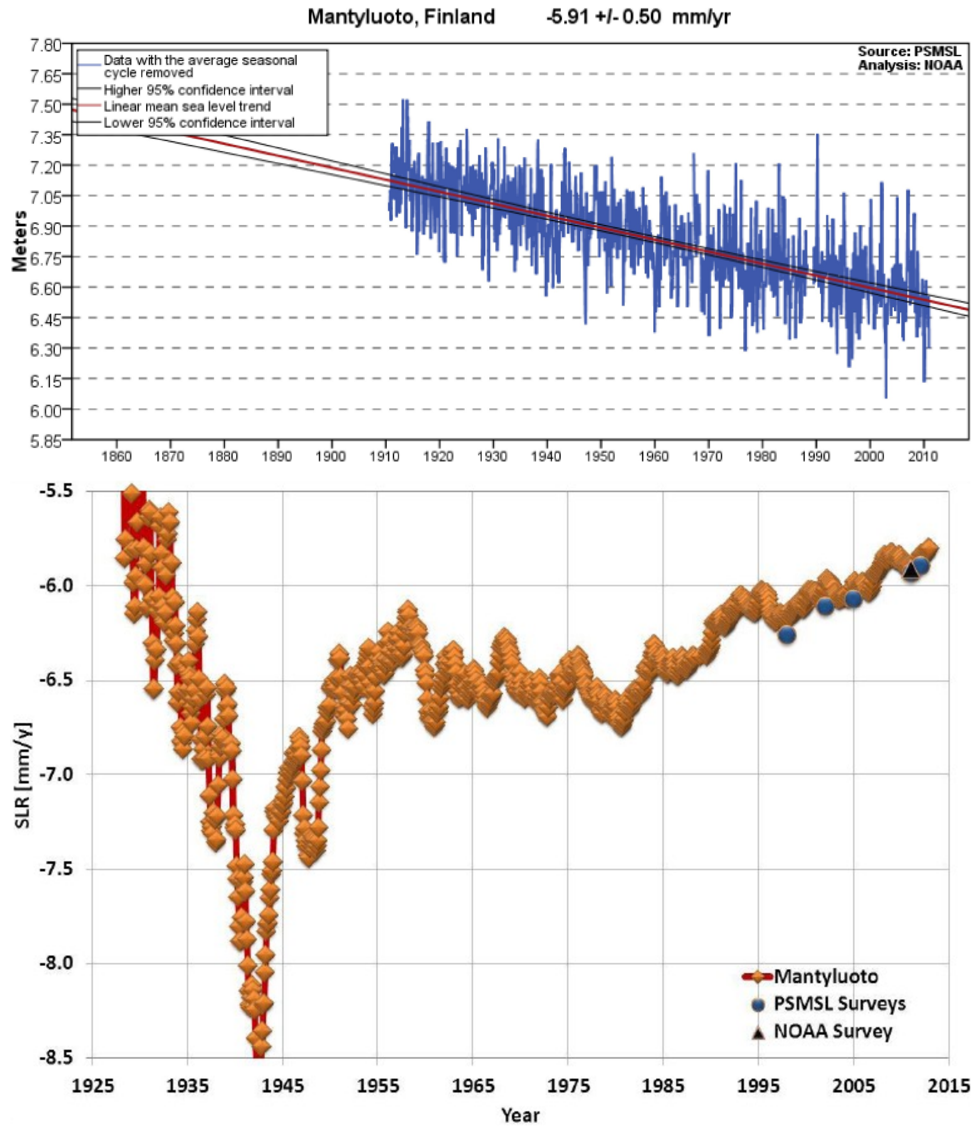

Figure 4 : SLR (from[11]), nearby GPS position (from[13]) and SLR_m distribution for Mantyluoto

of 4–5 mm/year, but immediately after deglaciation the rate of crustal rebound was several times higher[15]. The limited GPS data available do not permit to further study the isostasy movement over the length of the tide gauge record. In any case, the tide gauges of Finland have sea level rates of rises significantly negative and it is very unlikely these rates could turn positive because of reducing isostasy, mildly rising temperatures or melting of the Artic ices (the Antarctic ices have absolutely not changed over the last 35 years).

CONCLUSIONS

Temperatures have been warming mildly over the last century with oscillations of quasi 60 years about this about constant trend, with two upwards phases 1910 to 1940 and 1970 to 2000, and downwards phases 1940 to 1970 and 2000 to present and very likely 2030. Sea levels have been consistently oscillating over the same period about a constant trend with about same quasi 60 years periodicity. Much shorter and longer periodicities are also present in the temperature and sea levels signal. For the specific of Finland, subject to subsidy, the relative sea levels have been reducing and very likely the sea levels by 2100 will be lower than the present values no matter which carbon dioxide emission scenario will apply, being the actual influence of the changed composition of the atmosphere in the measurements definitively much less than the claimed on the basis of not validated theories.

REFERENCES

[1] A.Parker; Mismatch between acceleration of reconstructed sea levels and gradient of reconstructed temperatures, accepted paper, in Press, **(2013)**.

[2] A.Parker; The 'present global warming hiatus' is part of a quasi-60 years oscillation in the worldwide average temperatures in the downwards phase, accepted paper, in Press, **(2013)**.

[3] N.Scafetta; Discussion on climate oscillations: CMIP5 general circulation models versus a semi-empirical harmonic model based on astronomical cycles, Earth-Science Reviews, **126**, 321-357 **(2013)**.

[4] N.Scafetta; Solar and planetary oscillation control on climate change: hind-cast, forecast and a comparison with the CMIP5 GCMs, Energy & Environment, **24(3-4)**, 455–496 **(2013)**.

[5] N.Scafetta; Does the Sun work as a nuclear fusion amplifier of planetary tidal forcing?, paper presented At the Space Climate Symposium-5 in Oulu, Finland. people.duke.edu/~ns2002/pdf/Scafetta-Oulu.pdf, 15-19, June **(2013)**.

[6] A.Parker; Why global warming is missed since the year 2000, accepted paper, in Press, **(2013)**.

[7] A.Parker, M.Saad Saleem, M.Lawson; Sea-level trend analysis for coastal management, Ocean and Coastal Management, **73**, 63-81 **(2013)**.

[8] A.Parker; Sea level trends at locations of the United States with more than 100 years of recording, Natural Hazards, **65(1)**, 1011-1021 **(2013)**.

[9] A.Parker; Oscillations of sea level rise along the Atlantic coast of North America north of Cape Hatteras, Natural Hazards, **65(1)**, 991-997 **(2013)**.

[10] T.Watson, A.Parker; Discussion of towards a global regionally varying allowance for sea-levelrise by J.R.Hunter, J.A.Church, N.J.White, X.Zhang [Ocean Engineering, 71(1), 17-27, 10 October (2013),] Ocean Engineering, **72**, 470-472 **(2013)**.

[11] National Oceanic, Atmospheric Administration NOAA; MSL global trend table. tidesandcurrents.noaa.gov/sltrends/MSL_global_trendtable.html, **(2013)**.

[12] Permanent service on Mean Sea Level PSMSL, Sea level data. www.psmsl.org, **(2013)**.

[13] SONEL; GNSS Stations data. www.sonel.org, **(2013)**.

[14] A.Miettinen; Holocene sea-level changes and glacio-isostasy in theGulf of Finland,Baltic Sea, Quaternary International, **120**, 91–104 **(2004)**.

[15] M.Eronen, G.Glu¨ckert, L.Hatakka, O.van de Plassche, J.van der Plicht, P.Rantala; Rates of Holocene isostatic uplift and relative sea-level lowering of the Baltic in SW Finland based on studies of isolation contacts, Boreas, **30**, 17–30 **(2001)**.