The Nansen Environmental and Remote Sensing Center

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to
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FISHERY EARTH OBSERVATION, MODELING AND PREDICTION (FJOMP)

DATA ANALYSIS REPORT

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CORRELATIONS BETWEEN FISHERY TIME SERIES, MODEL DATA AND SATELLITE DERIVED PHYSICAL DATA

by

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REPORT

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Contents

Chapter 1

Introduction

This is the first step in analysing the data in the FJOMP data base. A simple correlation analysis is carried out between the physical data and the biological data in the database. The main purpose of this first step analysis is to find interesting correlations between the variables, and to help desiding where to carry out a more thorough analysis. The analysis is run for every Januar, May and October month. A timelag is introduced in order to check for environmental effects on the biology after a specified timelag. The timelag used in the analysis is from 0 to 3 years.

1.1 Statistics

The correlation between the biological variable and the physical variable is calculated for every gridcell in the physical varaiable (i.e. everery gridcell represents one timeserie). The correlation coefficient r is given in equation 1.1.

$$r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}} = \frac{\sum_i (x_i - \hat{x}) \cdot (y_i - \hat{y})}{\sqrt{\sum_i (y_i - \hat{y})^2 \cdot \sum_i (x_i - \hat{x})^2}} \tag{1.1}$$

1.2 How to read the report

The results from the analysis is automatically written the report. Depending on the correlation coefficient these results are plotted to a figure and /or written to a table. In order to spare the reader for reading through the whole report, references to the best correlations are given in chapter 2.

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	Physical variable	Biological variable
0.668	-0.491	0.117	0.269	0 Years	Jan82 Jan98	1982 1998
0.782	-0.498	0.231	0.269	1 Years	Jan82 Jan97	1983 1998

Table 1.1: Example of a table. *Max Corr* is the best positive correlation between the timeserie from the biological variable and the timeseries from all the gridcells (2D) in the physical variable (2D). If the variable is 1D, *Max Corr* gives the best positive correlation beteween the sub variables in the physical variable. *Min Corr* is the best negative correlation, equivalent to *max corr*. *Mean Corr* is the average correlation coefficient. *Std Corr* is the variance in the correlation coefficients. *Timelag* is difference in time betwen the physical variable and the biological variable. The physical parameter may not have influence on the biology instantly. A timelag is therefore introduced to study these effects. *Physical variable* is the time interval used for the physical parameter. *Biological variable* is the time interval used for the biological parameter.

Tables

The tables contain basic information about the correlation between the physical variable and the biological variable. Table 1.2 gives an example. The tables are written to the report if $max(r) > 0.8$.

Figures

If the physical variable is 1D, the figures show the timeserie of the biological variable against the timeserie of the subvariables in the physical variable. If the physical variable is 2D, the figures show the two dimansional correlation plot between the physical variable and the biological variable. The NAO index and iceindexes are also shown. Figure 1.2 gives an example of a 2D correlation plot.The figure is written to the report if $max(r) > 0.8$.

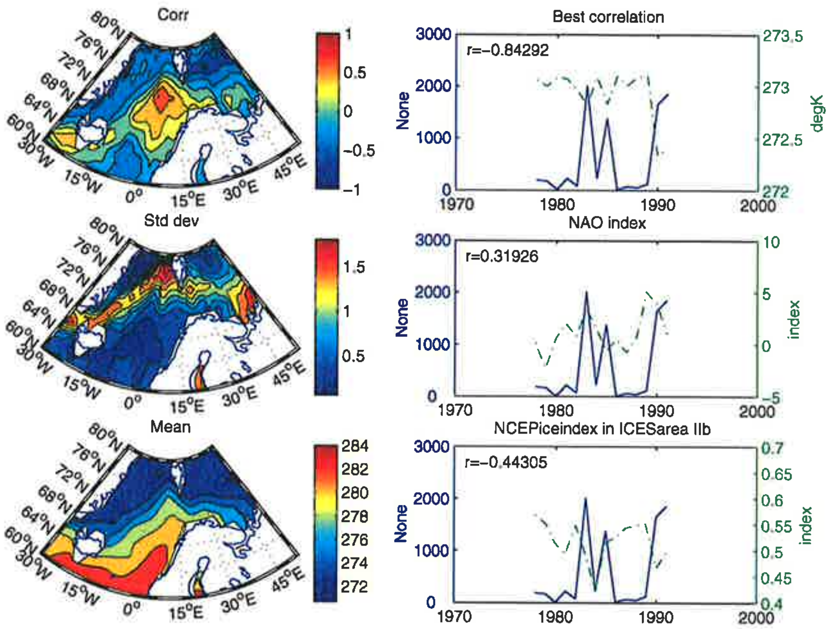

Figure 1.1: *Corr* shows the correlation coefficient in all the gridcells analyzed. *Std dev* shows the standard deviation of the physical variable for the specified month and in the specified timeinterval. *Mean* shows the mean of the physical variable for the specified month and in the specified timeinterval. *Best Correlation* shows the biological variable plotted against the physical variable in the gridcell with best correlation. *NAO index* shows the biological variable plotted against the NAO index. r is the correlation index between the NAO index and the biological variable. *NCEPiceindex* shows the biological variable plotted against the NCEP iceindex in IIb. r is the correlation index between the NCEP iceindex and the biological variable.

Chapter 2

Best Correlations

2.1 Best 1D Correlations

No.	Corr	Variables	Ref.
1	0.857	iceindex MonArciceindex TOTAL North East Artic Cod Early juvenile index	Figur 3.2
2	0.82	NAO NAOWinterStLi North East Artic Cod 0-group index	Figur 3.1
3	-0.818	iceindex MonArciceindex TOTAL North East Artic Cod VPA stock number at age	Figur 3.3

2.2 Best 2D Correlations

No.	Corr	Variables	Ref.
1	0.958	North East Artic Cod Early juvenile index NCEP SHTFLsfc	Figur 4.10
2	0.957	North East Artic Cod Early juvenile index NCEP LHTFLsfc	Figur 4.9
3	-0.955	North East Artic Cod Early juvenile index IGOSS sst	Figur 4.43
4	-0.926	North East Artic Cod Early juvenile index IGOSS sst	Figur 4.40
5	0.923	North East Artic Cod Early juvenile index IGOSS sst	Figur 4.36
6	0.908	North East Artic Cod Early juvenile index IGOSS sst	Figur 4.38
7	0.908	North East Artic Cod Catch in tonnes IGOSS sst	Figur 4.29
8	-0.899	Barents Sea Capelin Spawning stock biomass IGOSS sst	Figur 4.23
9	0.899	Barents Sea Capelin Spawning stock biomass IGOSS sst	Figur 4.22
10	-0.895	North East Artic Cod Early juvenile index IGOSS sst	Figur 4.37
11	-0.886	North East Artic Cod Early juvenile index IGOSS sst	Figur 4.42
12	0.886	North East Artic Cod Early juvenile index NCEP SKTsfc	Figur 4.3
13	-0.878	North East Artic Cod Early juvenile index NCEP SKTsfc	Figur 4.4
14	-0.876	North East Artic Cod 0-group index NCEP SKTsfc	Figur 4.2
15	0.872	North East Artic Cod 0-group index IGOSS sst	Figur 4.25
16	0.869	North East Artic Cod Catch in tonnes IGOSS sst	Figur 4.30
17	-0.868	Barents Sea Capelin Catch in 1000 tonnes IGOSS sst	Figur 4.19
18	0.866	North East Artic Cod VPA stock number at age IGOSS sst	Figur 4.47
19	0.864	North East Artic Cod Early juvenile index NCEP TCDCeatm	Figur 4.12
20	0.863	North East Artic Cod Catch in tonnes IGOSS sst	Figur 4.32

Chapter 3

1D Variables

3.1 NAO NAOWinterStGb

3.2 NAO NAOWinterStLi

3.2.1 NAO NAOWinterStLi - North East Artic Cod 0-group index

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	Ph. variable	Bio. variable
0.067	0.067	0.067	0	0 Years	Jan78 Jan97	1978 1997
0.515	0.515	0.515	0	1 Years	Jan77 Jan96	1978 1997
0.82	0.82	0.82	0	2 Years	Jan76 Jan95	1978 1997
0.592	0.592	0.592	0	3 Years	Jan75 Jan94	1978 1997

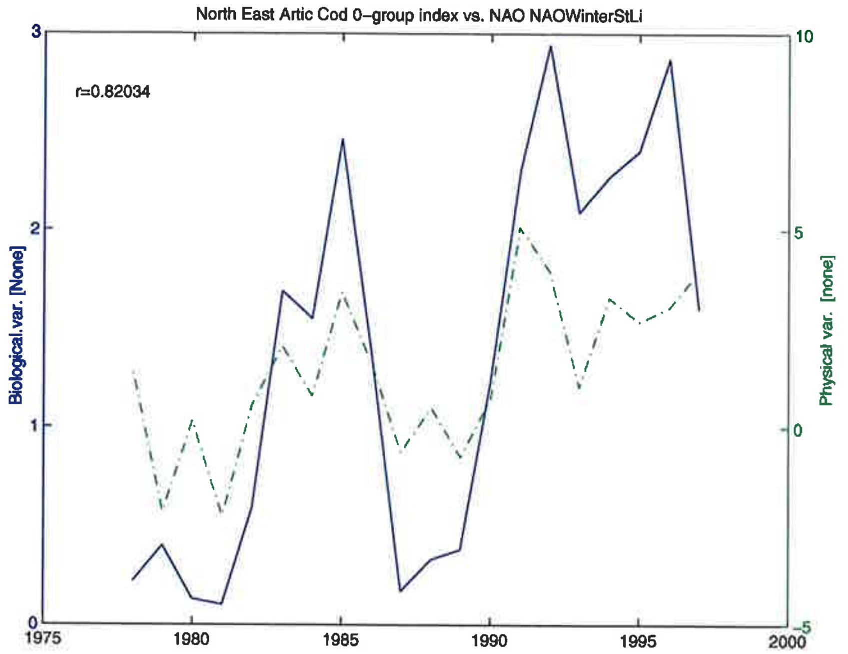

Figure 3.1: Correlation between NAO NAOWinterStLi and North East Artic Cod 0-group index. The solid line represent the biological variable. The timedifference between the NAO variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan76 Jan95] in the NAO variable and in the timinterval[1978 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

3.3 iceindex NCEPiceindex

3.4 iceindex MonArciceindex MY

3.5 iceindex MonArciceindex TOTAL

3.5.1 iceindex MonArciceindex TOTAL - North East Artic Cod Early juvenile index

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	Ph. variable	Bio. variable
-0.283	-0.504	-0.392	0.087	0 Years	Oct79 Oct91	1979 1991
0.223	-0.209	-0.037	0.16	1 Years	Oct79 Oct90	1980 1991
0.707	-0.02	0.334	0.274	2 Years	Oct79 Oct89	1981 1991
0.857	-0.059	0.486	0.412	3 Years	Oct79 Oct88	1982 1991

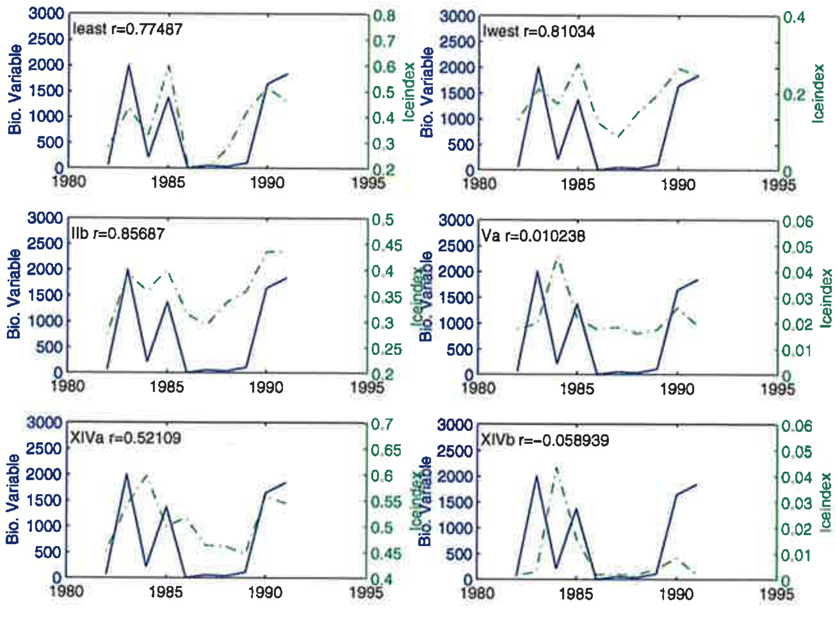

Figure 3.2: Correlation between iceindex MonArciceindex TOTAL and North East Artic Cod Early juvenile index. The solid line represent the biological variable. The timedifference between the iceindex variable and the fish timeserie is 3 years. The analysis is done for every Oct month in the interval [Oct79 Oct88] in the iceindex variable and in the timinterval[1982 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

3.5.2 iceindex MonArciceindex TOTAL - North East Artic Cod VPA stock number at age

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	Ph. variable	Bio. variable
-0.179	-0.403	-0.286	0.088	0 Years	Jan79 Jan98	1979 1998
-0.062	-0.645	-0.409	0.256	1 Years	Jan79 Jan97	1980 1998
0.358	-0.818	-0.308	0.443	2 Years	Jan79 Jan96	1981 1998
0.675	-0.443	-0.061	0.461	3 Years	Jan79 Jan95	1982 1998

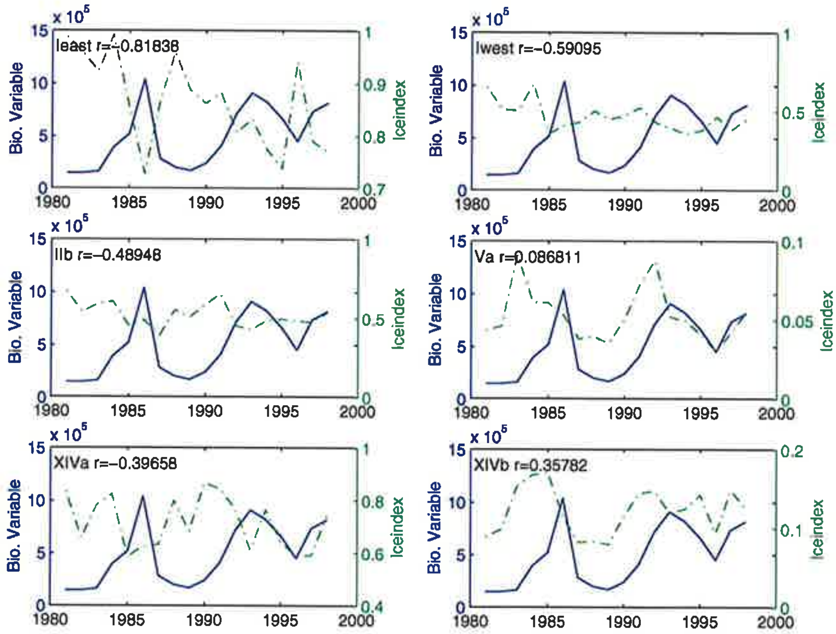

Figure 3.3: Correlation between iceindex MonArciceindex TOTAL and North East Artic Cod VPA stock number at age. The solid line represent the biological variable. The timedifference between the iceindex variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan79 Jan96] in the iceindex variable and in the timinterval[1981 1998] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Chapter 4

2D Surface fields

4.1 NCEP PRESsfc

4.2 NCEP SKTsfc

4.2.1 NCEP SKTsfc - North East Artic Cod 0-group index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	SKTsfc	Bio. variable
0.681	-0.817	0.167	0.311	0 Years	Jan78 Jan97	1978 1997
0.848	-0.876	0.101	0.37	1 Years	Jan77 Jan96	1978 1997
0.791	-0.765	0.027	0.305	2 Years	Jan76 Jan95	1978 1997
0.531	-0.56	-0.089	0.202	3 Years	Jan75 Jan94	1978 1997

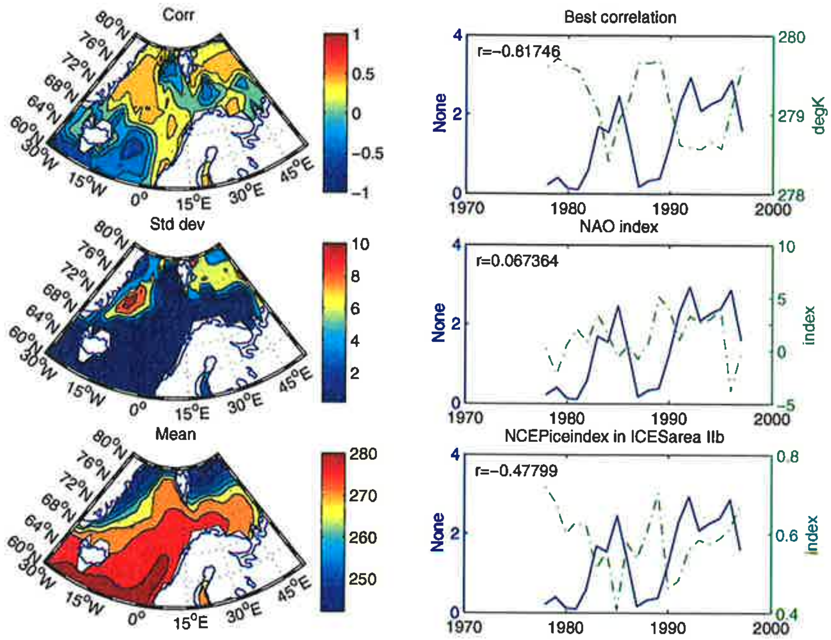

Figure 4.1: Correlation plot between NCEP SKTsfc in *degK* and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan78 Jan97] in the NCEP variable and in the timinterval[1978 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

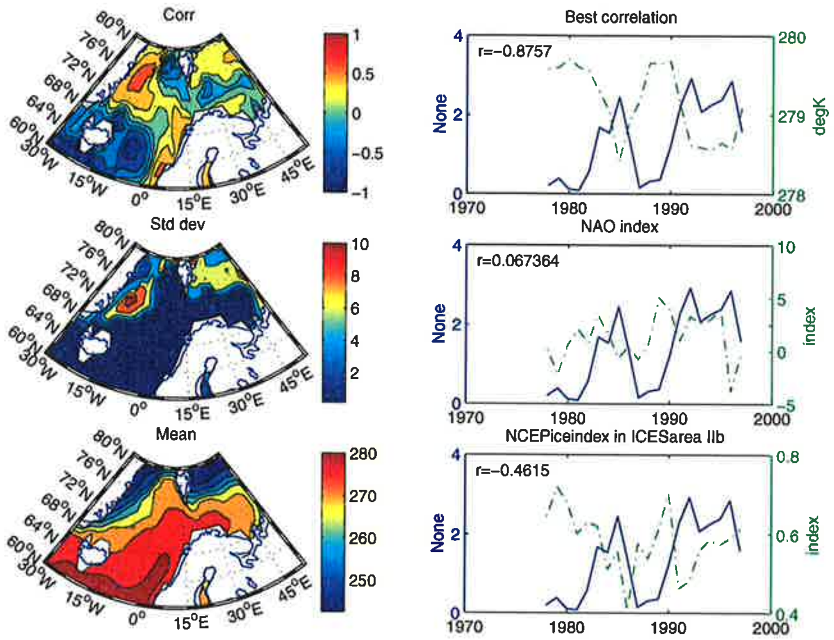

Figure 4.2: Correlation plot between NCEP SKTsfc in *degK* and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan77 Jan96] in the NCEP variable and in the timinterval[1978 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.2.2 NCEP SKTsfc - North East Artic Cod Early juvenile index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	SKTsfc	Bio. variable
0.886	-0.662	0.282	0.365	0 Years	Jan78 Jan91	1978 1991
0.566	-0.878	-0.148	0.298	1 Years	Jan77 Jan90	1978 1991
0.658	-0.66	-0.128	0.269	2 Years	Jan76 Jan89	1978 1991
0.593	-0.643	-0.092	0.226	3 Years	Jan75 Jan88	1978 1991

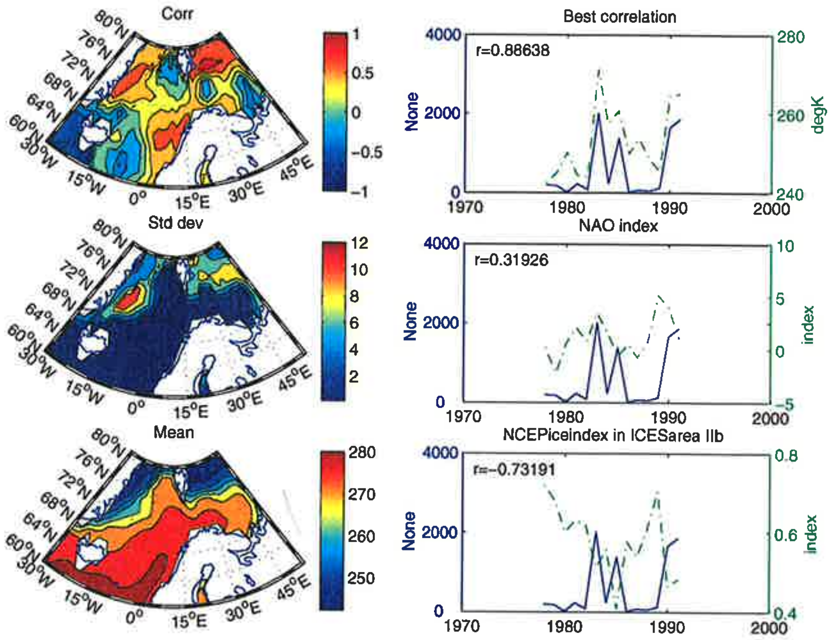

Figure 4.3: Correlation plot between NCEP SKTsfc in *degK* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan78 Jan91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

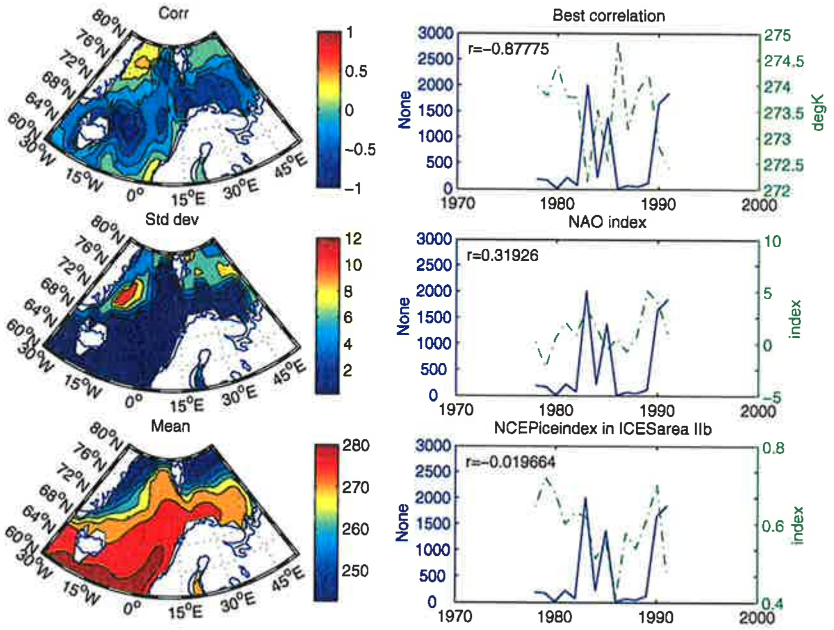

Figure 4.4: Correlation plot between NCEP SKTsfc in *degK* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan77 Jan90] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

May months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	SKTsfc	Bio. variable
0.835	-0.472	0.022	0.254	0 Years	May78 May91	1978 1991
0.79	-0.791	0.11	0.371	1 Years	May77 May90	1978 1991
0.619	-0.527	0.047	0.248	2 Years	May76 May89	1978 1991
0.677	-0.513	0.092	0.262	3 Years	May75 May88	1978 1991

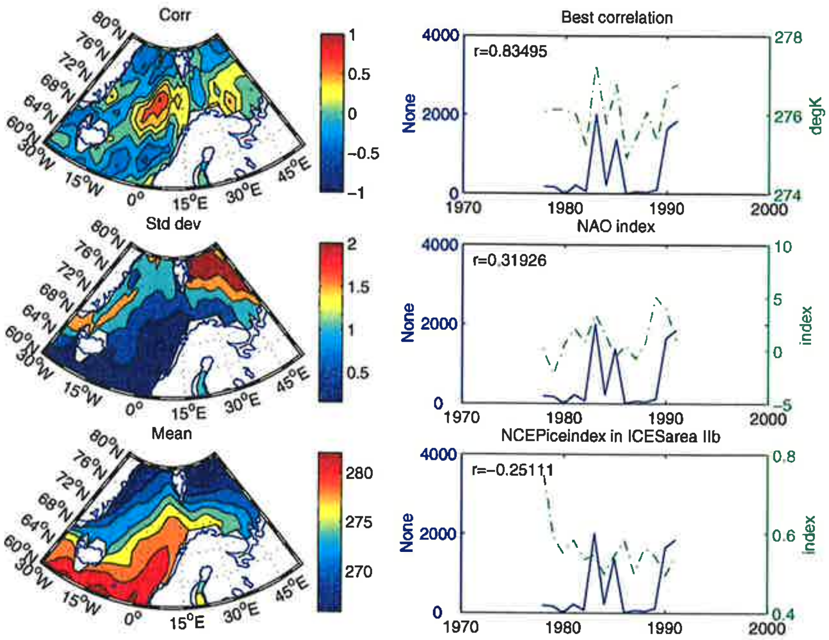

Figure 4.5: Correlation plot between NCEP SKTsfc in *degK* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every May month in the interval [May78 May91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	SKTsfc	Bio. variable
0.664	-0.571	0.076	0.282	0 Years	Oct78 Oct91	1978 1991
0.737	-0.64	0.008	0.287	1 Years	Oct77 Oct90	1978 1991
0.652	-0.825	-0.061	0.26	2 Years	Oct76 Oct89	1978 1991
0.578	-0.791	-0.108	0.34	3 Years	Oct75 Oct88	1978 1991

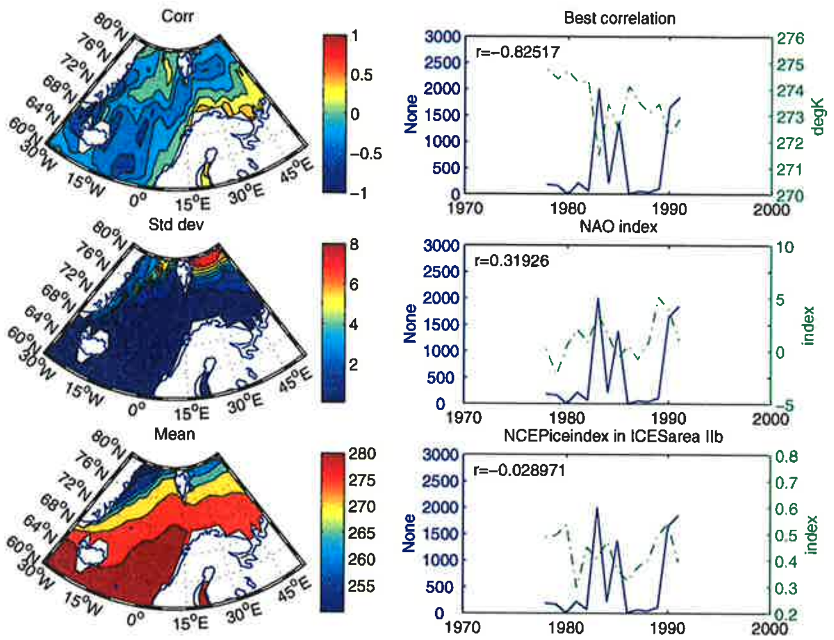

Figure 4.6: Correlation plot between NCEP SKTsfc in *degK* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 2 years. The analysis is done for every Oct month in the interval [Oct76 Oct89] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.3 NCEP NLWRSsfc

4.4 NCEP LHTFLsfc

4.4.1 NCEP LHTFLsfc - Barents Sea Capelin Total stock biomass

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	LHTFLsfc	Bio. variable
0.541	-0.526	-0.014	0.171	0 Years	Jan72 Jan99	1972 1999
0.55	-0.642	-0.071	0.224	1 Years	Jan71 Jan99	1972 2000
0.594	-0.756	-0.093	0.246	2 Years	Jan70 Jan98	1972 2000
0.553	-0.803	-0.097	0.246	3 Years	Jan69 Jan97	1972 2000

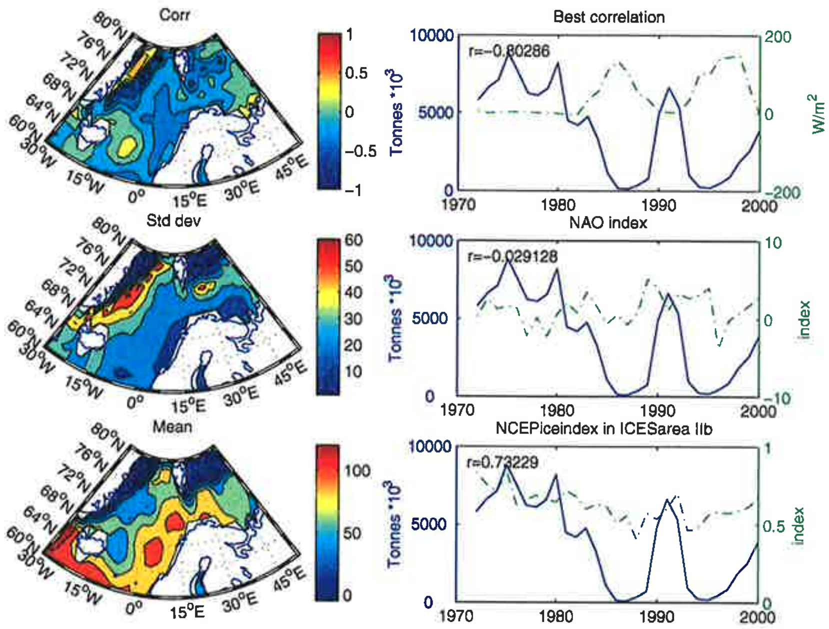

Figure 4.7: Correlation plot between NCEP LHTFLsfc in W/m^2 and Barents Sea Capelin Total stock biomass. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 3 years. The analysis is done for every Jan month in the interval [Jan69 Jan97] in the NCEP variable and in the timinterval[1972 2000] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.4.2 NCEP LHTFLsfc - North East Artic Cod 0-group index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	LHTFLsfc	Bio. variable
0.633	-0.6	-0.063	0.279	0 Years	Jan78 Jan97	1978 1997
0.803	-0.562	-0.029	0.257	1 Years	Jan77 Jan96	1978 1997
0.715	-0.538	-0.048	0.243	2 Years	Jan76 Jan95	1978 1997
0.502	-0.617	-0.096	0.234	3 Years	Jan75 Jan94	1978 1997

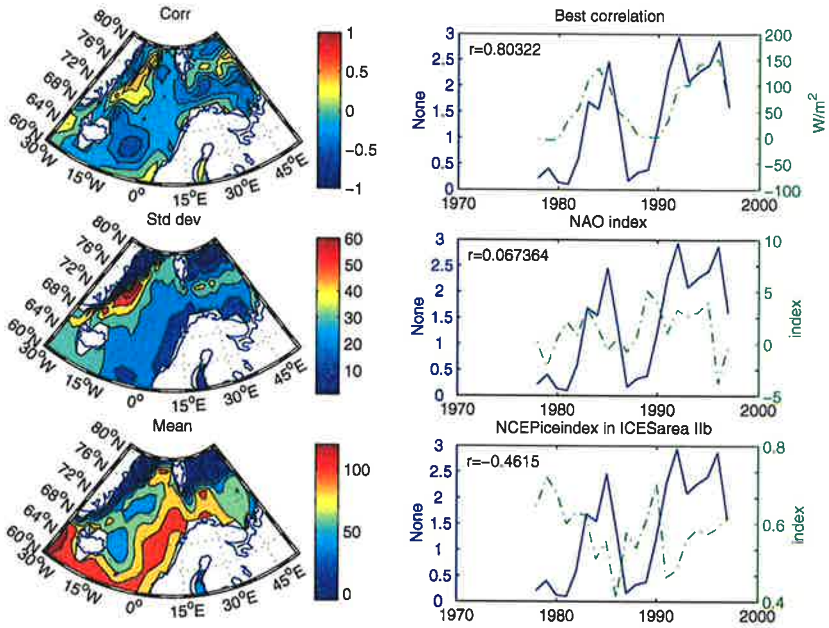

Figure 4.8: Correlation plot between NCEP LHTFLsfc in W/m^2 and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan77 Jan96] in the NCEP variable and in the timinterval[1978 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.4.3 NCEP LHTFLsfc - North East Artic Cod Early juvenile index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	LHTFLsfc	Bio. variable
0.957	-0.833	-0.032	0.352	0 Years	Jan78 Jan91	1978 1991
0.507	-0.73	-0.203	0.241	1 Years	Jan77 Jan90	1978 1991
0.682	-0.782	0.027	0.268	2 Years	Jan76 Jan89	1978 1991
0.519	-0.679	-0.133	0.284	3 Years	Jan75 Jan88	1978 1991

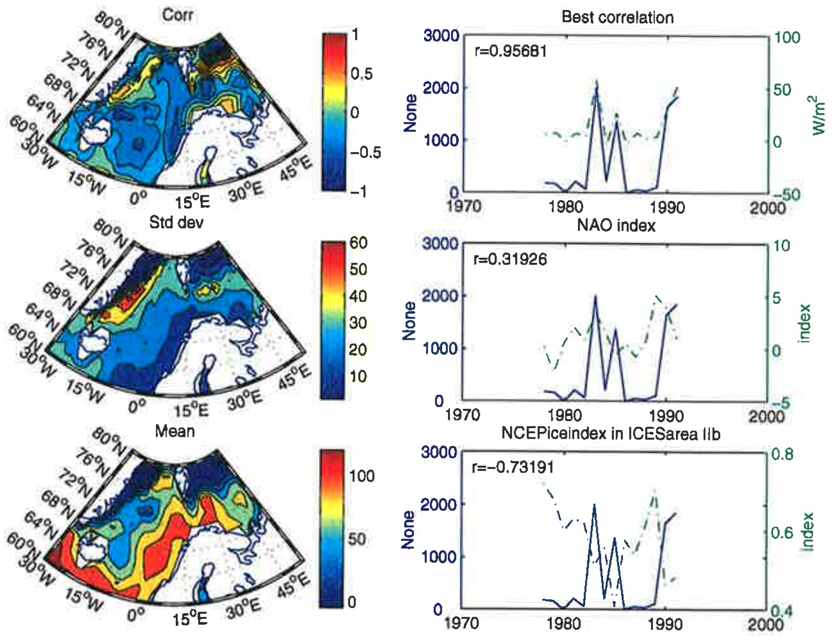

Figure 4.9: Correlation plot between NCEP LHTFLsfc in W/m^2 and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan78 Jan91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.5 NCEP UFLXsfc

4.6 NCEP VFLXsfc

4.7 NCEP SHTFLsfc

4.7.1 NCEP SHTFLsfc - North East Artic Cod Early juvenile index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	SHTFLsfc	Bio. variable
0.958	-0.731	-0.099	0.357	0 Years	Jan78 Jan91	1978 1991
0.579	-0.748	-0.164	0.271	1 Years	Jan77 Jan90	1978 1991
0.576	-0.765	-0.008	0.279	2 Years	Jan76 Jan89	1978 1991
0.574	-0.643	-0.102	0.247	3 Years	Jan75 Jan88	1978 1991

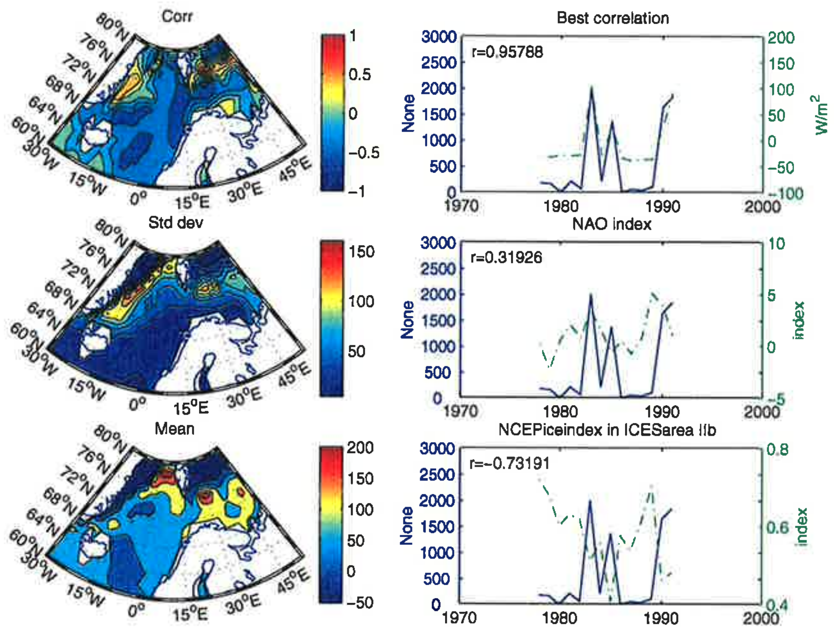

Figure 4.10: Correlation plot between NCEP SHTFLsfc in W/m^2 and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan78 Jan91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.8 NCEP TCDCeatm

4.8.1 NCEP TCDCeatm - North East Artic Cod 0-group index

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	TCDCeatm	Bio. variable
0.435	-0.612	-0.102	0.282	0 Years	Oct78 Oct97	1978 1997
0.351	-0.794	-0.23	0.284	1 Years	Oct77 Oct96	1978 1997
0.366	-0.694	-0.262	0.229	2 Years	Oct76 Oct95	1978 1997
0.471	-0.802	-0.234	0.245	3 Years	Oct75 Oct94	1978 1997

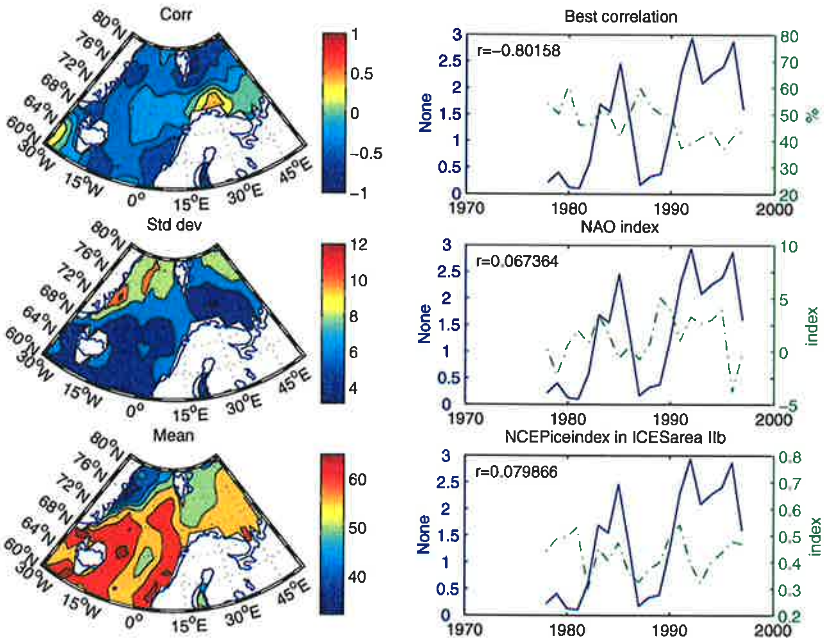

Figure 4.11: Correlation plot between NCEP TCDCeatm in z and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 3 years. The analysis is done for every Oct month in the interval [Oct75 Oct94] in the NCEP variable and in the timinterval[1978 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.8.2 NCEP TCDCeatm - North East Artic Cod Early juvenile index

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	TCDCeatm	Bio. variable
0.864	-0.53	0.022	0.285	0 Years	Oct78 Oct91	1978 1991
0.492	-0.62	-0.12	0.277	1 Years	Oct77 Oct90	1978 1991
0.448	-0.758	-0.158	0.249	2 Years	Oct76 Oct89	1978 1991
0.56	-0.714	-0.154	0.346	3 Years	Oct75 Oct88	1978 1991

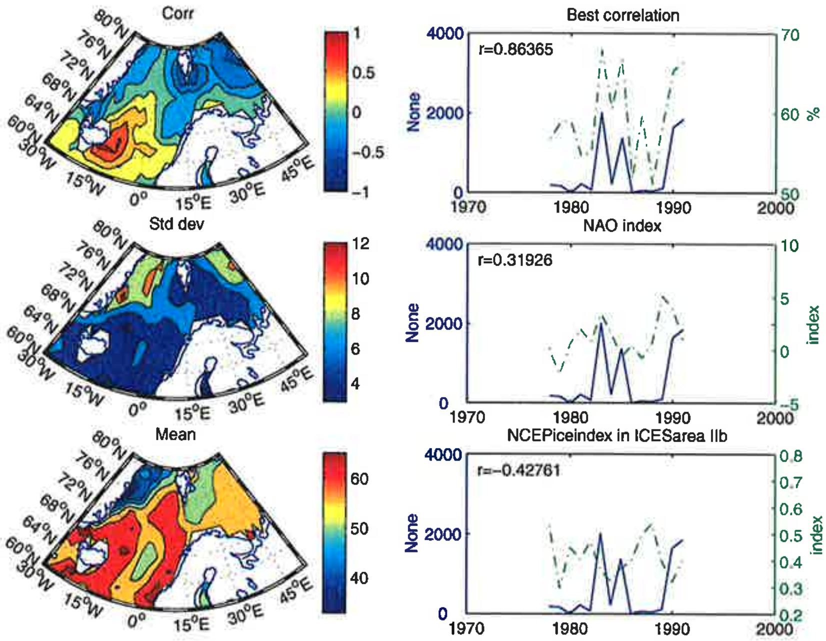

Figure 4.12: Correlation plot between NCEP TCDCeatm in z and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Oct month in the interval [Oct78 Oct91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.9 NCEP DSWRFsfc

4.9.1 NCEP DSWRFsfc - North East Artic Cod Early juvenile index

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	DSWRFsfc	Bio. variable
0.565	-0.816	-0.035	0.269	0 Years	Oct78 Oct91	1978 1991
0.444	-0.728	-0.127	0.286	1 Years	Oct77 Oct90	1978 1991
0.495	-0.744	-0.003	0.249	2 Years	Oct76 Oct89	1978 1991
0.648	-0.685	-0.009	0.342	3 Years	Oct75 Oct88	1978 1991

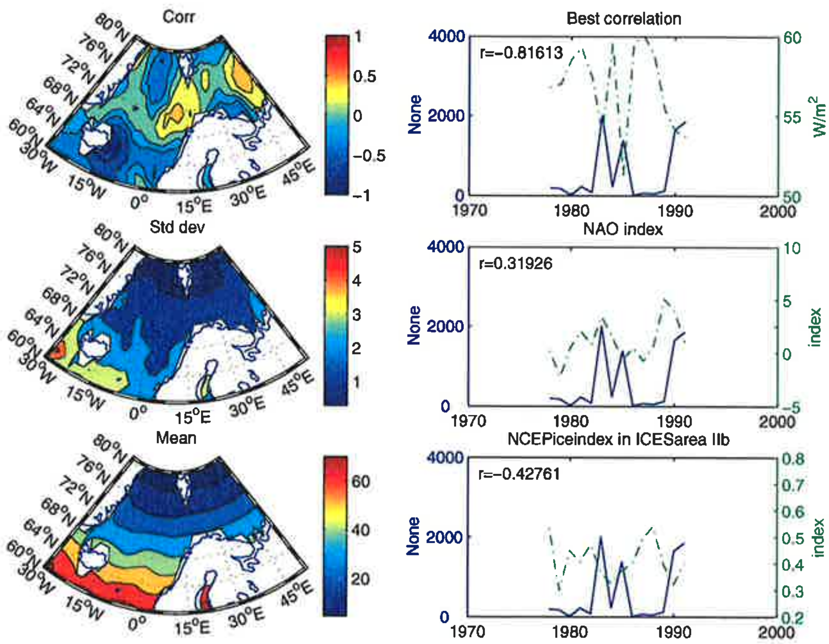

Figure 4.13: Correlation plot between NCEP DSWRFsfc in W/m^2 and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Oct month in the interval [Oct78 Oct91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.10 NCEP NSWRSsfc

4.10.1 NCEP NSWRSsfc - Barents Sea Capelin O-group index in August

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	NSWRSsfc	Bio. variable
0.627	-0.381	0.084	0.2	0 Years	Oct81 Oct99	1981 1999
0.825	-0.383	0.175	0.277	1 Years	Oct80 Oct99	1981 2000
0.632	-0.563	0.068	0.252	2 Years	Oct79 Oct98	1981 2000
0.476	-0.451	-0.003	0.202	3 Years	Oct78 Oct97	1981 2000

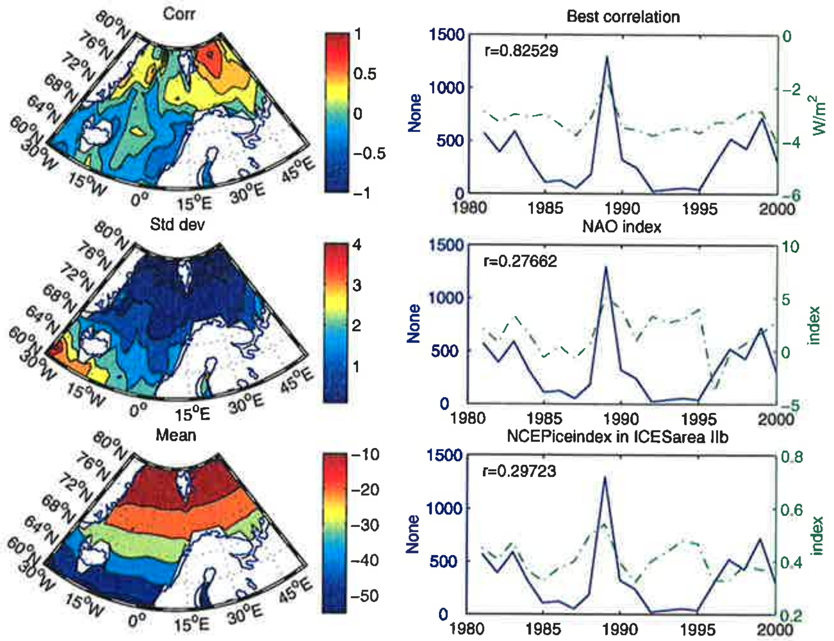

Figure 4.14: Correlation plot between NCEP NSWRSsfc in W/m^2 and Barents Sea Capelin O-group index in August. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 1 years. The analysis is done for every Oct month in the interval [Oct80 Oct99] in the NCEP variable and in the timinterval[1981 2000] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.10.2 NCEP NSWRSsfc - North East Artic Cod Early juvenile index

May months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	NSWRSsfc	Bio. variable
0.701	-0.712	-0.098	0.274	0 Years	May78 May91	1978 1991
0.778	-0.829	-0.168	0.26	1 Years	May77 May90	1978 1991
0.713	-0.65	-0.104	0.253	2 Years	May76 May89	1978 1991
0.466	-0.811	-0.153	0.246	3 Years	May75 May88	1978 1991

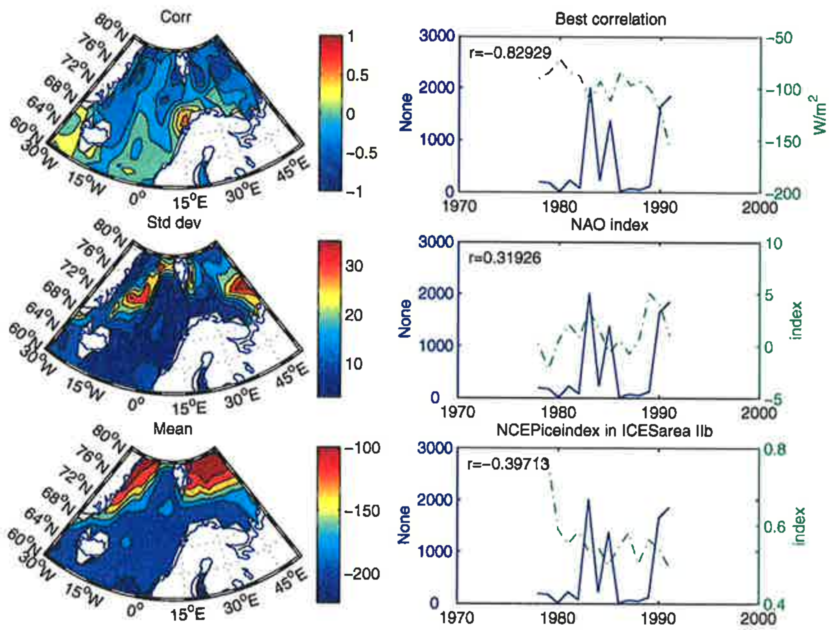

Figure 4.15: Correlation plot between NCEP NSWRSsfc in W/m^2 and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 1 years. The analysis is done for every May month in the interval [May77 May90] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

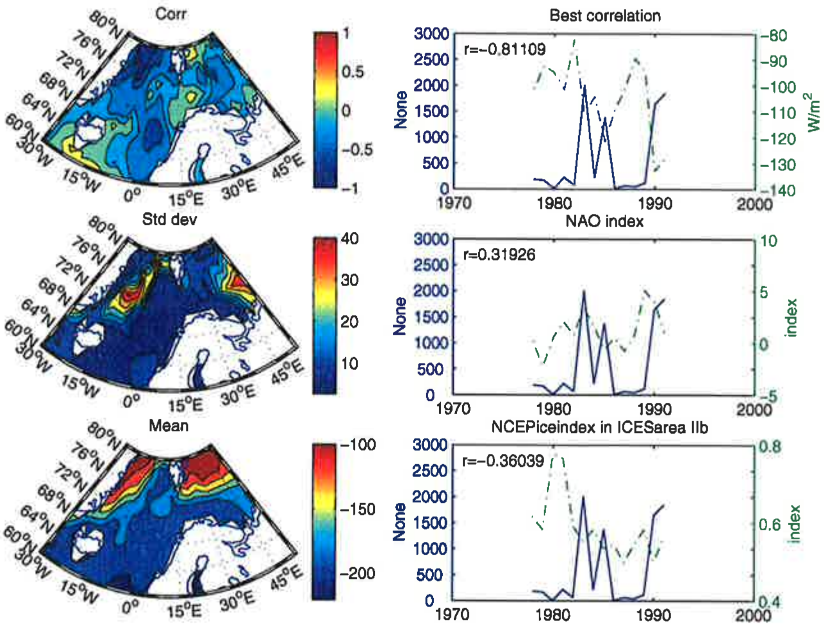

Figure 4.16: Correlation plot between NCEP NSWRSsfc in W/m^2 and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 3 years. The analysis is done for every May month in the interval [May75 May88] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	NSWRSsfc	Bio. variable
0.814	-0.652	-0.095	0.326	0 Years	Oct78 Oct91	1978 1991
0.639	-0.547	0.033	0.227	1 Years	Oct77 Oct90	1978 1991
0.666	-0.47	0.06	0.24	2 Years	Oct76 Oct89	1978 1991
0.781	-0.636	0.121	0.357	3 Years	Oct75 Oct88	1978 1991

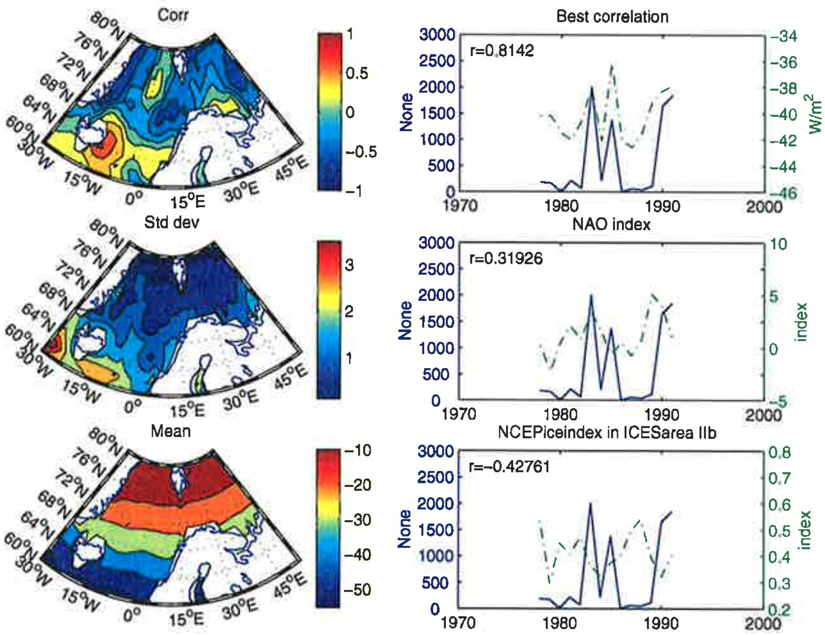

Figure 4.17: Correlation plot between NCEP NSWRSsfc in W/m^2 and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the NCEP variable and the fish timeserie is 0 years. The analysis is done for every Oct month in the interval [Oct78 Oct91] in the NCEP variable and in the timinterval[1978 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11 IGOSS sst

4.11.1 IGOSS sst - Barents Sea Capelin O-group index in August

May months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.603	-0.311	0.058	0.156	0 Years	May82 May00	1982 2000
0.724	-0.794	-0.087	0.278	1 Years	May82 May99	1983 2000
0.802	-0.671	-0.164	0.244	2 Years	May82 May98	1984 2000
0.289	-0.608	-0.195	0.161	3 Years	May82 May97	1985 2000

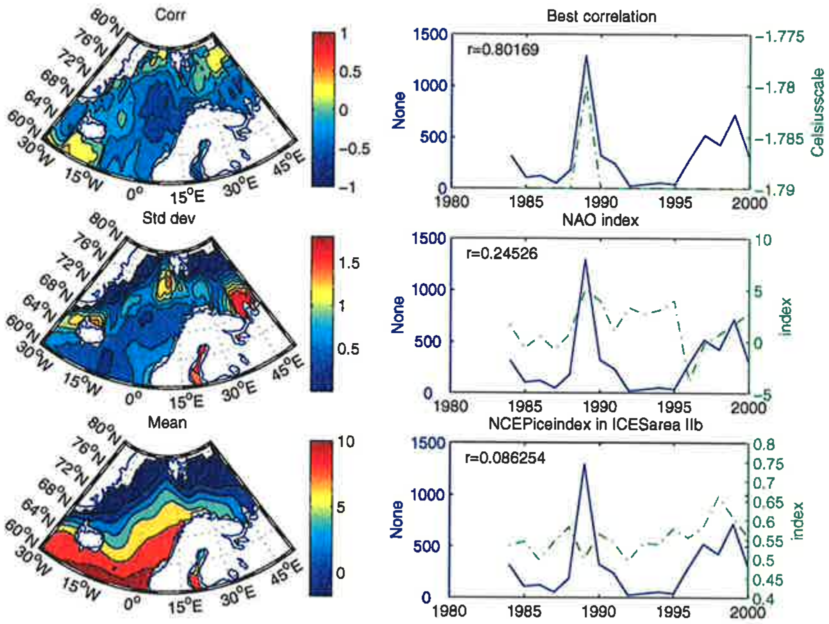

Figure 4.18: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin O-group index in August. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every May month in the interval [May82 May98] in the IGOSS variable and in the timinterval[1984 2000] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.2 IGOSS sst - Barents Sea Capelin Catch in 1000 tonnes

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.577	-0.7	-0.115	0.209	0 Years	Jan82 Jan99	1982 1999
0.482	-0.649	-0.116	0.178	1 Years	Jan82 Jan98	1983 1999
0.519	-0.765	-0.121	0.241	2 Years	Jan82 Jan97	1984 1999
0.756	-0.868	-0.168	0.349	3 Years	Jan82 Jan96	1985 1999

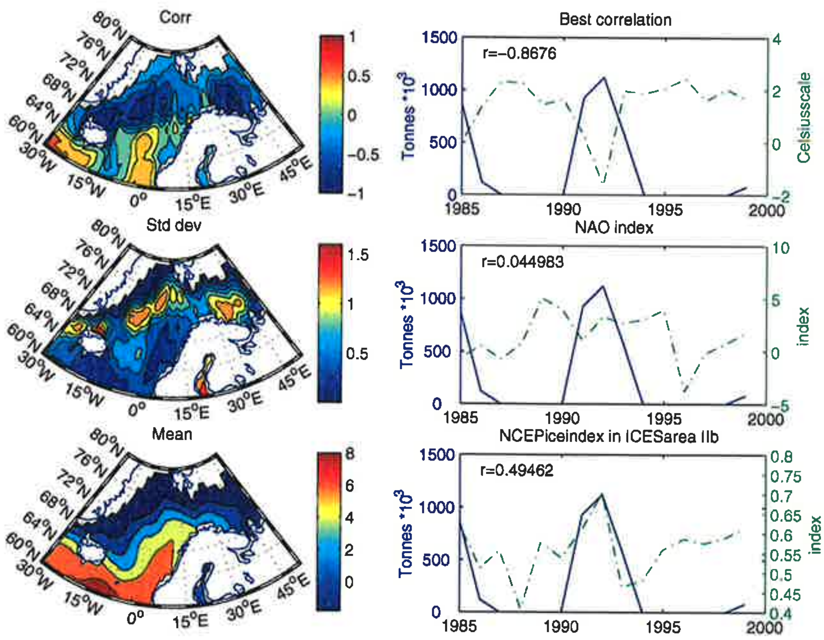

Figure 4.19: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin Catch in 1000 tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Jan month in the interval [Jan82 Jan96] in the IGOSS variable and in the timinterval[1985 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.3 IGOSS sst - Barents Sea Capelin Spawning stock biomass

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.827	-0.378	0.084	0.225	0 Years	Jan82 Jan99	1982 1999
0.723	-0.361	0.122	0.259	1 Years	Jan82 Jan98	1983 1999
0.748	-0.74	-0.019	0.315	2 Years	Jan82 Jan97	1984 1999
0.731	-0.667	-0.057	0.266	3 Years	Jan82 Jan96	1985 1999

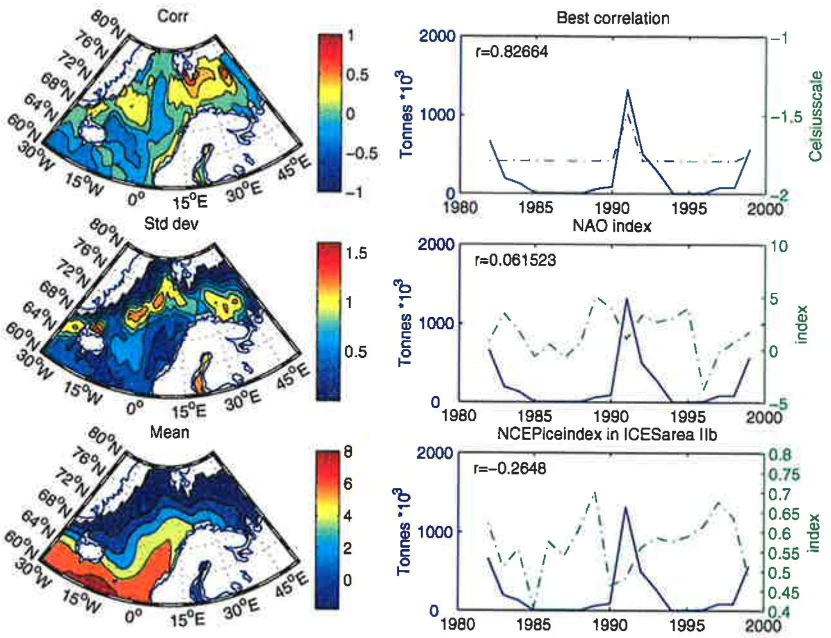

Figure 4.20: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin Spawning stock biomass. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan82 Jan99] in the IGOSS variable and in the timinterval[1982 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

May months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.813	-0.468	0.143	0.189	0 Years	May82 May99	1982 1999
0.899	-0.258	0.29	0.236	1 Years	May82 May98	1983 1999
0.656	-0.268	0.144	0.173	2 Years	May82 May97	1984 1999
0.852	-0.899	-0.042	0.258	3 Years	May82 May96	1985 1999

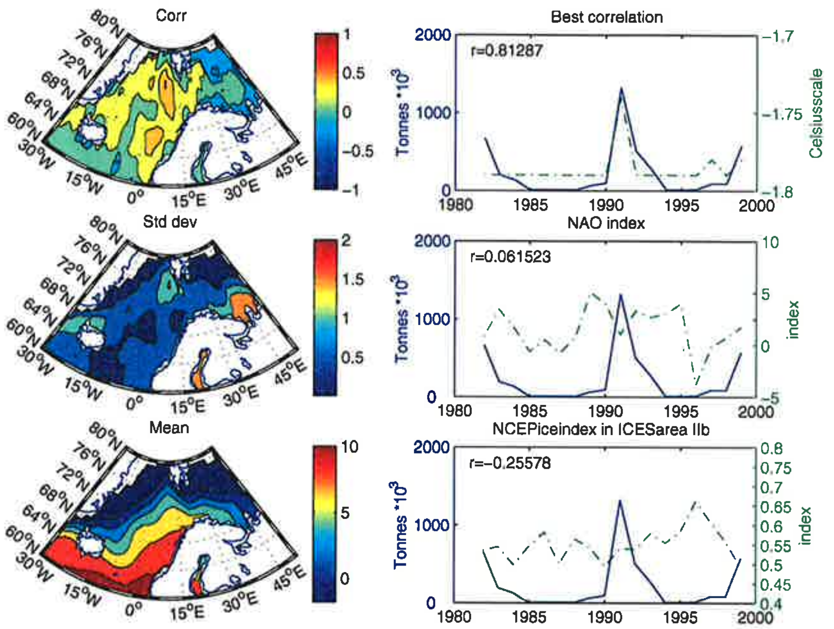

Figure 4.21: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin Spawning stock biomass. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 0 years. The analysis is done for every May month in the interval [May82 May99] in the IGOSS variable and in the timinterval[1982 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

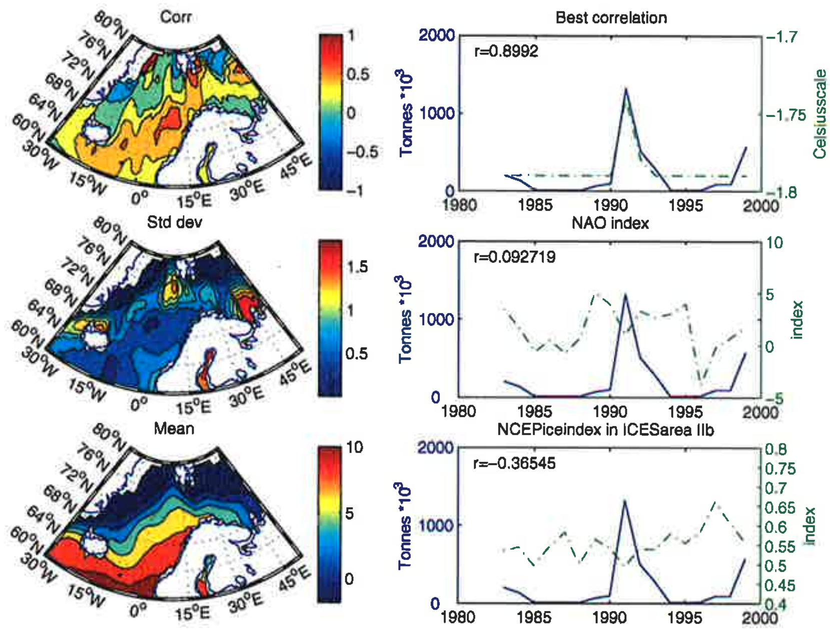

Figure 4.22: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin Spawning stock biomass. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 1 years. The analysis is done for every May month in the interval [May82 May98] in the IGOSS variable and in the timinterval[1983 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

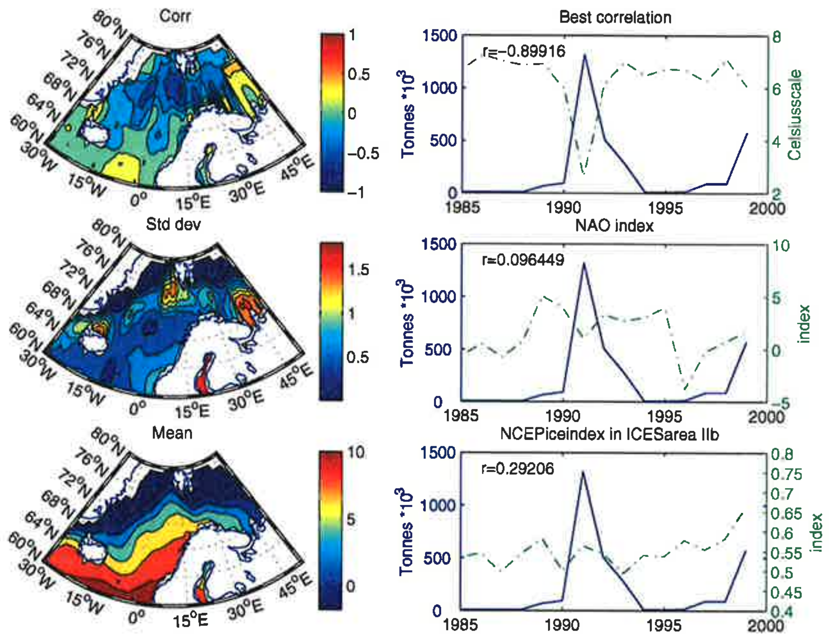

Figure 4.23: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin Spawning stock biomass. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every May month in the interval [May82 May96] in the IGOSS variable and in the timinterval[1985 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.471	-0.715	-0.034	0.226	0 Years	Oct81 Oct99	1981 1999
0.799	-0.442	0.101	0.286	1 Years	Oct81 Oct98	1982 1999
0.679	-0.401	0.089	0.222	2 Years	Oct81 Oct97	1983 1999
0.861	-0.638	-0.007	0.363	3 Years	Oct81 Oct96	1984 1999

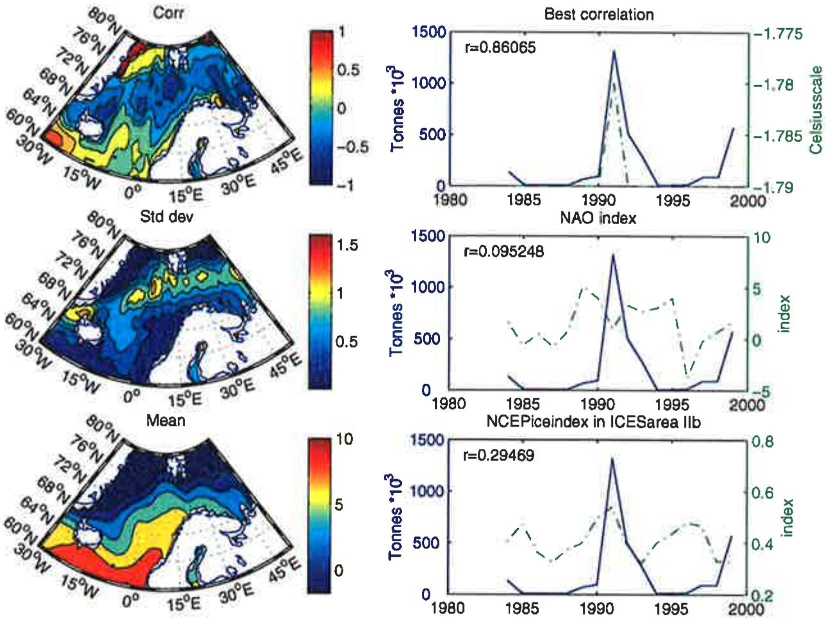

Figure 4.24: Correlation plot between IGOSS sst in *Celsiusscale* and Barents Sea Capelin Spawning stock biomass. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Oct month in the interval [Oct81 Oct96] in the IGOSS variable and in the timinterval[1984 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.4 IGOSS sst - North East Artic Cod 0-group index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.872	-0.714	0.228	0.334	0 Years	Jan82 Jan97	1982 1997
0.786	-0.856	0.223	0.396	1 Years	Jan82 Jan96	1983 1997
0.829	-0.64	0.123	0.316	2 Years	Jan82 Jan95	1984 1997
0.743	-0.721	-0.009	0.273	3 Years	Jan82 Jan94	1985 1997

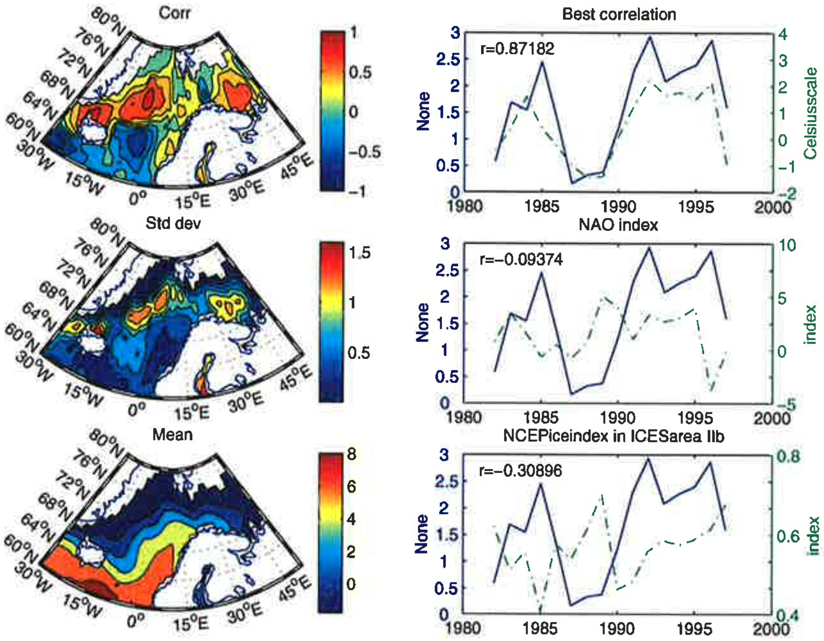

Figure 4.25: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan82 Jan97] in the IGOSS variable and in the timinterval[1982 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

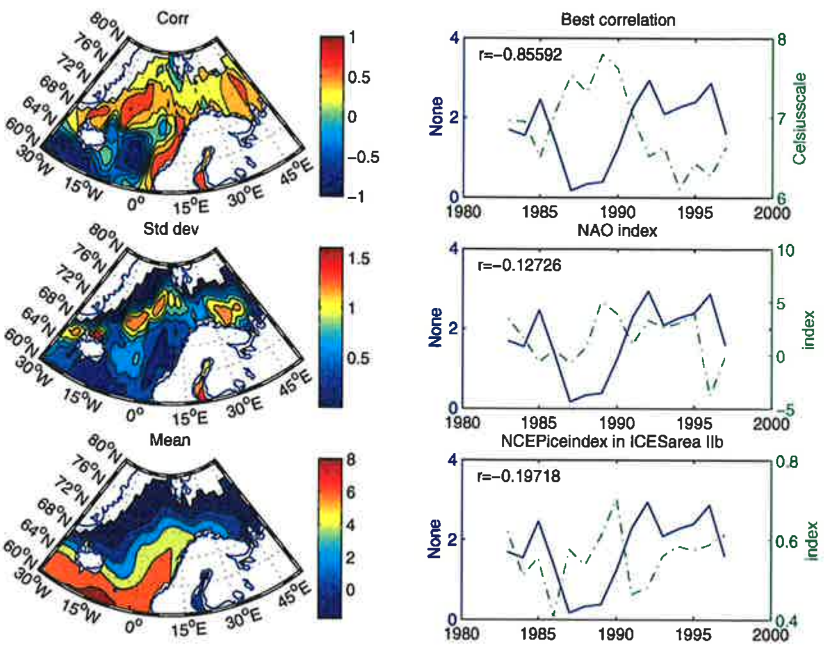

Figure 4.26: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan82 Jan96] in the IGOSS variable and in the timinterval[1983 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

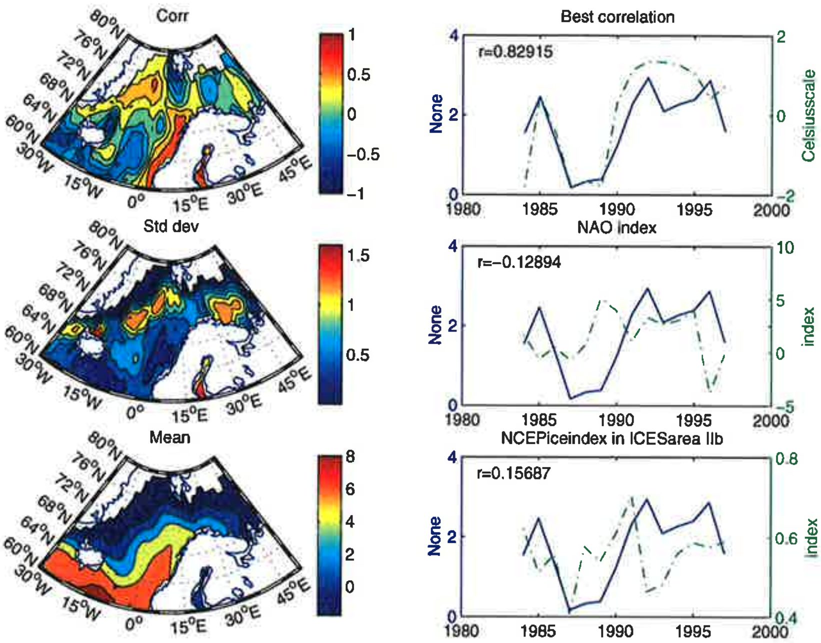

Figure 4.27: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod 0-group index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan82 Jan95] in the IGOSS variable and in the timinterval[1984 1997] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.5 IGOSS sst - North East Artic Cod Catch in tonnes

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.687	-0.558	0.07	0.26	0 Years	Jan82 Jan99	1982 1999
0.844	-0.711	0.157	0.335	1 Years	Jan82 Jan98	1983 1999
0.908	-0.879	0.243	0.382	2 Years	Jan82 Jan97	1984 1999
0.869	-0.794	0.272	0.385	3 Years	Jan82 Jan96	1985 1999

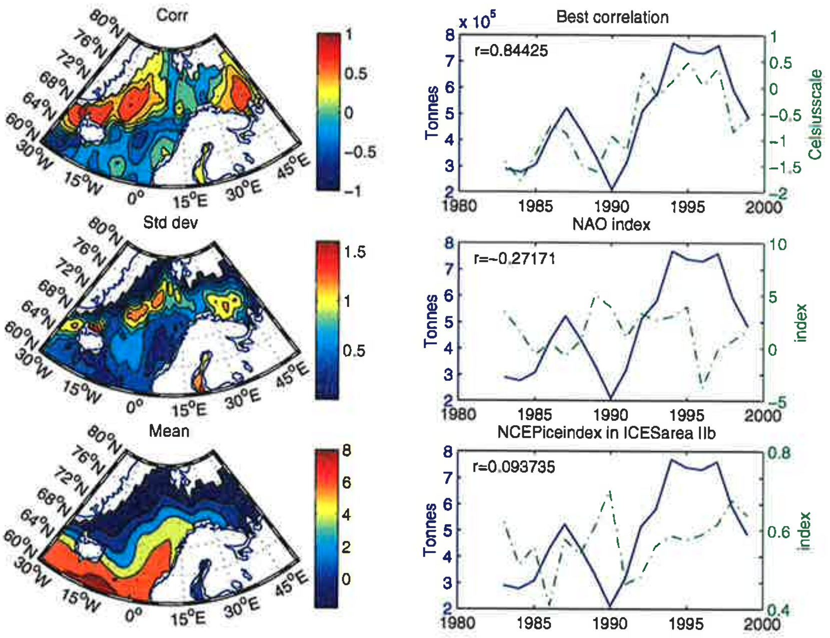

Figure 4.28: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Catch in tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan82 Jan98] in the IGOSS variable and in the timinterval[1983 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

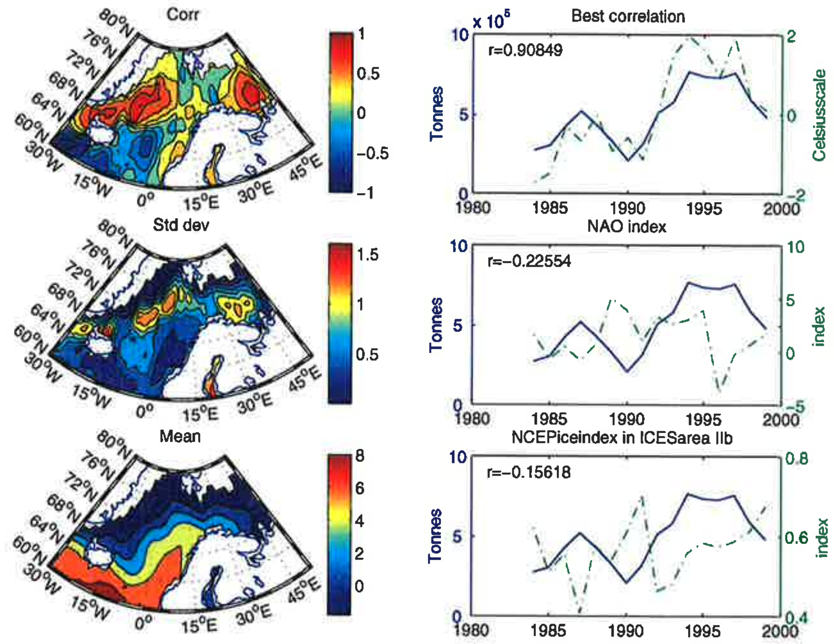

Figure 4.29: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Catch in tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan82 Jan97] in the IGOSS variable and in the timinterval[1984 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

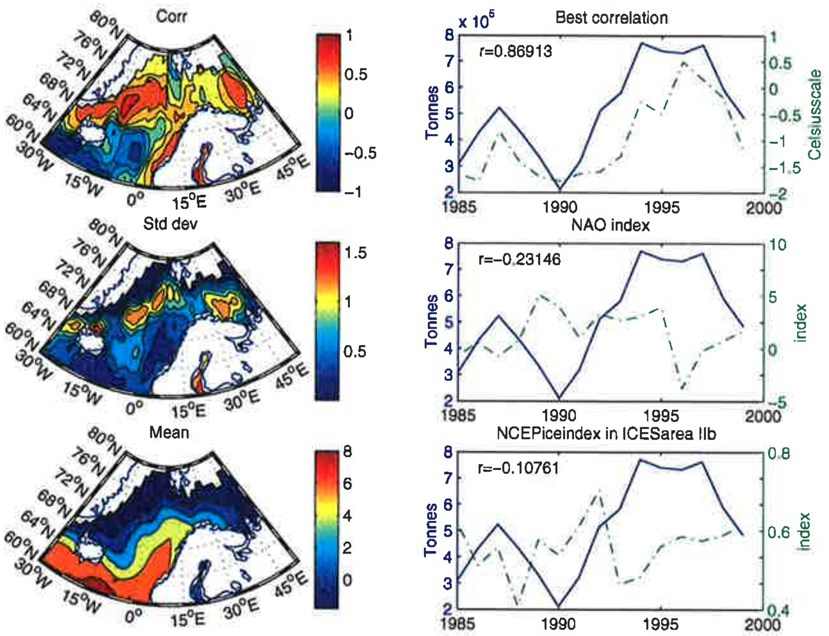

Figure 4.30: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Catch in tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Jan month in the interval [Jan82 Jan96] in the IGOSS variable and in the timinterval[1985 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

May months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.501	-0.664	-0.079	0.251	0 Years	May82 May99	1982 1999
0.487	-0.572	-0.019	0.243	1 Years	May82 May98	1983 1999
0.742	-0.513	0.163	0.259	2 Years	May82 May97	1984 1999
0.861	-0.466	0.309	0.305	3 Years	May82 May96	1985 1999

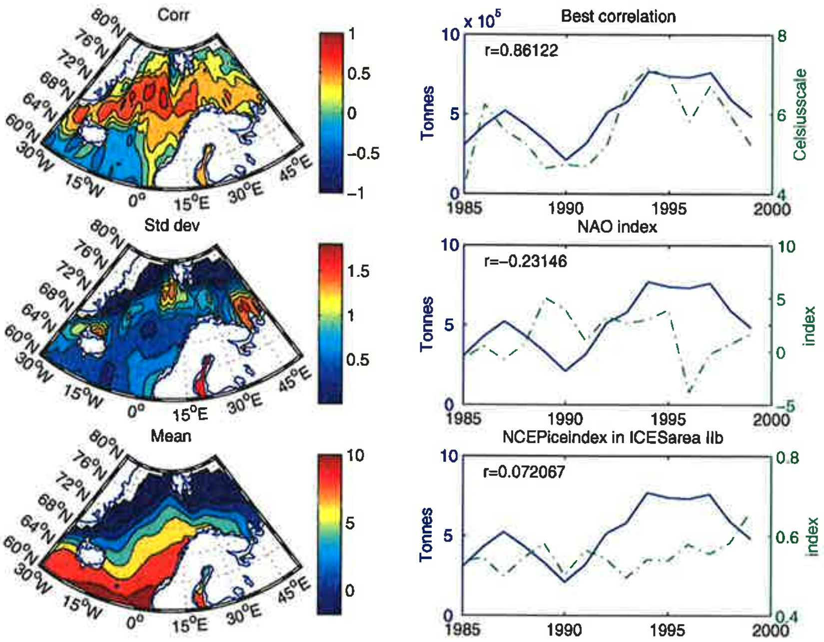

Figure 4.31: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Catch in tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every May month in the interval [May82 May96] in the IGOSS variable and in the timinterval[1985 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.596	-0.676	-0.048	0.281	0 Years	Oct81 Oct99	1981 1999
0.694	-0.711	-0.023	0.273	1 Years	Oct81 Oct98	1982 1999
0.863	-0.692	0.043	0.294	2 Years	Oct81 Oct97	1983 1999
0.818	-0.64	0.094	0.279	3 Years	Oct81 Oct96	1984 1999

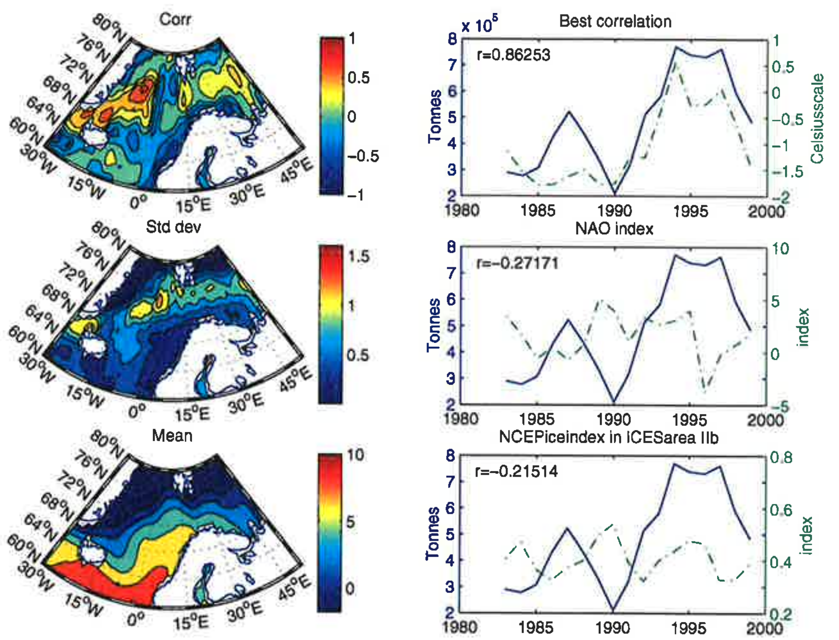

Figure 4.32: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Catch in tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Oct month in the interval [Oct81 Oct97] in the IGOSS variable and in the timinterval[1983 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

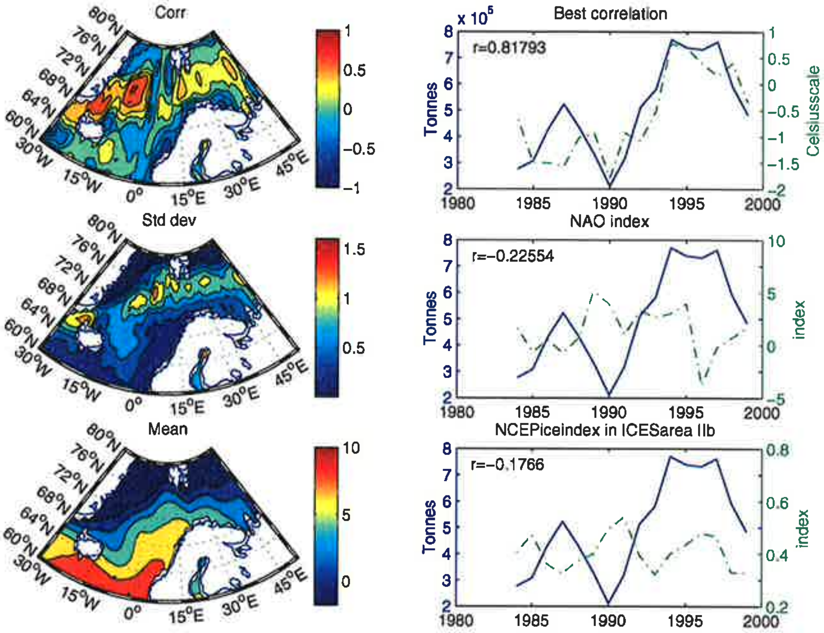

Figure 4.33: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Catch in tonnes. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Oct month in the interval [Oct81 Oct96] in the IGOSS variable and in the timinterval[1984 1999] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.6 IGOSS sst - North East Artic Cod Early juvenile index

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.862	-0.605	0.278	0.327	0 Years	Jan82 Jan91	1982 1991
0.763	-0.846	-0.038	0.314	1 Years	Jan82 Jan90	1983 1991
0.923	-0.902	-0.01	0.446	2 Years	Jan82 Jan89	1984 1991
0.675	-0.895	-0.232	0.387	3 Years	Jan82 Jan88	1985 1991

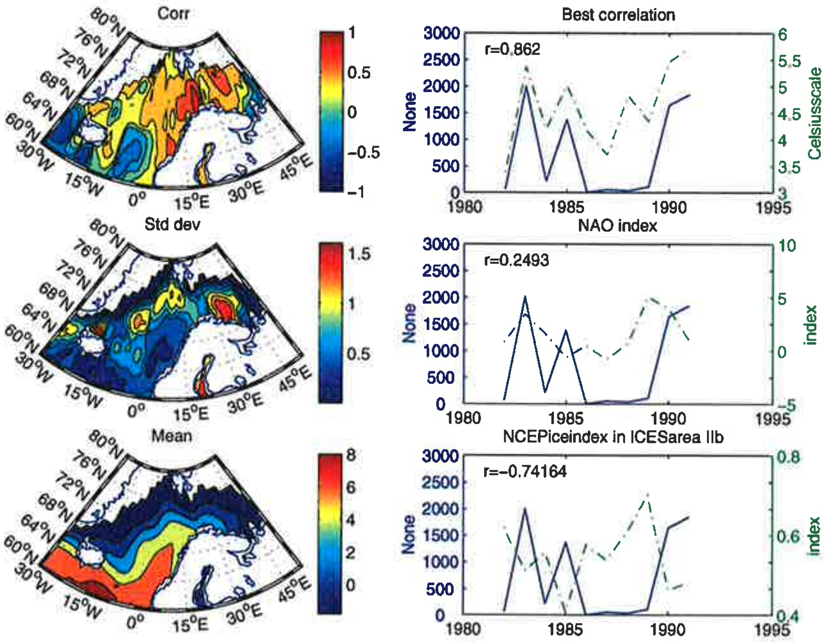

Figure 4.34: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 0 years. The analysis is done for every Jan month in the interval [Jan82 Jan91] in the IGOSS variable and in the timinterval[1982 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

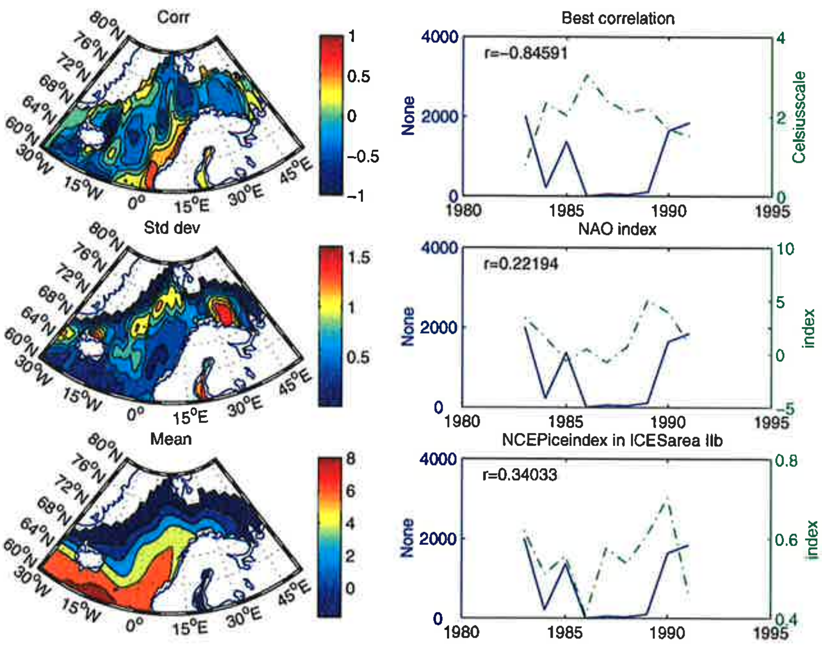

Figure 4.35: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan82 Jan90] in the IGOSS variable and in the timinterval[1983 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

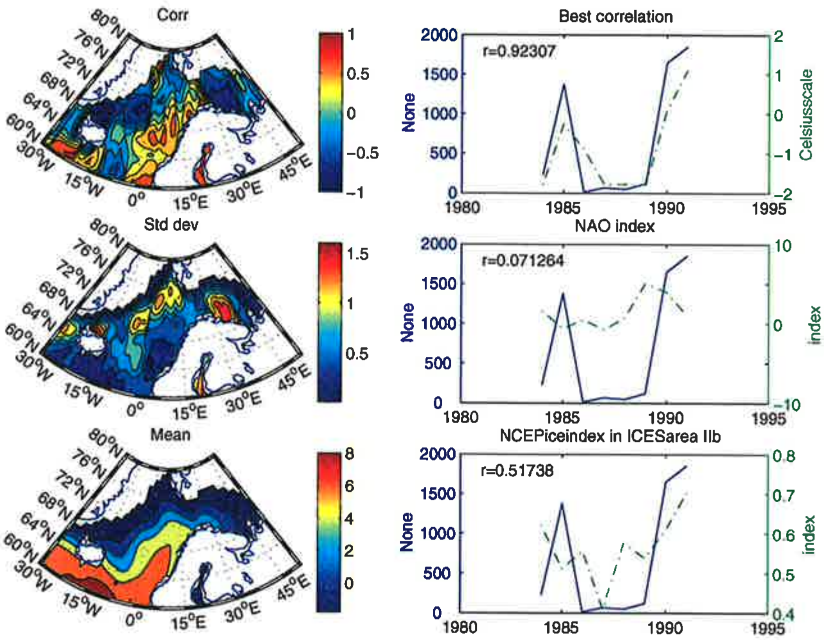

Figure 4.36: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan82 Jan89] in the IGOSS variable and in the timinterval[1984 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

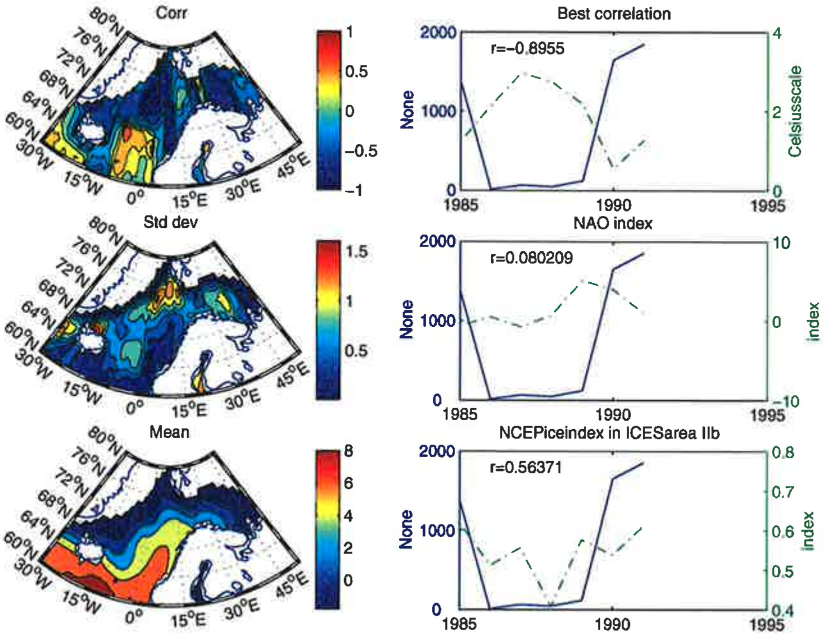

Figure 4.37: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Jan month in the interval [Jan82 Jan88] in the IGOSS variable and in the timinterval[1985 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

May months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.908	-0.479	0.232	0.289	0 Years	May82 May91	1982 1991
0.766	-0.542	0.264	0.265	1 Years	May82 May90	1983 1991
0.858	-0.787	0.068	0.376	2 Years	May82 May89	1984 1991
0.758	-0.926	-0.156	0.411	3 Years	May82 May88	1985 1991

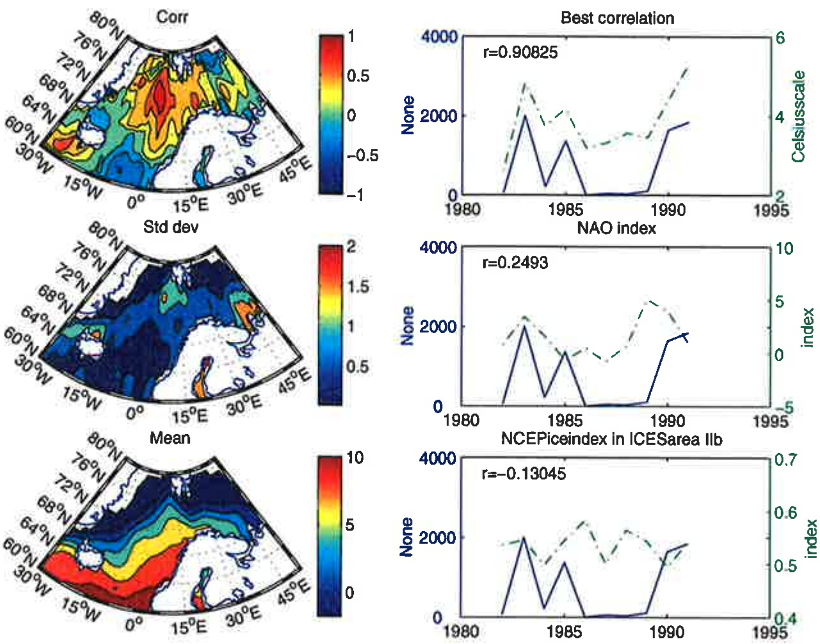

Figure 4.38: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 0 years. The analysis is done for every May month in the interval [May82 May91] in the IGOSS variable and in the timinterval[1982 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

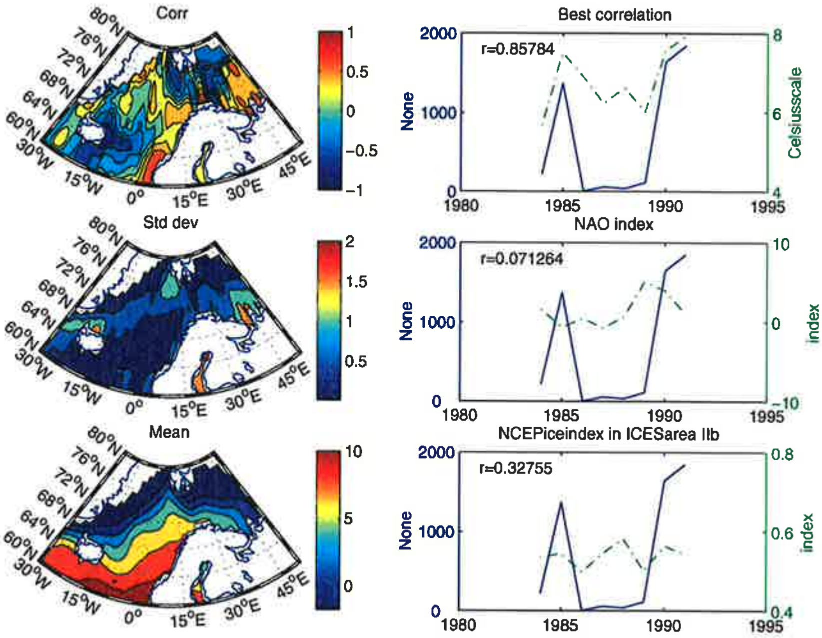

Figure 4.39: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every May month in the interval [May82 May89] in the IGOSS variable and in the timinterval[1984 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

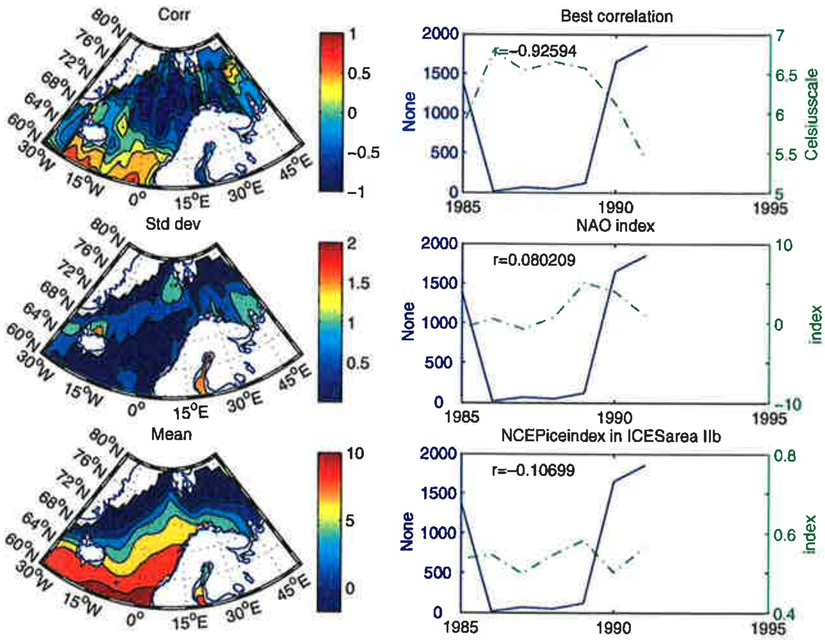

Figure 4.40: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every May month in the interval [May82 May88] in the IGOSS variable and in the timinterval[1985 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.697	-0.654	0.034	0.292	0 Years	Oct81 Oct91	1981 1991
0.852	-0.547	0.189	0.299	1 Years	Oct81 Oct90	1982 1991
0.857	-0.886	-0.11	0.326	2 Years	Oct81 Oct89	1983 1991
0.859	-0.955	-0.027	0.509	3 Years	Oct81 Oct88	1984 1991

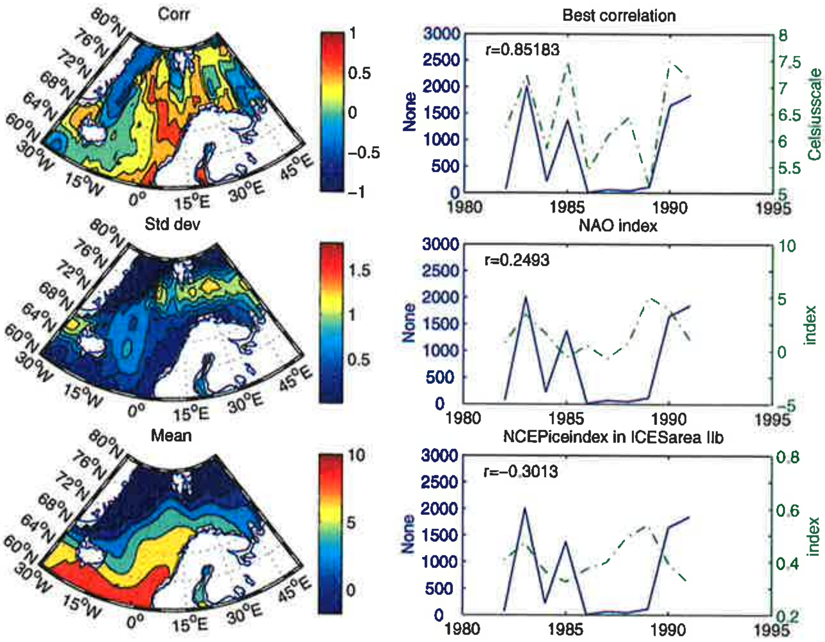

Figure 4.41: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 1 years. The analysis is done for every Oct month in the interval [Oct81 Oct90] in the IGOSS variable and in the timinterval[1982 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

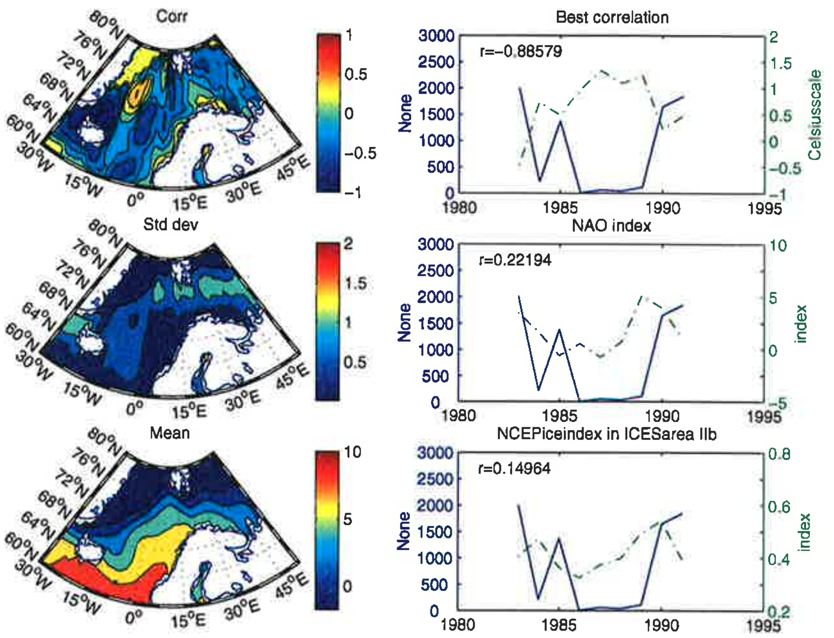

Figure 4.42: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Oct month in the interval [Oct81 Oct89] in the IGOSS variable and in the timinterval[1983 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

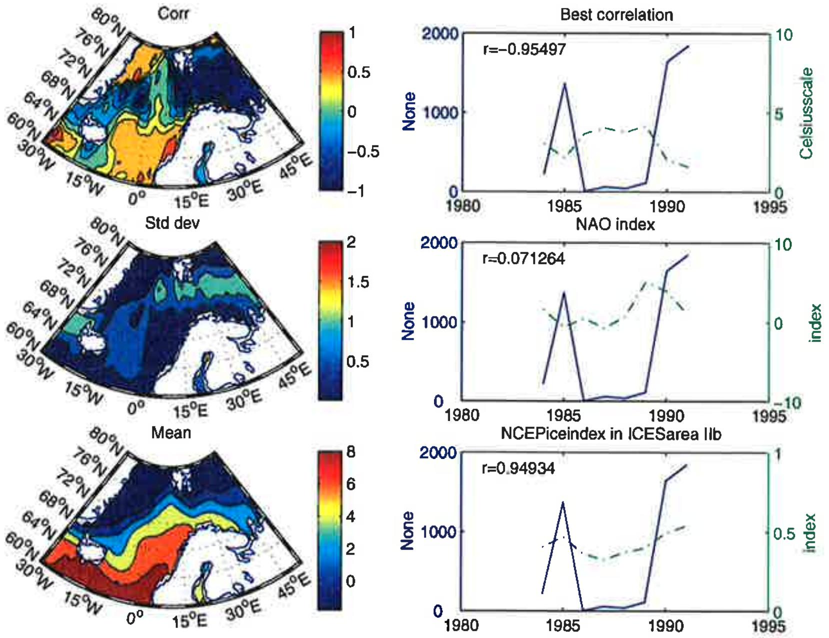

Figure 4.43: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod Early juvenile index. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Oct month in the interval [Oct81 Oct88] in the IGOSS variable and in the timinterval[1984 1991] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.7 IGOSS sst - North East Artic Cod VPA stock biomass at age

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.668	-0.491	0.117	0.269	0 Years	Jan82 Jan98	1982 1998
0.782	-0.498	0.231	0.269	1 Years	Jan82 Jan97	1983 1998
0.816	-0.493	0.092	0.298	2 Years	Jan82 Jan96	1984 1998
0.62	-0.785	-0.039	0.306	3 Years	Jan82 Jan95	1985 1998

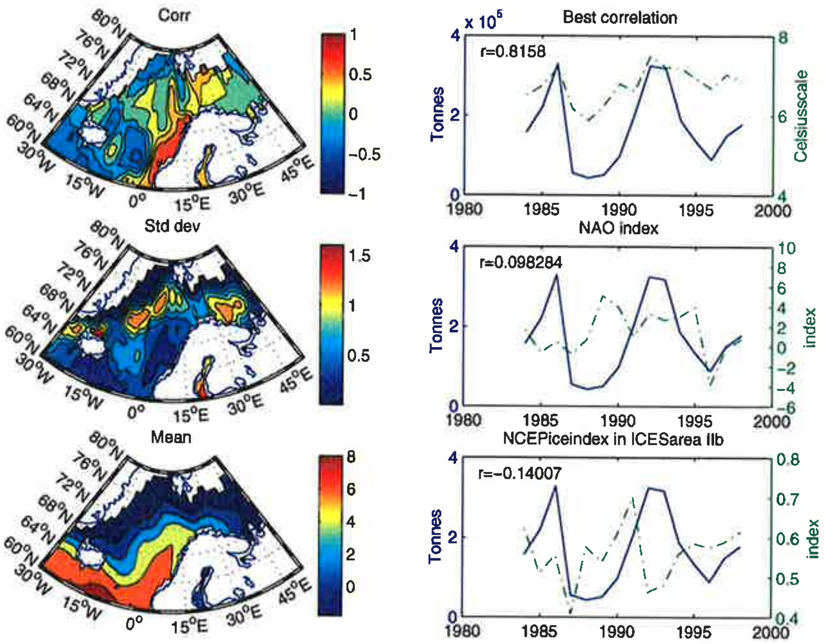

Figure 4.44: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod VPA stock biomass at age. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan82 Jan96] in the IGOSS variable and in the timinterval[1984 1998] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Oct months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.753	-0.753	0.001	0.276	0 Years	Oct81 Oct98	1981 1998
0.611	-0.527	0.102	0.253	1 Years	Oct81 Oct97	1982 1998
0.725	-0.288	0.209	0.223	2 Years	Oct81 Oct96	1983 1998
0.637	-0.856	-0.014	0.247	3 Years	Oct81 Oct95	1984 1998

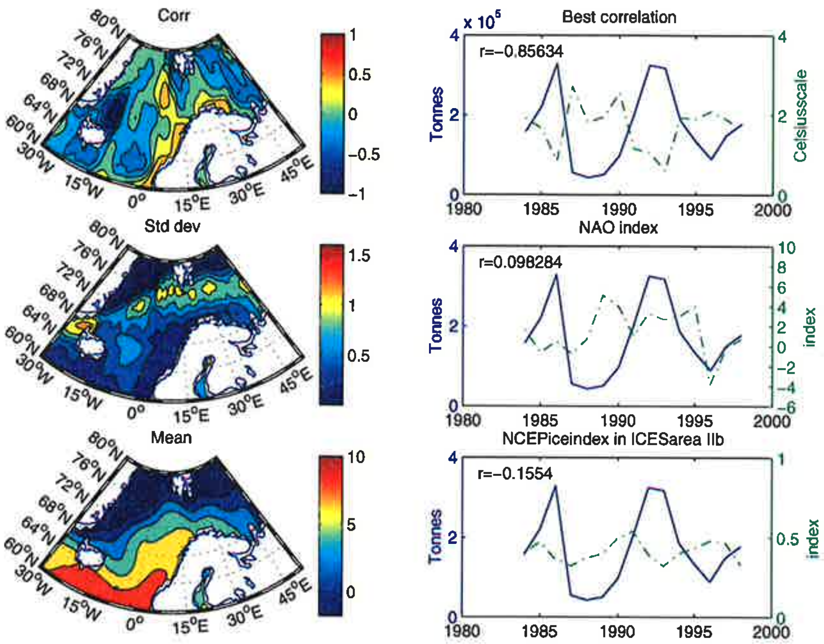

Figure 4.45: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod VPA stock biomass at age. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 3 years. The analysis is done for every Oct month in the interval [Oct81 Oct95] in the IGOSS variable and in the timinterval[1984 1998] for the fishvariable. The time axis represents the biological variable where there is a timelag.

4.11.8 IGOSS sst - North East Artic Cod VPA stock number at age

Jan months

Max Corr	Min Corr	Mean Corr	Std Corr	Timelag	sst	Bio. variable
0.706	-0.495	0.147	0.262	0 Years	Jan82 Jan98	1982 1998
0.806	-0.574	0.233	0.266	1 Years	Jan82 Jan97	1983 1998
0.866	-0.741	0.165	0.371	2 Years	Jan82 Jan96	1984 1998
0.744	-0.57	0.122	0.289	3 Years	Jan82 Jan95	1985 1998

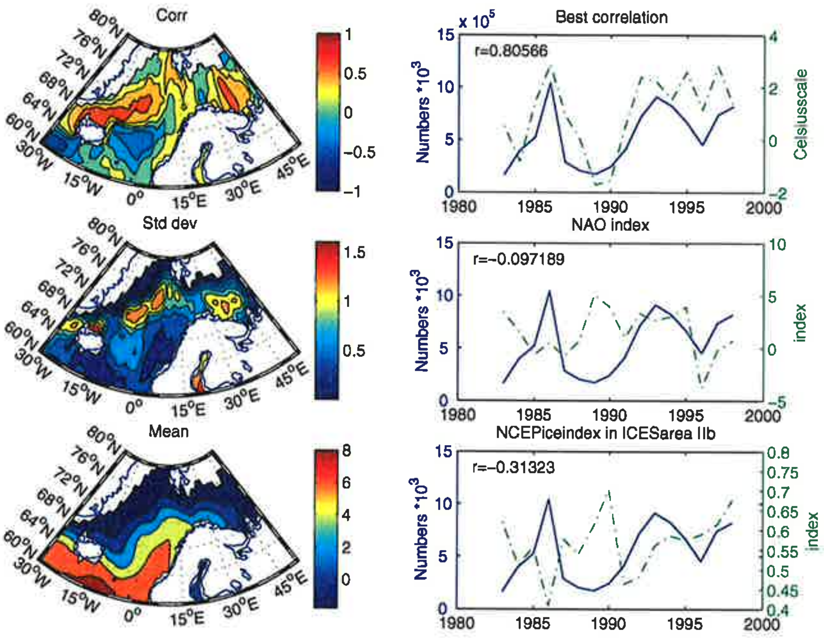

Figure 4.46: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod VPA stock number at age. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 1 years. The analysis is done for every Jan month in the interval [Jan82 Jan97] in the IGOSS variable and in the timinterval[1983 1998] for the fishvariable. The time axis represents the biological variable where there is a timelag.

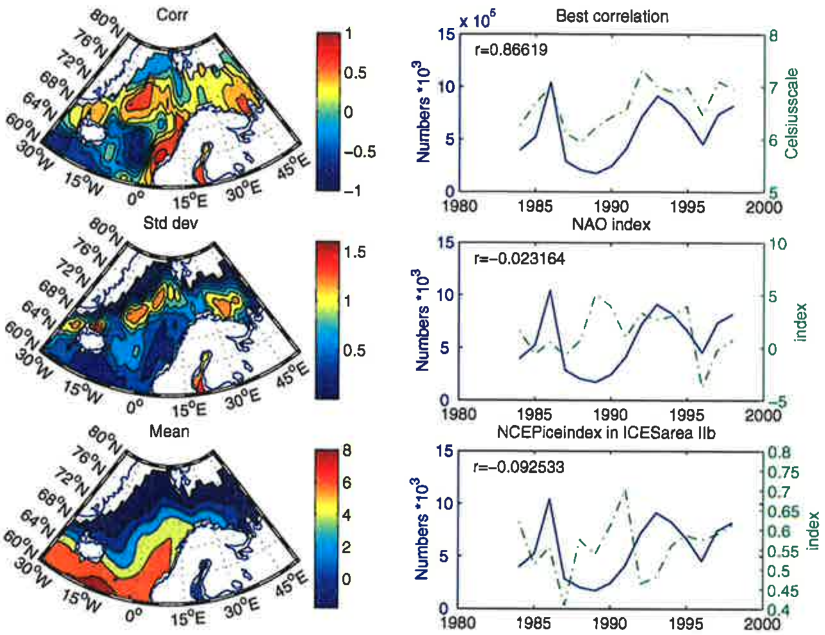

Figure 4.47: Correlation plot between IGOSS sst in *Celsiusscale* and North East Artic Cod VPA stock number at age. The solid line represents the biological variable. The timedifference between the IGOSS variable and the fish timeserie is 2 years. The analysis is done for every Jan month in the interval [Jan82 Jan96] in the IGOSS variable and in the timinterval[1984 1998] for the fishvariable. The time axis represents the biological variable where there is a timelag.

Appendix A

Variabelnames

A.1 Biological Variables

A.1.1 Fish

- Barents Sea Capelin O-group index in August
- Barents Sea Capelin Catch in 1000 tonnes
- Barents Sea Capelin Larval abundance in June
- Barents Sea Capelin Spawning stock biomass
- Barents Sea Capelin Total stock biomass
- Norwegian Coastal Cod Catch in tonnes
- North East Artic Cod 0-group index
- North East Artic Cod Catch in numbers
- North East Artic Cod Catch in tonnes
- North East Artic Cod Early juvenile index
- North East Artic Cod VPA spawning stock biomass at age
- North East Artic Cod VPA stock biomass at age - First year only
- North East Artic Cod VPA stock number at age - First year only
- Greenland Halibut Catch in tonnes
- North East Artic Haddock Catch in tonnes
- Norwegian Spring Spawning Herring O-group index
- North East Artic Saith Catch in tonnes

A.2 Physical Variables

A.2.1 NCEP

- PRESsfc
  Pressure at sea surface.
- ICECsfc
  Ice concentration
- SKTsfc
  Skin temperature at sea surface as described in Kalnay and Coauthors (1996).
- NLWRSsfc
  Net Long Wave Radiation at sea surface.
- RUNOFsfc
  Water Runoff
- LHTFLsfc
  Latent Heat Net Flux at sea surface.
- UFLXsfc
  Zonal component of momentum flux at sea surface.
- VFLXsfc
  Meridional component of momentum flux at sea surface.
- SHTFLsfc
  Sensible Heat Net Flux at sea surface.
- PRATEsfc
  Precipitation Rate
- TCDCeatm
  Total Cloud Cover, entire atmosphere.
- DSWRFsfc
  Downward Short Wave Radiation Flux at sea surface.
- NSWRSsfc
  Net Short Wave Radiation Flux at sea surface
- AIR2m
  Air Temperature 2m above sea level.
- UWND10m
  Zonal component of Windspeed at 10 m above sea level.
- VWND10m
  Meridional component of Windspeed at 10 m above sea level.

A.2.2 IGOSS

- sst
  Sea Surface Temperature from satelites.

A.2.3 NAO

- NAOStGb
  The North Atlantic Oscillation between Iceland and Gibraltar.
- NAOStLi
  The North Atlantic Oscillation between Iceland and Lisboa.
- NAOWinterStGb
  The winter mean, December to March, of the North Atlantic Oscillation between Iceland and Gibraltar.
- NAOWinterStLi
  The winter mean, December to March, of the North Atlantic Oscillation between Iceland and Lisboa.

A.2.4 Iceindex

- NCEPiceindex
  Iceindex derived from NCEP data.
- MonArciceindex_MY
  Iceindex derived from Norsex Multi Year ice consentration data.
- MonArciceindex_TOTAL
  Iceindex derived from Norsex Total Ice Consentration data.

Appendix B

Acknowledgements

COADS, Woodruff *et al.* (1987)

COADS data are provided by the US National Center for Atmospheric Reseach and the US National Oceanic and Atmospheric Administration from the website:
`http://www.cdc.noaa.gov/coads/egs_paper.html`

NAO index, Hurrell (1995)

The Lisbon-Stykkishamn NAO index is provided by the Ucar Climate and Global Dynamics Division from their Website :
`http://www.cgd.ucar.edu/cas/climind/`

IGOSS, Reynolds and Smith (1994)

IGOSS data is provided by The International Research Institute for climate prediction (IRI) from their website:
`http://ingrid.ldeo.columbia.edu`

Iceindexes

NCEP Ice Index data and MonArc Ice Index data is provided by the Nansen Environmental and Remote sensing Center, Bergen, Norway. The NCEP Ice Index data is derived from NCEP Reanalysis Ice Concetration, and the Mon Arc Ice concentration data is derived from Mon Arc Total Ice Concetration Data

Ice Concentration data

Multi Year Ice Concentratioon data from the Team algorithm is provided by the EOS Distributed Active Archive Center (DAAC) at the National Snow and Ice Data Center, University of Colorado, Boulder, CO, US.

Norsex Sea Ice Concentration, Johannesen *et al.* (1999)

The ice concentration data have been taken from O.M Johannesen, E.V.Shalina and M.W.Miles 'NORSEX CD-ROM that was prodiced by the Nansen Environmental and Remote Sensing Center(NERSC), Bergen Norway and Nansen International Environmental and Remote sensing Center(NIERSC), St.Petersburg, Russia.

NCEP Reanalysis data, Kalnay and Coauthors (1996)

NCEP Reanalysis data provided by the NOAA-CIRES Climate Diagnostics Center, Boulder, Colorado, USA, from their Web site at:
`http://www.cdc.noaa.gov/`

Biological variables

Fishery statistics, VPA model data and indices are provided by Institute of marine research, Bergen, Norway and the International Council for the Exploration of the Sea (ICES).

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