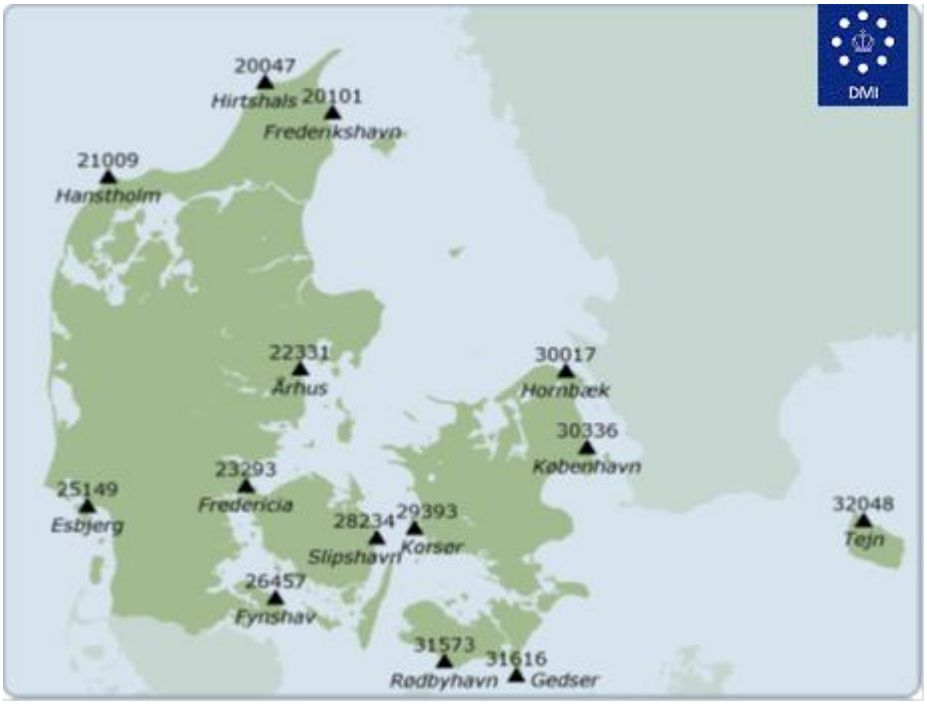
Danish Meteorological Institute

DMI Report 18-16

Sea Level data 1889 – 2017 from 14 stations in Denmark

Mean, maximum and minimum values calculated on monthly and yearly basis including plots of mean values

Lonny Hansen



Copenhagen 2018

Danish Meteorological Institute

Colophon

Serial title
DMI Report 18-16

Title
Sea Level data 1889 – 2017 from 14 stations in Denmark

Subtitle
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Responsible institution
Danish Meteorological Institute

Language
English

Keywords
Sea level data

Url
www.dmi.dk

ISSN
1399-1949 (online)

Version
December 2018

Website
www.dmi.dk

Attached files
month.csv
year.csv

Front page
Map of sea level station

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Content

Abstract

This report present means and maximum and minimum values calculated on a monthly and yearly basis from 14 sea level stations with more than 20 years of data.

This report also presents plots of mean values on a monthly and yearly basis from these 14 sea level stations and each plot include trend/year and summarized trend during the timespan.

Resumé

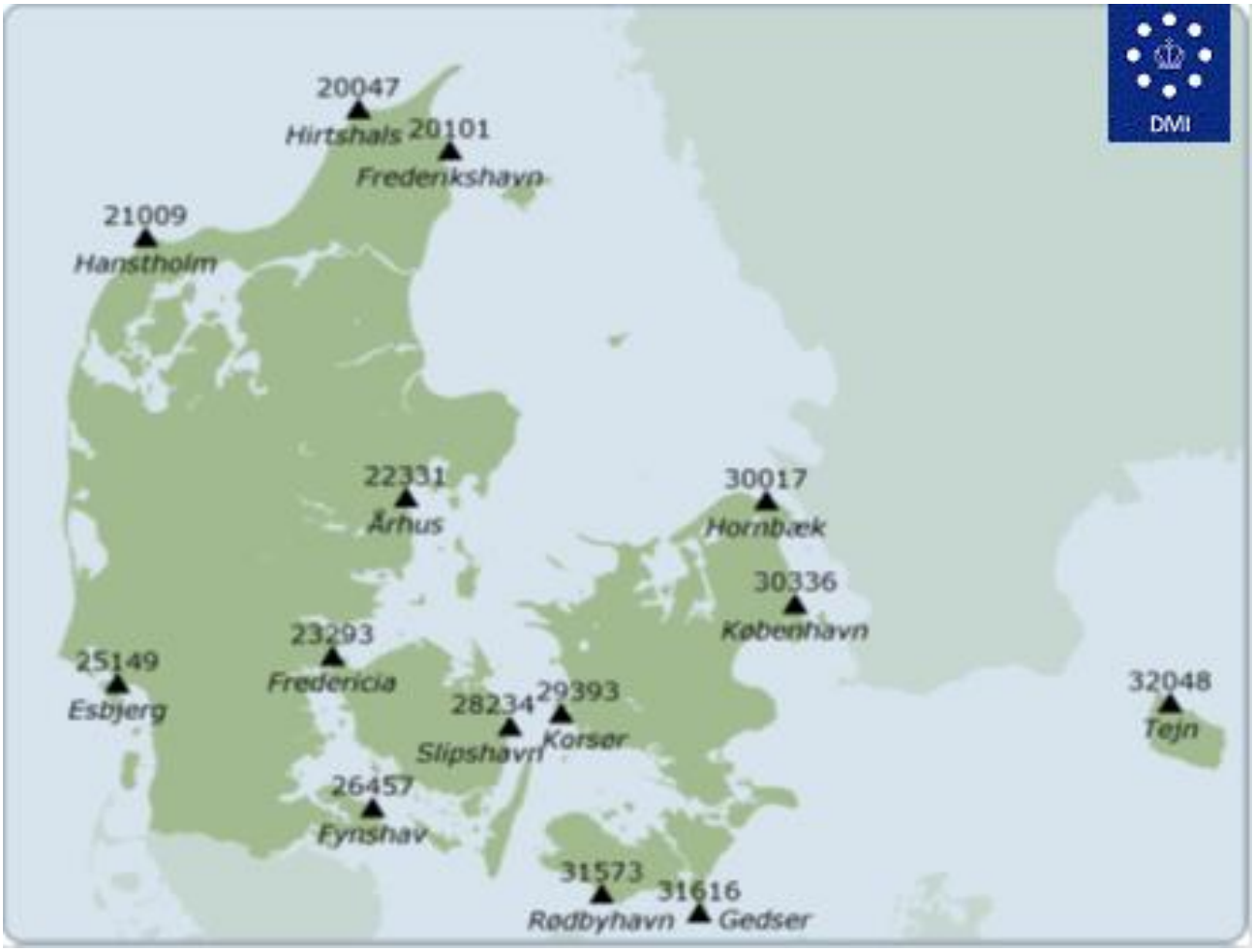
Denne rapport præsenterer middelværdier samt maksimum- og minimums-værdier udregnet på henholdsvis måneds og års basis for 4 vandstandsstationer med mere end 20 års data.

Desuden præsenteres plots af middelværdierne på måneds og års basis fra hver at disse 14 vandstandsstationer og på hvert plot er angivet stigningsgraden pr. år samt den samlede stigning over årene.

Introduction

In the end of the 19.th century DMI established 10 sea level stations scattered along the coast of Denmark. During the 20.th century 5 stations were added and in the 21.st century additional stations were established or transferred from Danish Marine Society Administration, resulting in the present set-up of 33 sea level stations – all fully operational.

Stations with more than 20 years of data are shown in the map below and data from these stations are presented.



Map of sea level stations

Data and plots

Data from Esbjerg, Gedser and Hornbæk are stored in DMI's database from establishments approximately 1890.

Data from all other stations are stored in DMI's database from approximately 1970 or from establishment. Fortunately files with mean, maximum and minimum values on a monthly and yearly basis up till approximately 1970 have been maintained, but with no explanation at all and especially with no indication regarding number of observation used for calculations or eliminations.

Until approximately 1970 data were collected on an hourly basis – with timestamp 00:00, 01:00, 02:00 ..... 23:00. Since then data has been collected every 15 minute and later on every 10 minute but for the sake of homogeneity only data with hourly timestamp are used.

Datum
All data are converted to datum = LN, where LN is local zero, which is the originally established mean sea level (MSL) for each station.

Conversion from LN to DVR (Danish Vertical Reference) is outlined for each station.

Data processing
Data are converted to datum with no further processing. No corrections are made due changes in meteorology, oceanography, geology/geodesy and climatology on local, regional or global scale, potential anthropogenic effects on local scale and maybe more important changes in instruments and/or measurement methods, position, harbor construction etc. etc.

Mean is calculated as simple average (arithmetic mean).
Maximum is largest value.
Minimum is smallest value.
Number of observations is the number of observations used for calculations of mean, maximum and minimum.

Units
All measures of the sea level are in cm. and therefore data are presented in cm.

Meta data
Positions as latitude and longitude in ED50 and as coordinates in UTM ED50 are outlined for each station

Presentation
Means with more than 90 % data (number of observations – if available) are plotted on monthly and yearly basis, respectively. Trend/year and summarized trend during the timespan is calculated and included in each plot.

Issues found in the former report and corresponding data
This report is a sequel to and update of former report published on www.dmi.dk:

No. 13-15
Lonny Hansen
Sea level data 1889-2012 from 14 stations in Denmark
Mean, maximum and minimum values calculated on monthly and yearly basis including plots of mean values

Errors found in data and plots in this report have been addressed and revised, if possible: If not, they are described below.

Data 1889++ - high water. Until approximately 1970 registrations of sea level were continuous drawn on paper (wide sheet on a roll), and later read and written manually on datasheets with hourly value. These datasheets reveals gaps in data seen mainly at high water. These gaps might be due to the fact, that the paper had insufficient width. Unfortunately all rolls of paper with original registrations are lost and therefore no further investigation is possible.

Rødbyhavn: Data 1980 - 1985 has been revised due to erroneous values

All stations. Data 2010 - 2012 has been revised due to few erroneous values and new updated levellings.

Esbjerg. Extreme low mean value February 1947. Relevant datasheet has been revisited but there is no indication of errors in these data. Associated roll of paper is lost – see above.

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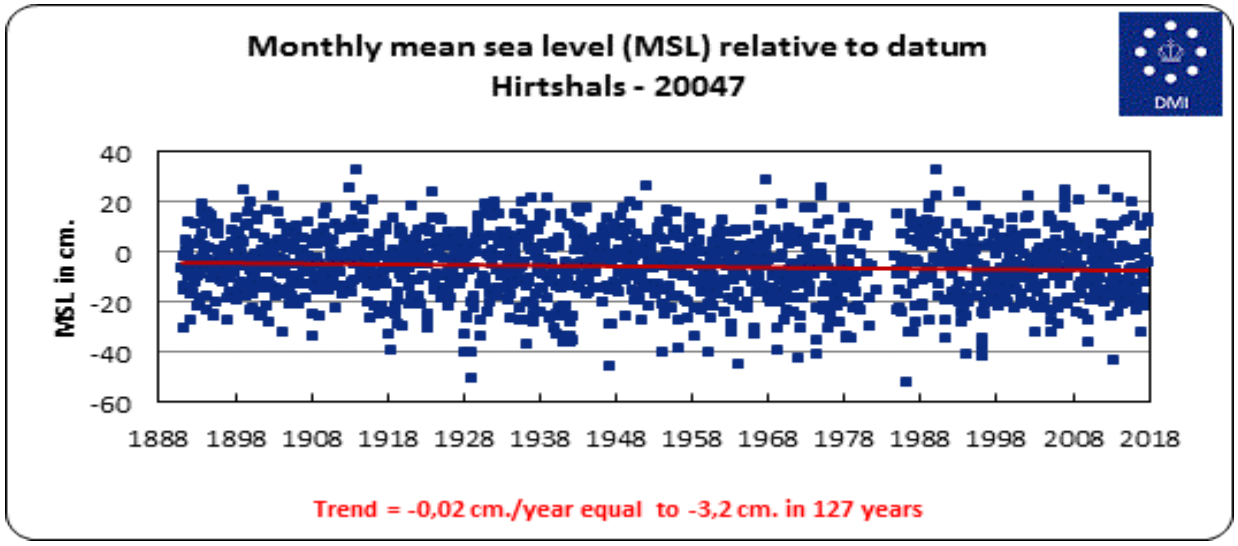
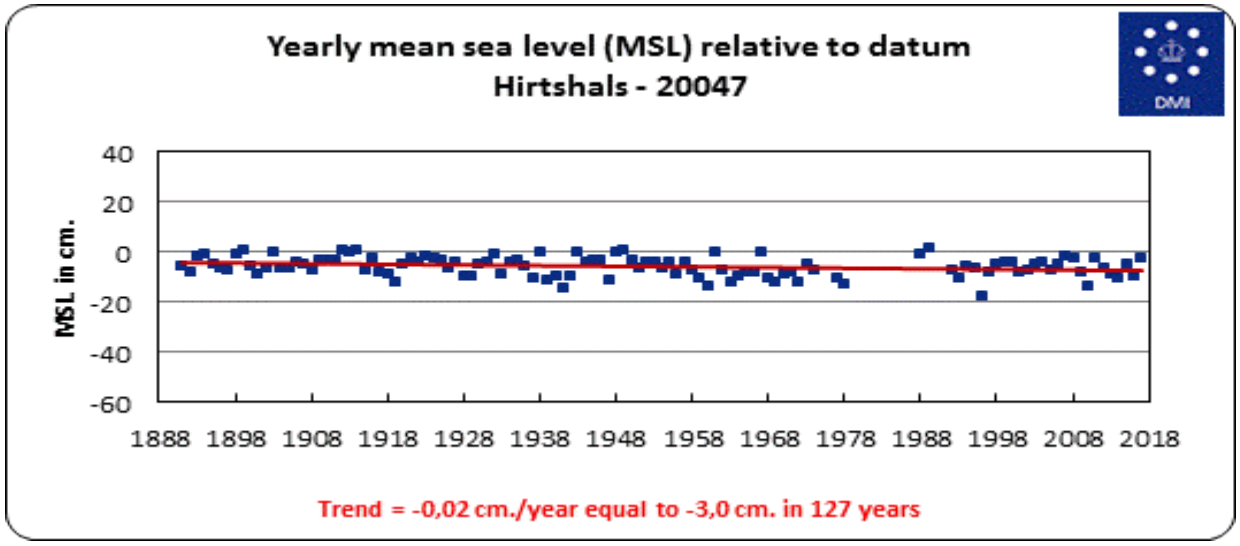
Hirtshals – 20047

Position	WGS84		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1891	57° 35,6'	9° 57,5'	32V	6384044	557410
18-12-1952	57° 35,7'	9° 57,8'	32V	6384248	557615



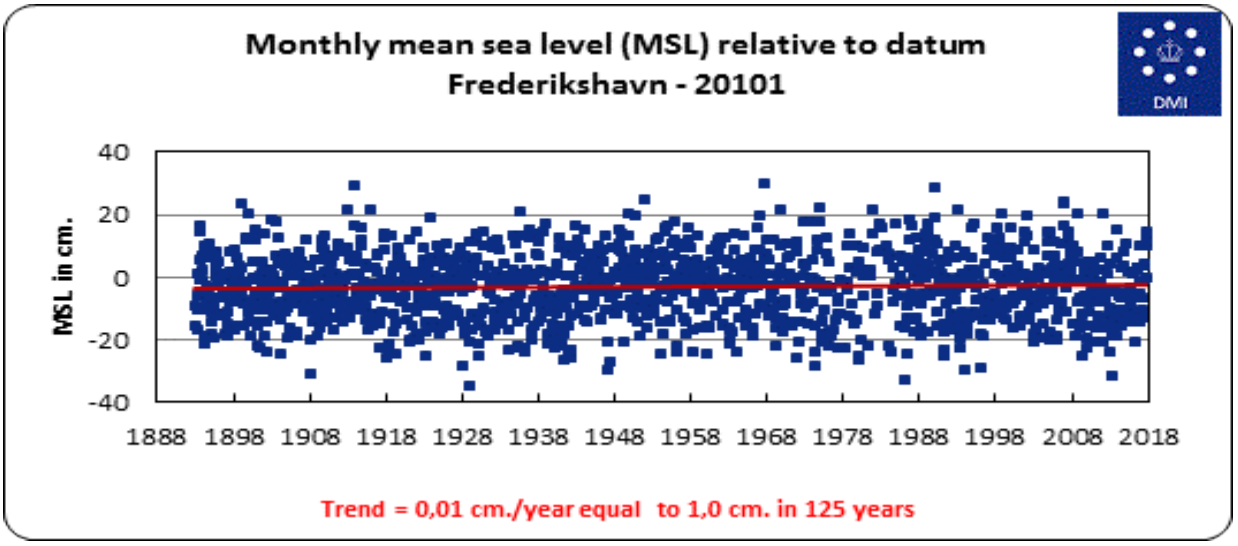


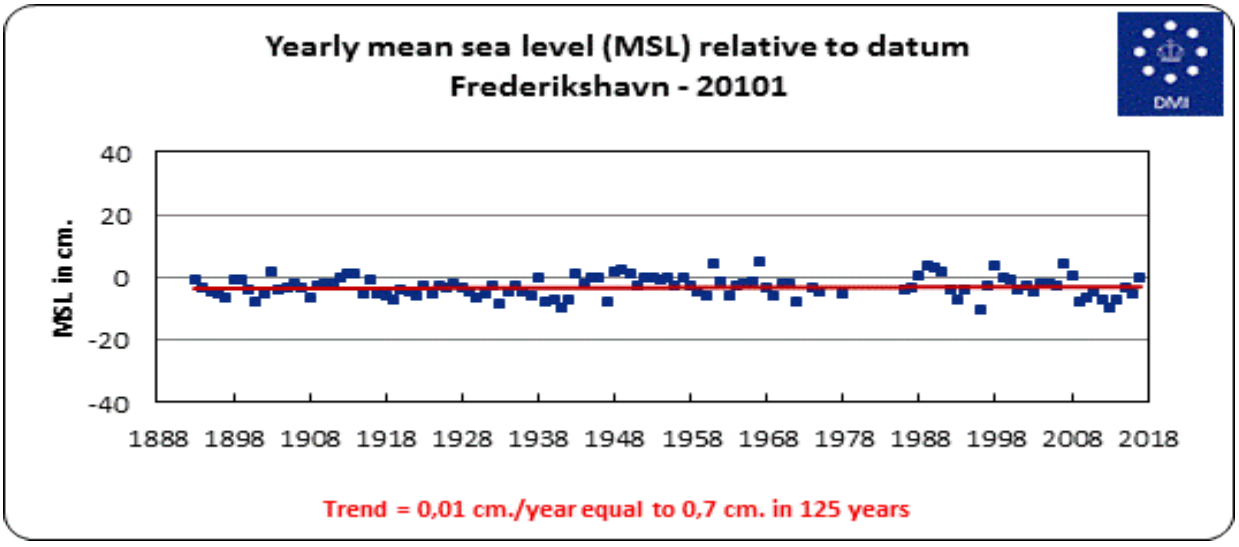
Datum	DVR - LN
Offset in cm.	-1

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

Frederikshavn – 20101

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1893	57° 26,0'	10° 33,2'	32V	6366897	593309
13-06-1957	57° 26,1'	10° 32,6'	32V	6367071	592776
14-01-1970	57° 26,1'	10° 32,7'	32V	6367088	592839
02-12-1977	57° 26,2'	10° 33,1'	32V	6367233	593250
01-10-1987	57° 26,2'	10° 32,9'	32V	6367168	592985
25-03-2014	57° 26,1	10° 32,9'	32V	6367157	593004





Datum	DVR - LN
Offset in cm.	-3

LN is local zero, which is the originally established mean sea level (MSL) for the station
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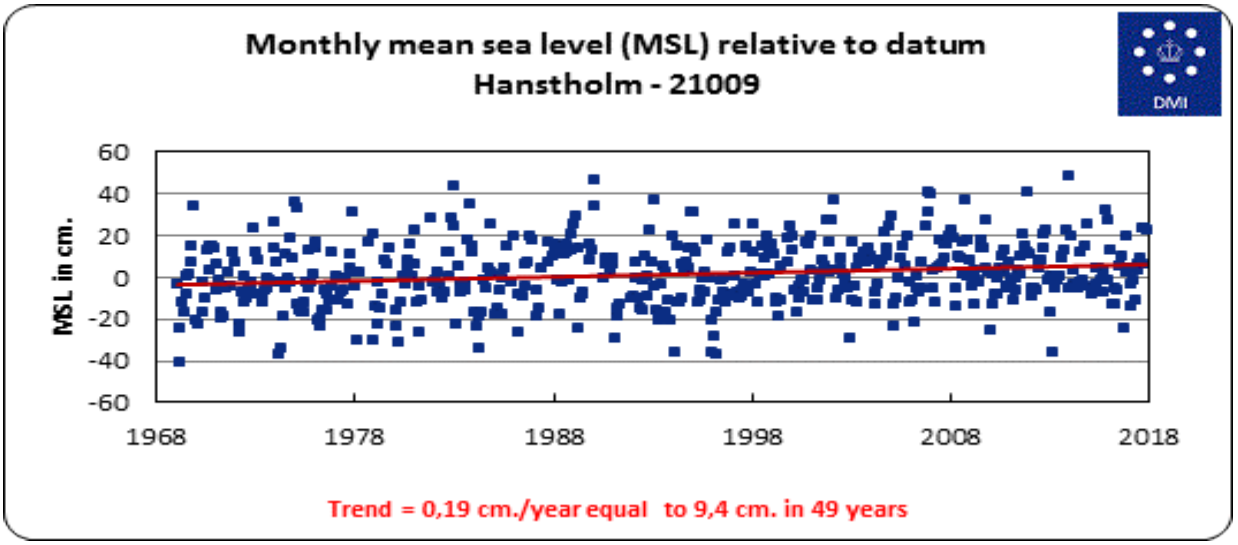
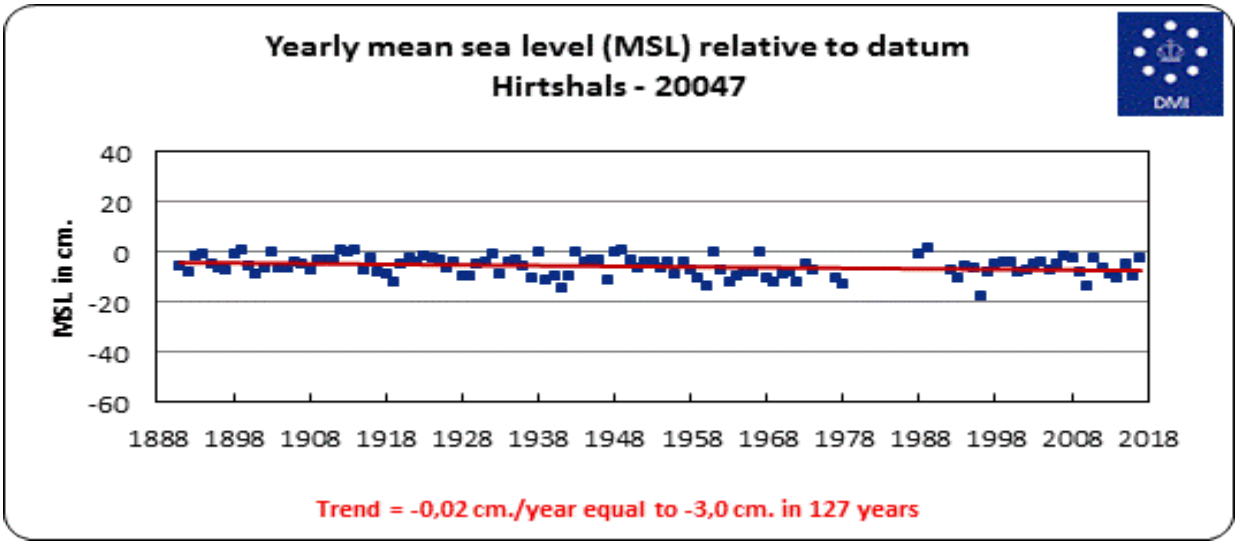
Hanstholm – 20047

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1969	57° 7,3'	8° 36,1'	32V	6331200	475950
21-09-1989	57° 7,1'	8° 35,7'	32V	6330824	475514
02-06-2014	57° 7,2'	8° 35,7'	32V	6331028	475587





Datum	DVR - LN
Offset in cm.	-4

LN is local zero, which is the originally established mean sea level (MSL) for the station
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Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

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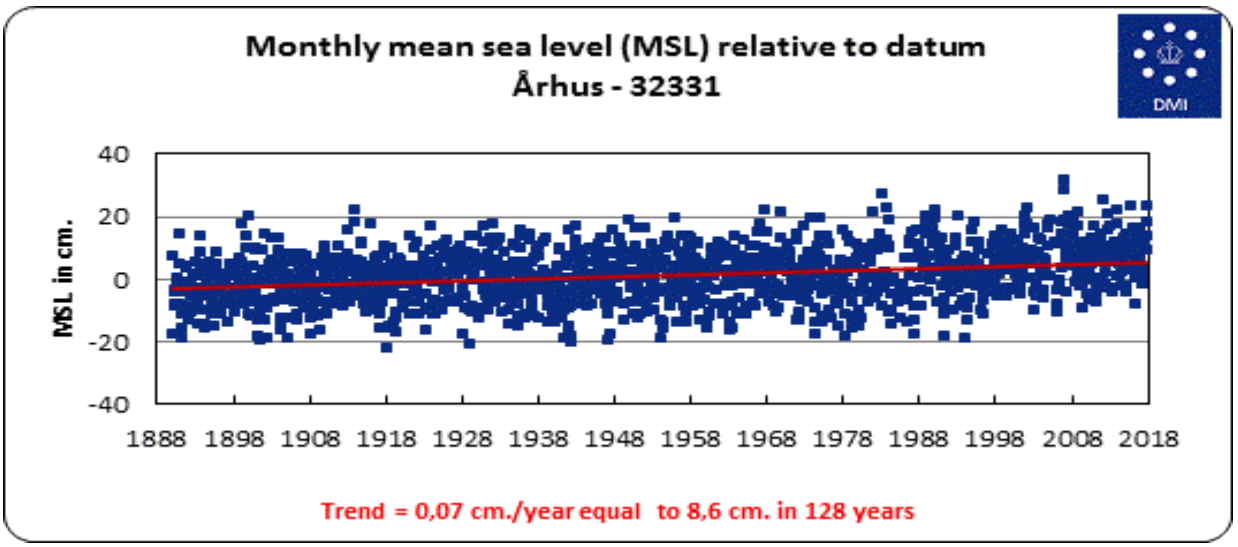
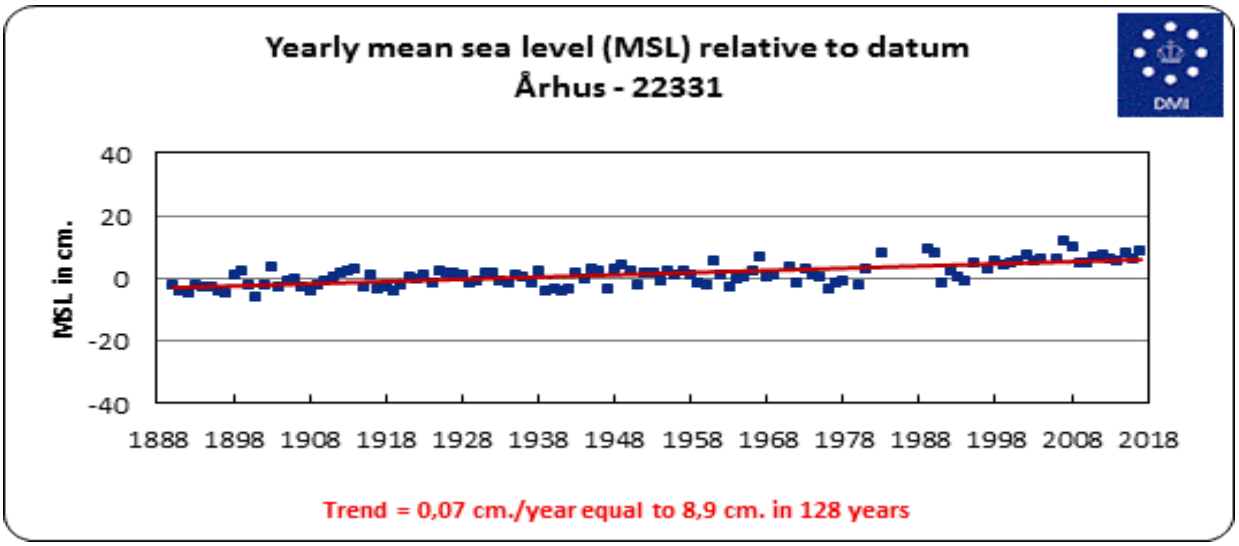
Århus – 22331

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1890	56° 9,5'	10° 13'	32V	6224532	575678
16-06-1938	56° 10,2'	10° 13,4'	32V	6225799	576057
08-07-1992	56° 8,8'	10° 13,4'	32V	6223284	576039



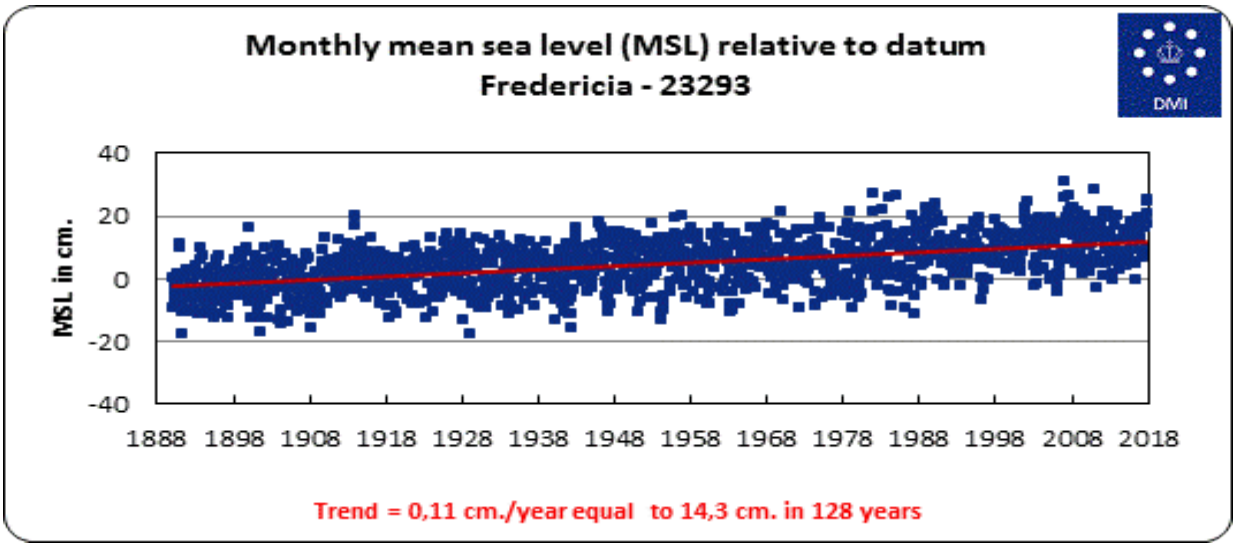


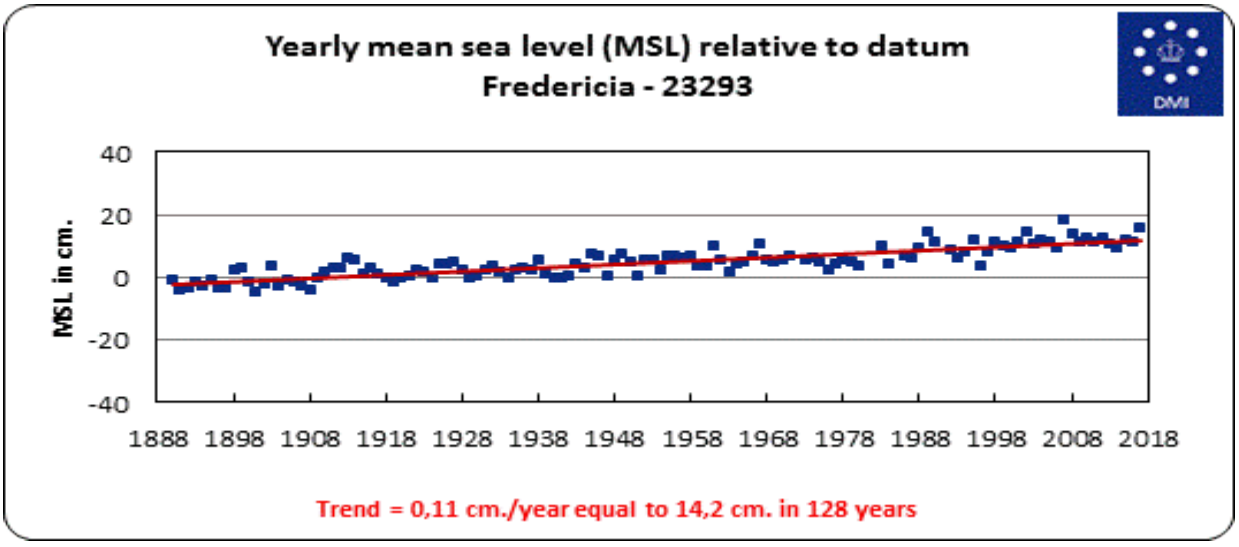
Datum	DVR - LN
Offset in cm.	-3

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

Fredericia – 23293

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1890	55° 33,6'	9° 45,2'	32U	6157593	547587
14-08-2014	55° 33,6'	9° 45,2'	32U	6157518	547579





Datum	DVR - LN
Offset in cm.	-9

LN is local zero, which is the originally established mean sea level (MSL) for the station
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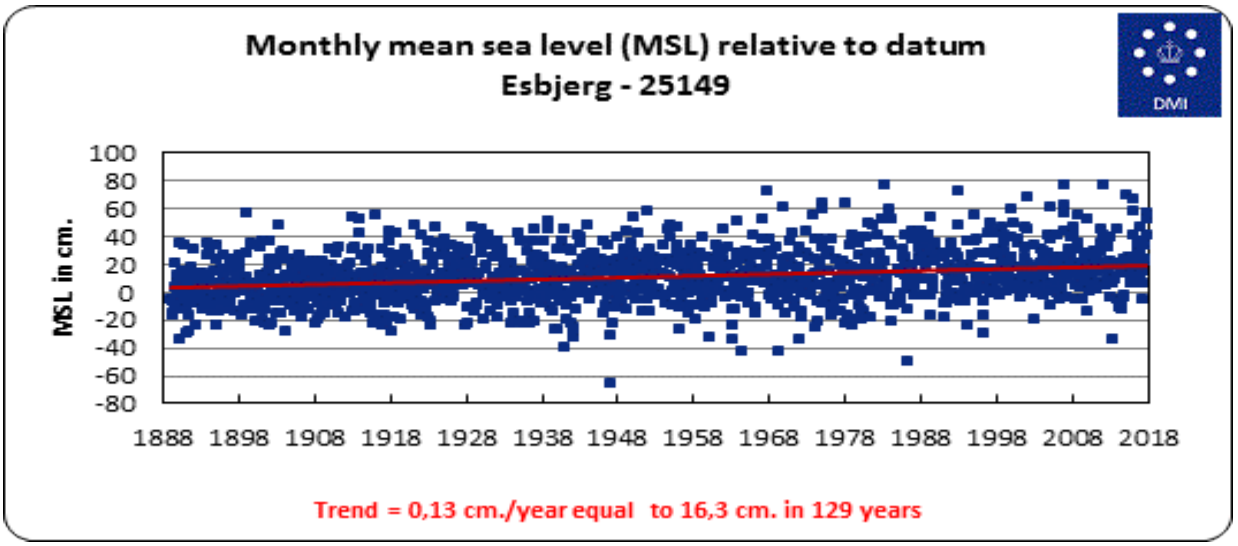
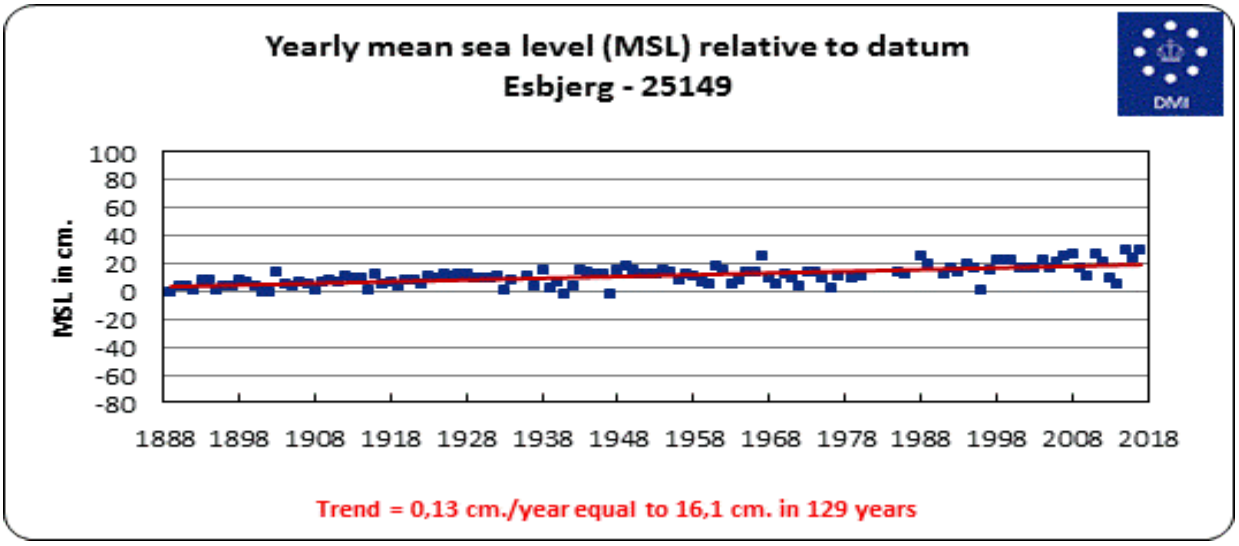
Esbjerg – 25149

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1889	55° 27,6'	8° 26,4'	32U	6146350	464650





Datum	DVR - LN
Offset in cm.	-11

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

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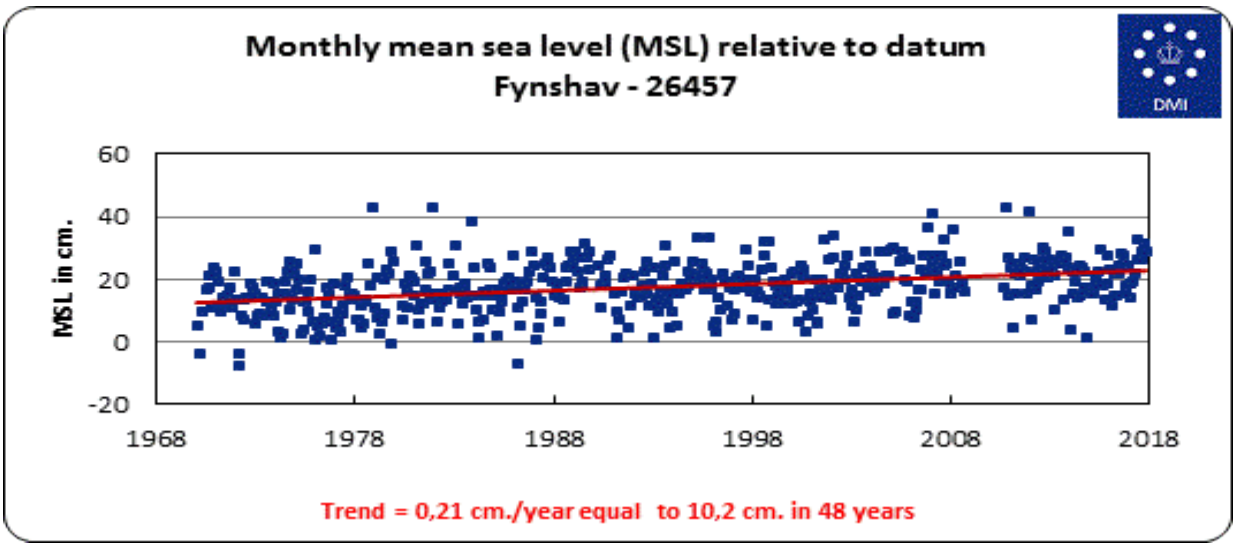
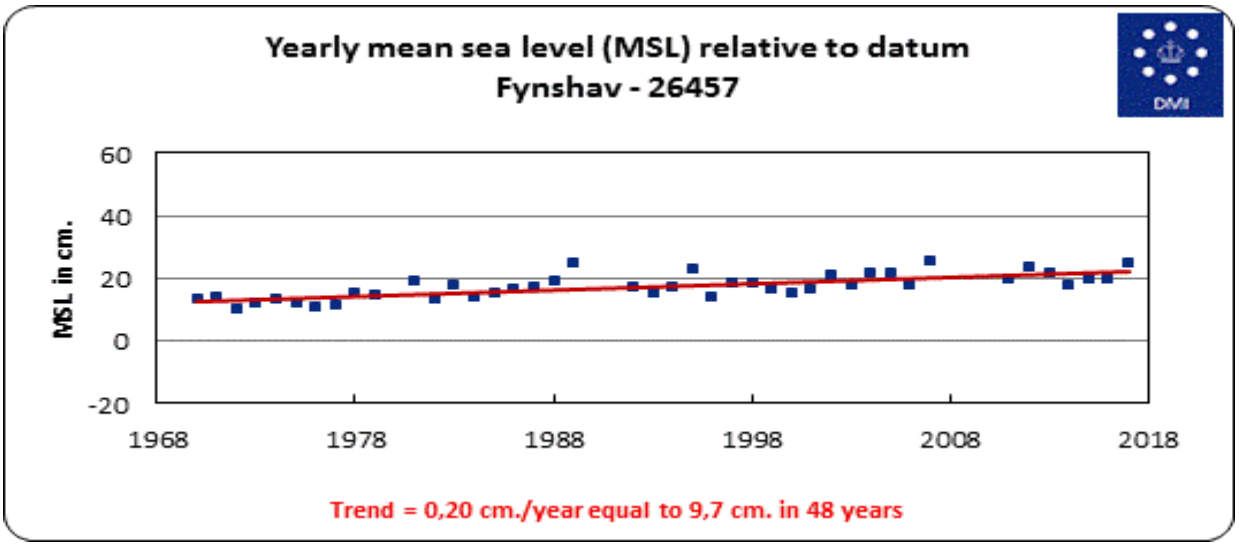
Fynshav – 26457

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1970	54° 59,7'	9° 59,1'	32U	6094855	563096
29-10-1991	54° 59,7'	9° 59,1'	32U	6094848	563106
29-09-2010	54° 59,7'	9° 59,1'	32U	6094818	563138





Datum	DVR - LN
Offset in cm.	-17

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

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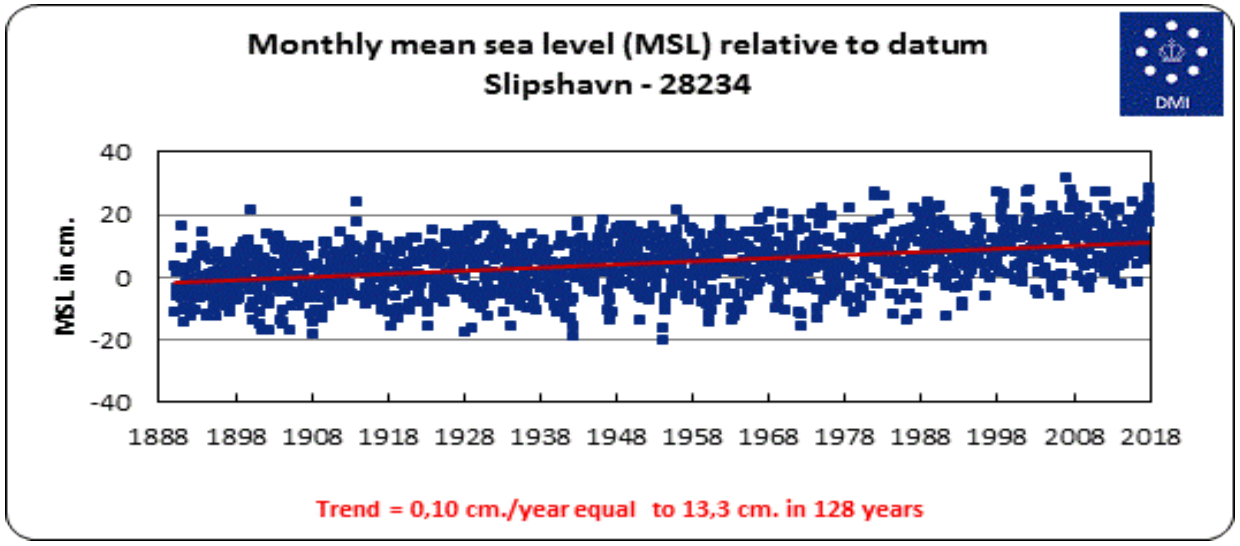
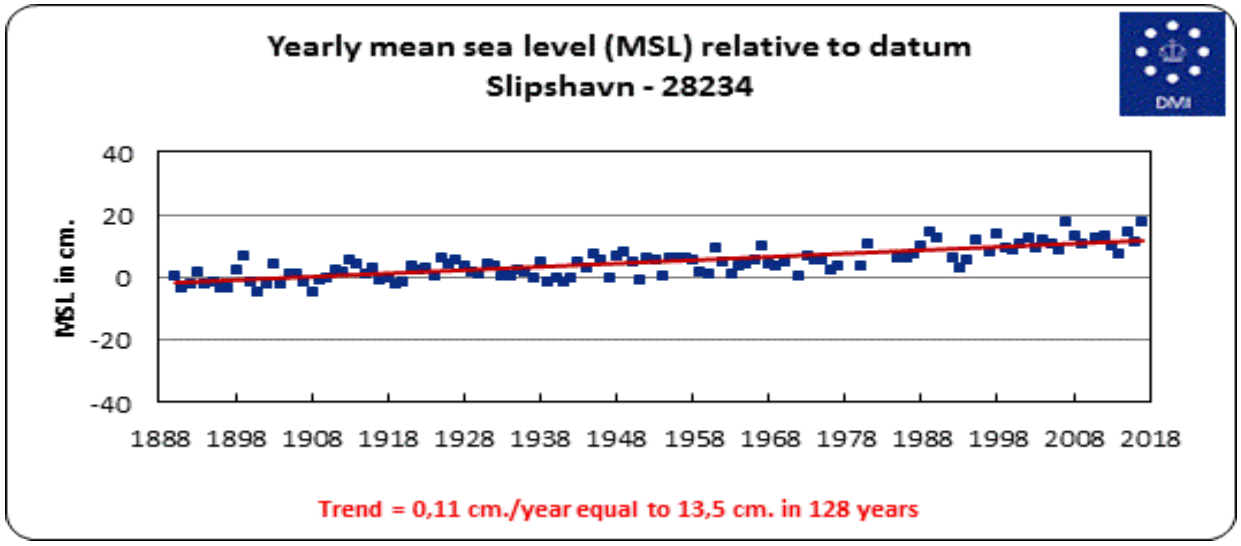
Slipshavn – 28234

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1890	55° 17,3'	10° 49,6'	32U	6128565	616095
18-11-1996	55° 17,3'	10° 49,6'	32U	6128547	616070



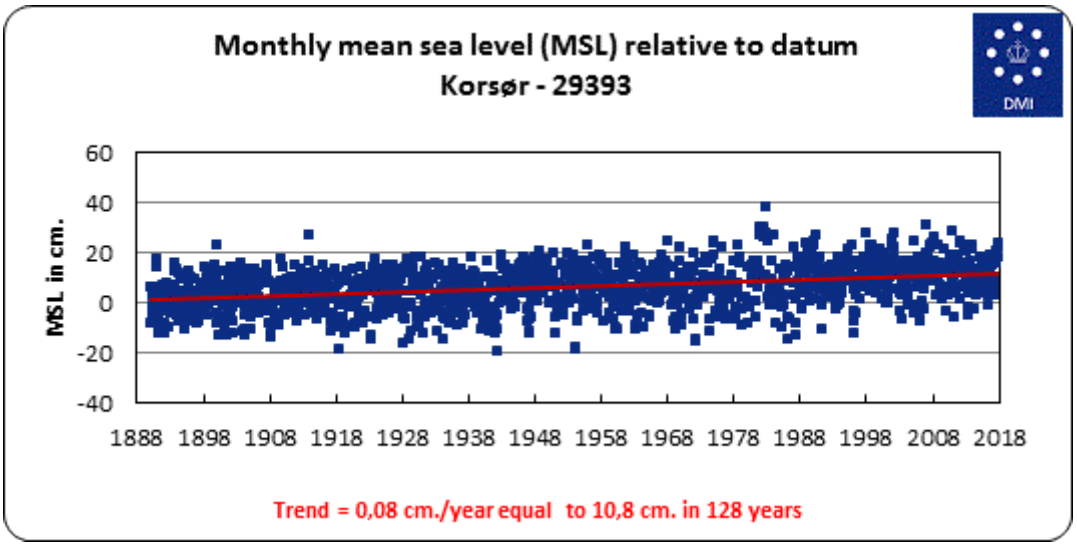


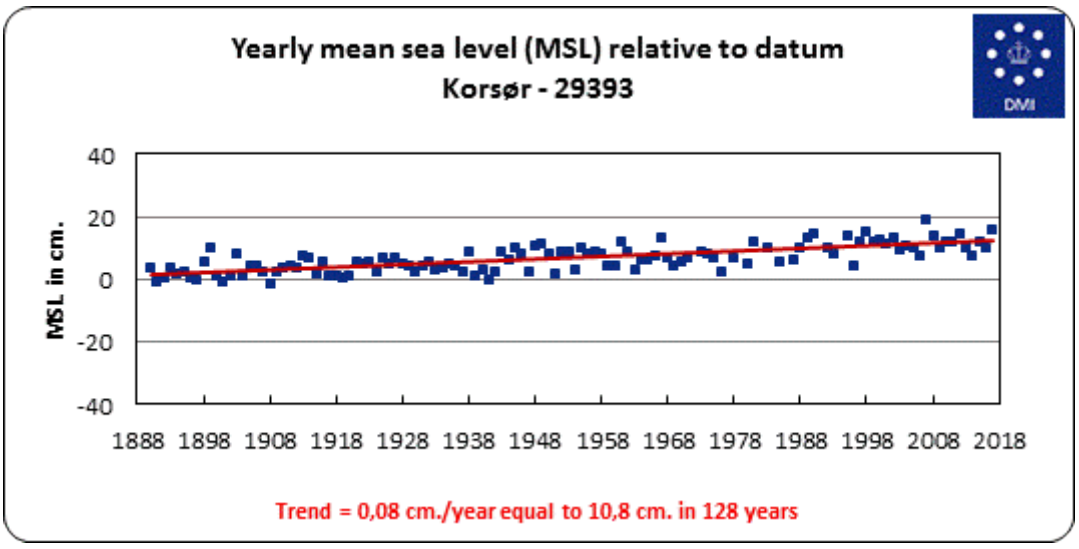
Datum	DVR - LN
Offset in cm.	-7

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

Korsør – 29393

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1890	55° 19,8'	11° 8,6'	32U	6133865	636005
01-08-1924	55° 20,1'	11° 8,3'	32U	6134412	635754
16-10-1991	55° 20,1'	11° 8,3'	32U	6134411	635755
12-10-2000	55° 19,9'	11° 8,5'	32U	6133974	635890
13-05-2014	55° 19,8'	11° 8,5'	32U	6133883	635977



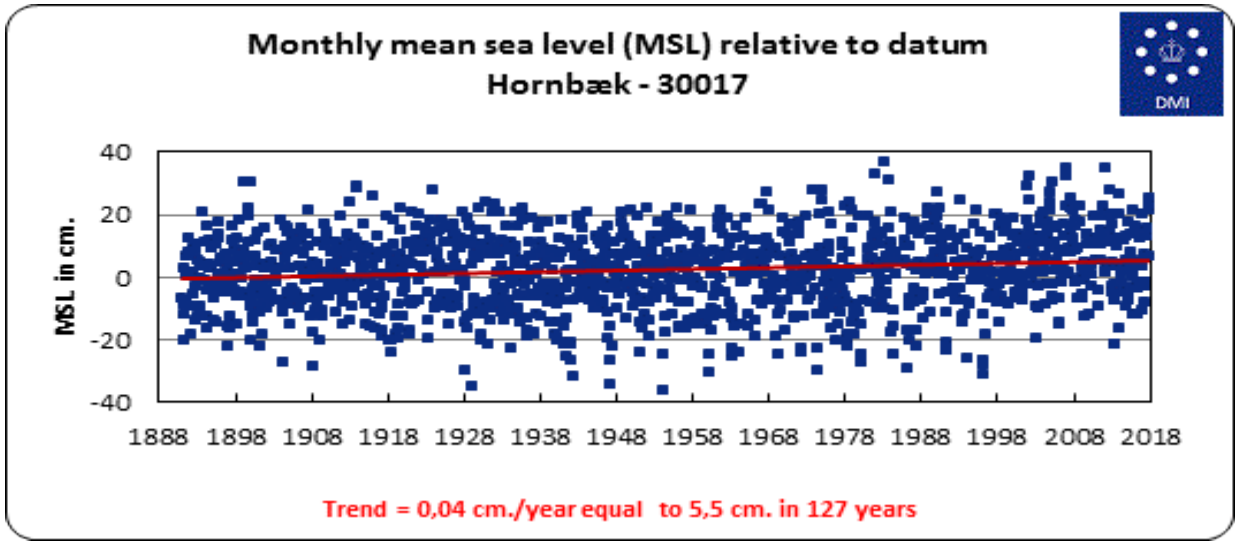


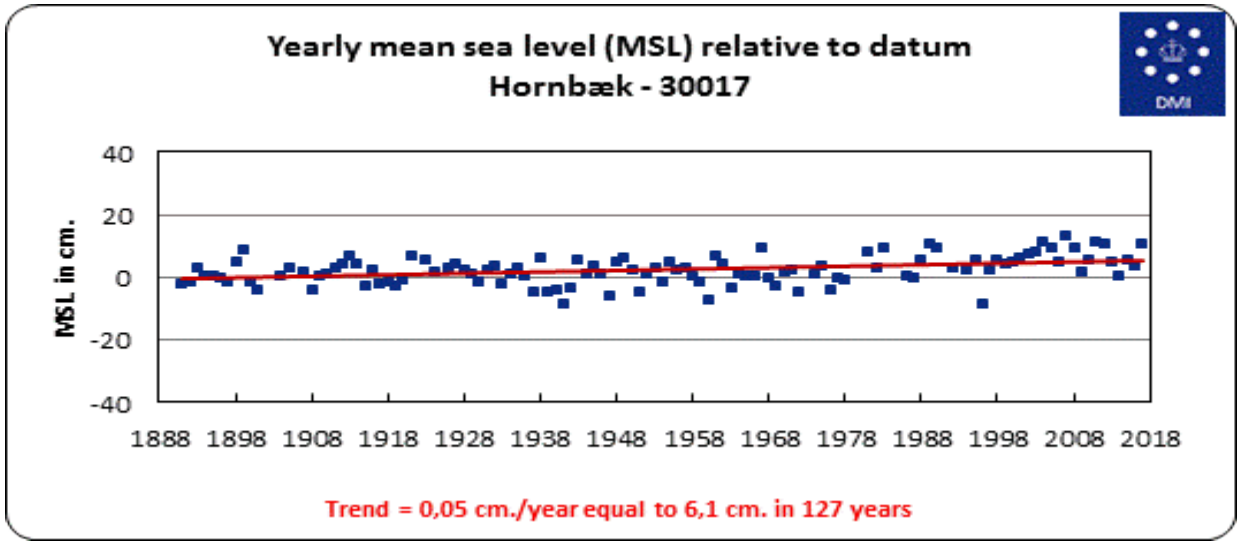
Datum	DVR - LN
Offset in cm.	-6

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

Hornbæk – 30017

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1891	56° 5,6'	12° 27,4'	33V	6219602	341894
24-04-1959	56° 5,6'	12° 27,4'	33V	6219588	341879



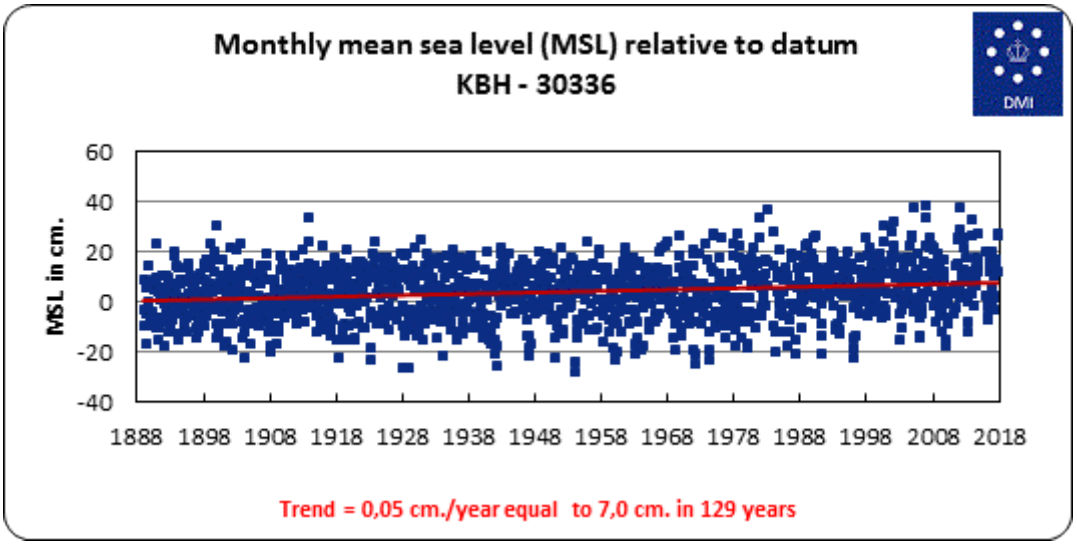


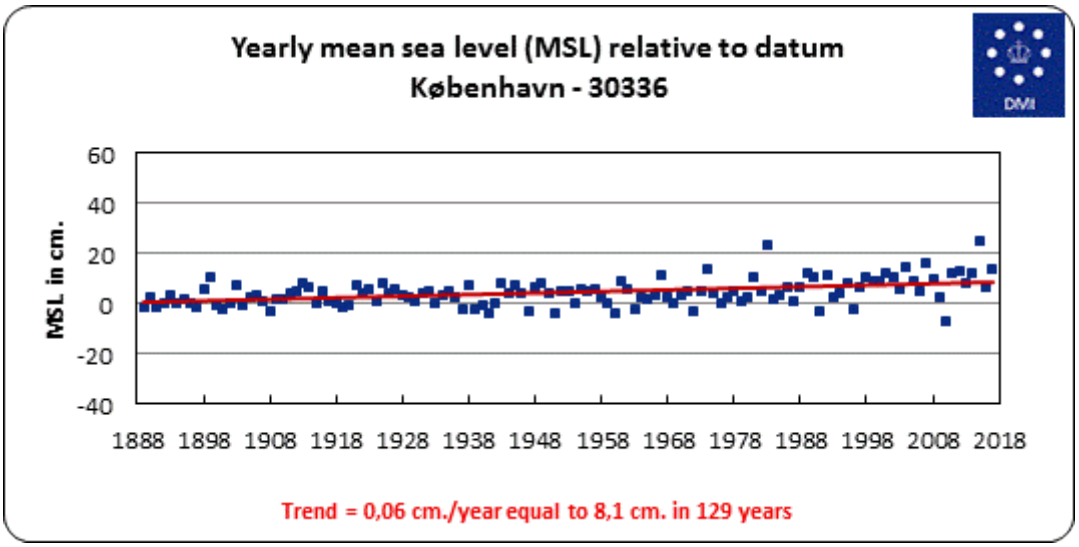
Datum	DVR - LN
Offset in cm.	-2

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

København – 30336

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1989	55° 41,4'	12° 36'	33U	6174345	349160
01-01-1985	55° 41,4'	12° 36'	33U	6174327	349154
24-06-1999	55° 42,3'	12° 35,9'	33U	6175974	349185
06-04-2001	55° 42,3'	12° 35,9'	33U	6175994	349197
19-01-2011	55° 42,3'	12° 35,9'	33U	6175981	349194





Datum	DVR - LN
Offset in cm.	0

LN is local zero, which is the originally established mean sea level (MSL) for the station
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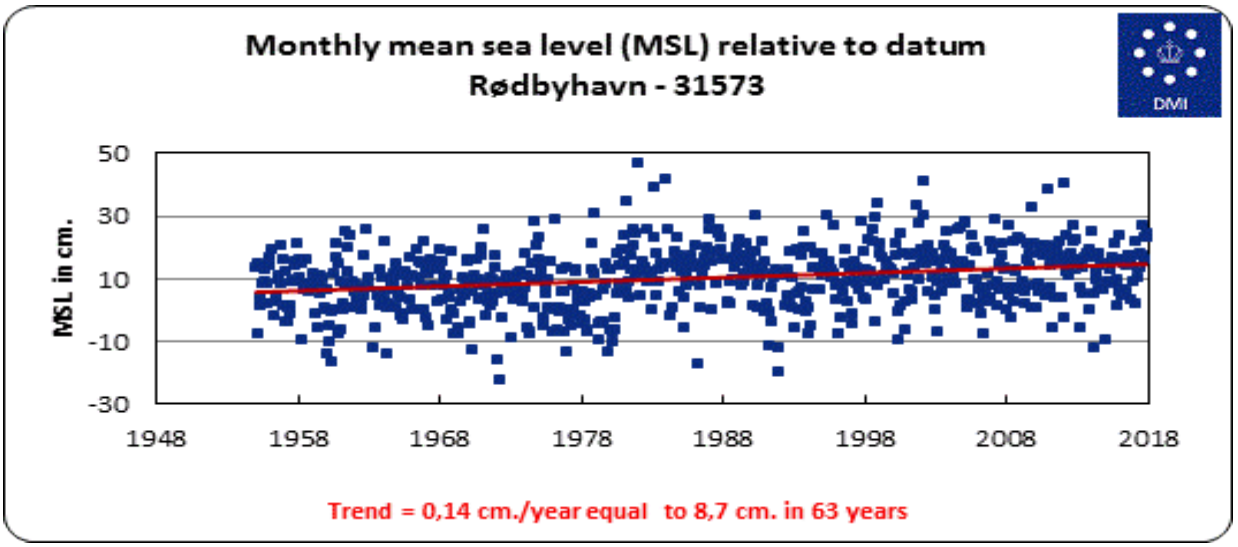
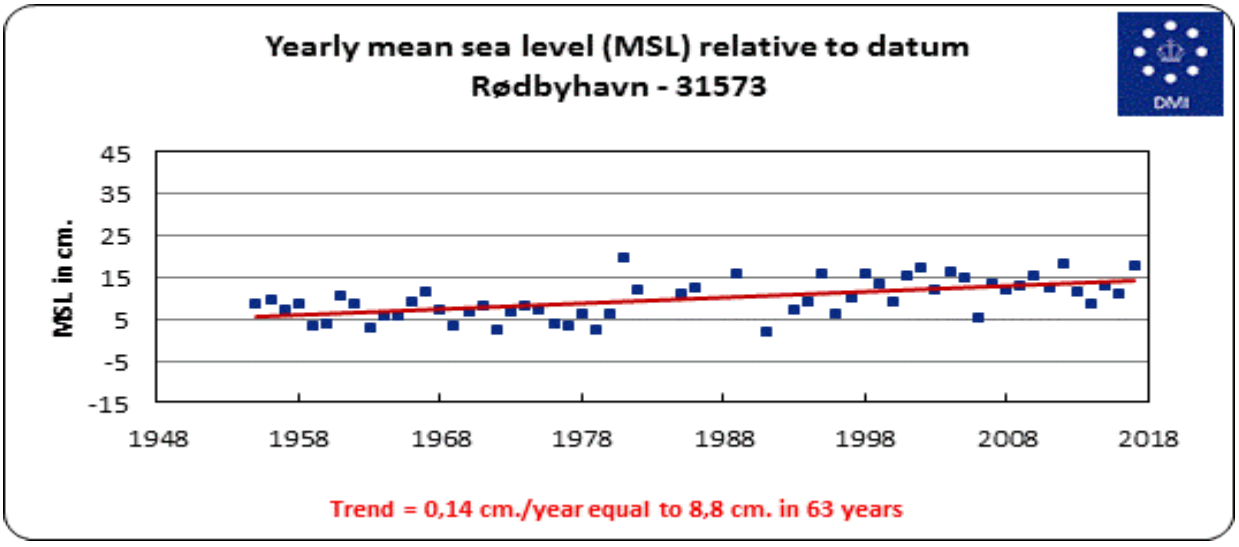
Rødbyhavn – 31573

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1955	54° 39,3'	11° 20,8'	32U	6059150	651510
39-04-2014	54° 39,4'	11° 20,8'	32U	6059262	651514





Datum	DVR - LN
Offset in cm.	-6

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

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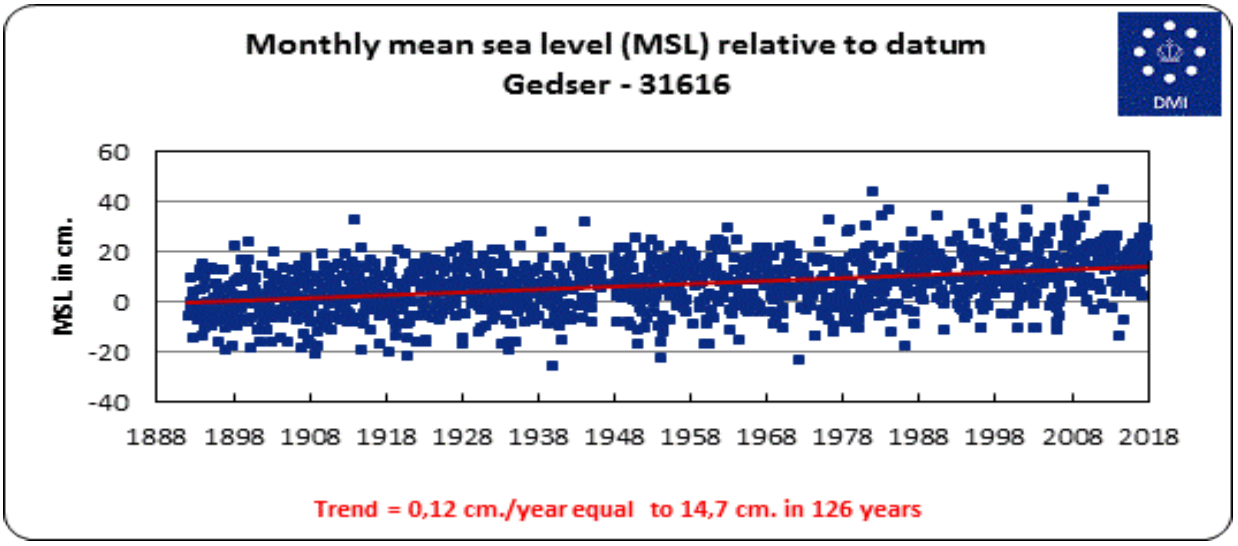
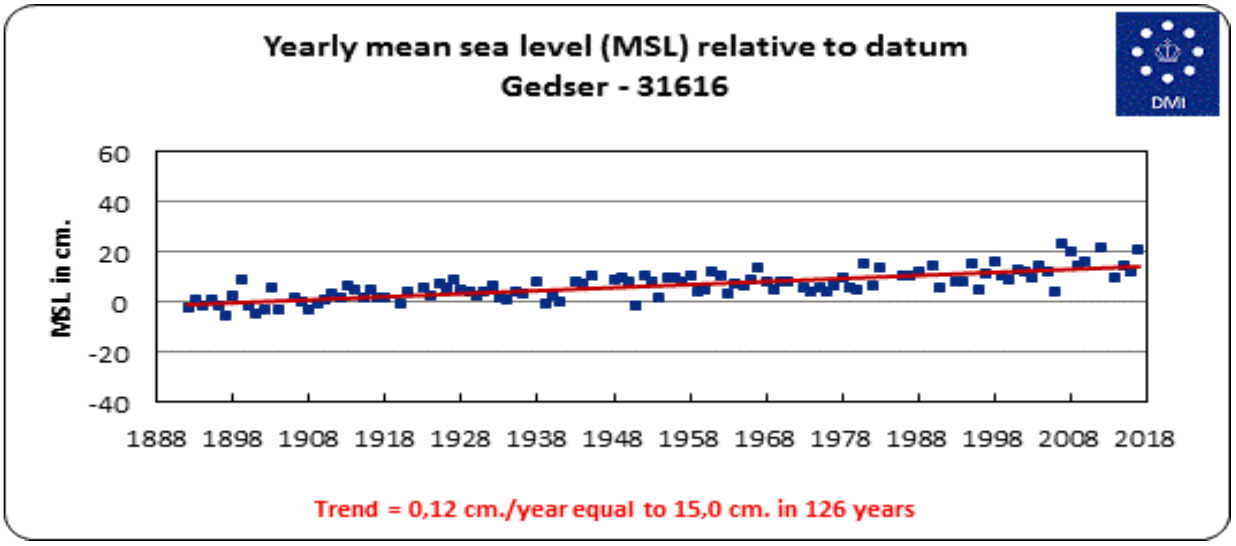
Gedser – 31616

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1892	54° 34,3'	11° 55,4'	32U	6051340	689090
23-11-2001	54° 34,3'	11° 55,5'	32U	6051317	689115





Datum	DVR - LN
Offset in cm.	-5

LN is local zero, which is the originally established mean sea level (MSL) for the station
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Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

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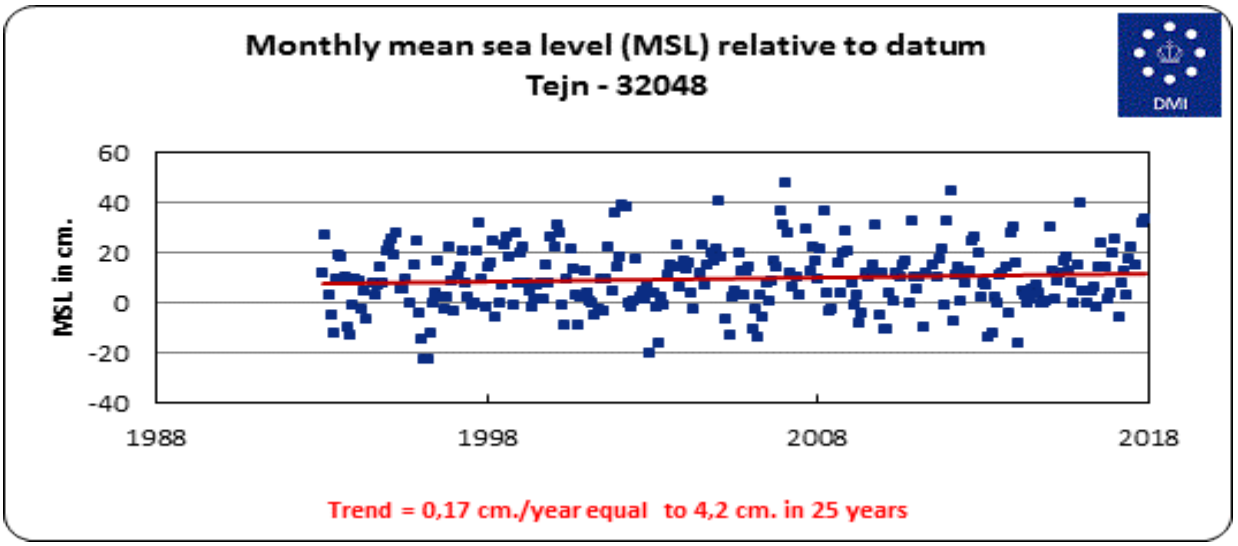
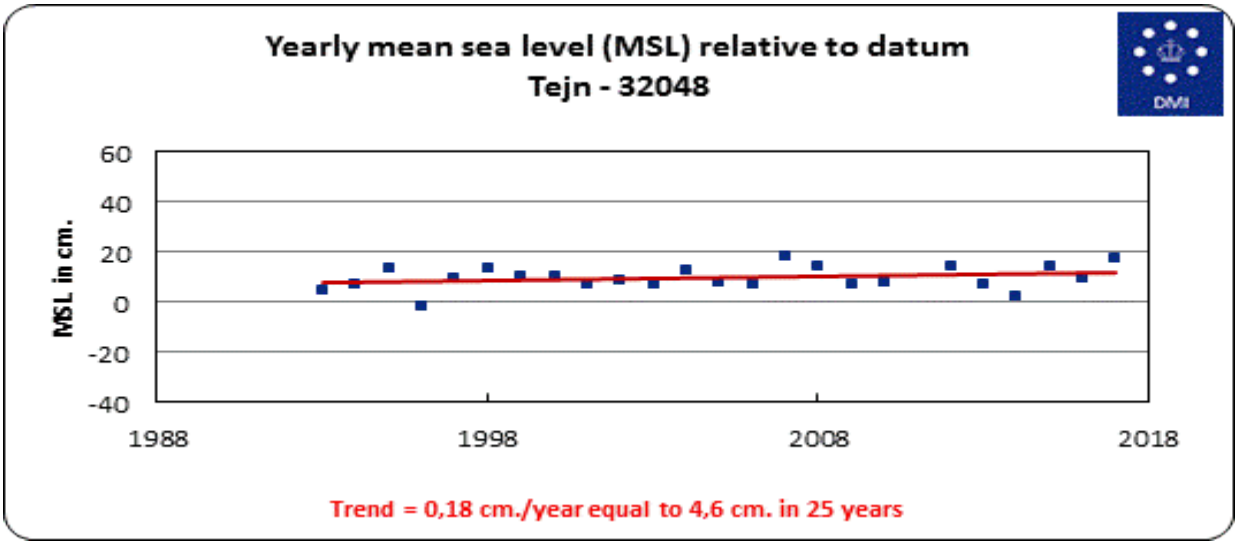
Tejn – 32048

Position	ED50		UTM (m) – ED50		
From	Latitude	Longitude	Zone	Northing	Easting
01-01-1993	55° 14,9'	14° 50,2'	33U	6122711	489692





Datum	DVR - LN
Offset in cm.	-8

LN is local zero, which is the originally established mean sea level (MSL) for the station
DVR is Danish Vertical Reference
Conversion from sea level (LN) to sea level (DVR): sea level (DVR) = sea level (LN) + offset

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Attached files

Attached files are named month.csv and year.csv. The files are semicolon-separated with header-information in line 1 to 3 and data from line 4 and onwards as described below.

month.csv		Column									
		1	2	3	4	5	6	7	8	.....	98
Header	Line 1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station2	.....	Name of station14
	Line 2	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station2	.....	DMI number of station14
	Line 3	Year	Month	Mean	Maximum	Minimum	NOO	Mean for plot	Year	.....	Mean for plot
Data	Line 4									.....	
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Line 1551									.....	

year.csv		Column							.....	84
		1	2	3	4	5	6	7		
Header	Line 1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station1	Name of station2	.....	Name of station14
	Line 2	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station1	DMI number of station2	.....	DMI number of station14
	Line 3	Year	Mean	Maximum	Minimum	NOO	Mean for plot	Year	.....	Mean for plot
Data	Line 4								.....	
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Line 132								.....	

“NOO” is number of observations for actual month and year, respectively.
“Mean for plot” is average calculated only if number of observations >= 90 %
Missing values indicate no data.

Danish Meteorological Institute

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