Influence of Climate Change on the Changing Arctic and Sub-Arctic Conditions

edited by

/

Jacques C.J. Nihoul

University of Liege, Belgium

and

Andrey G. Kostianoy

P.P. Shirshov Institute of Oceanology Russian Academy of Sciences Moscow, Russia

4Q Springer

Published in cooperation with NATO Public Diplomacy Division

Contents

Contributors	xi
Overture	1
Jacques C.J. Nihoul and Louis Fortier	
Oceanography and surveillance of the rapidly changing Arctic	
and Sub-Arctic	1
A problem of sovereignty and security	
Global warming effects on the Arctic and Sub-Arctic Seas	7
Jacques C.J. Nihoul"	
The North Atlantic Oscillation (NAO)	7
The NAO strange attractors	
References!	12
The case for global warming in the Arctic	13
James E. Overland	
Introduction	13
How do we know we are not wrong?	15
Arctic change	
Data	
Models	19
2007 sea ice loss-the fast track of Arctic change	20
Conclusion	
References	23
A coherency between the North Atlantic temperature nonlinear trend,	
the eastern Arctic ice extent drift and change in the atmospheric	
circulation regimes over the northern Eurasia	25
Oleg M. Pokrovsky	
Introduction	25
North Atlantic and Arctic SST trends	
Modulation of the ice extent in Kara Sea	
Rapid increasing of SST in Kara and Laptev Seas	
Modulation of the sea level pressure over northern Asia	
The Arctic dipole and North Siberian oscillation	
Changes in atmospheric circulation regimes	
Modulation of the surface air temperature	
Discussion and conclusion.	34
References.	35

Mesoscale atmospheric vortices in the Okhotsk and Bering Seas: resul	
of satellite m ultisensor study	37
Leonid M. Milnik ,	
Introduction	37
Climatology	38
Satellites and sensors	
Simulation of the AMSR-E brightness temperatures and retrieval	
algorithm development	41
Data	44
Mesoscale cyclones	
Okhotsk Sea'	45
Bering Sea	
Discussion and conclusions.	53
References.	55
i'	
Recent sea ice ecosystem in the Arctic Ocean: a review	57
Igor A. Melnikov	
Introduction	57
Sea ice extent and thickness.	
Physical-chemical variables. *,	
Sea ice biota	
Discussion and conclusions	
References	
The effects of irradiance and nutrient supply on the productivity	
of Arctic waters: a perspective on climate change	73
Jean-Eric Tremblay and Jonathan Gagnon	
Introduction	73
Data mining	
General properties of the data set	
The roleof irradiance	
Onset of the productive season.	
Cumulative irradiance.	
The role of nutrients.	
Allochthonous nitrate.	
The contribution of new and regenerated production	
Implications, perspectives and future research	
References.	

Production of pliytoplankton in the Arctic Seas and its response	0.5
on recent warming	95
Introduction'.	
Materials and methods	
Primary production	
Response on recent wanning	
Conclusions	
Reconstruction of oceanic circulation using mineralogical and isotopical (Nd/Pb) signatures of deep sea sediments: the case study of the northern North Atlantic and some perspectives for the Arctic	
Introduction !'	
Present distribution of deep water masses in northern North Atlantic	
Calibration of proxies on surface sediments from northern North Atlantic. The clay mineralogical tool	
The Nd and Pb isotopical tool.	
Results and discussion.	
Holocene variability of deep current supplies.	15
Long term stability of deep current supplies (ODSP 646)	17
Conclusion and perspectives	121
References	122
Observing and interpreting the seasonal variability of the oceanographic fluxes passing through Lancaster Sound of the Canadian Arctic Archipelago	125
	100
Introduction Mooring instrumentation	
Ocean parameters	
Ice velocities, drafts and fluxes	
Ocean fluxes.	
Wind forcing	
Conclusion	
References	142
River flux of dissolved organic carbon (DOC) and particulate organic carbon (POC) to the Arctic Ocean: what are the consequences of the global changes?	145
Introduction	1/15
River water and sediment discharges.	
Probable increase of DOC concentration and flux by 2100	

viii ' Contents

Probable increase of POC and TOC fluxes by 2100	154
Discussion	
Conclusion , , , , , , , , , , , , , , , , , , ,	
References.	158
Mechanisms of the recent sea ice decay in the Arctic Ocean related	
to the Pacific-to-Atlantic pathway	161
Motoyoshi Ikeda	
Introduction	161
Arctic pathway	
Wind-induced ice cover variability	
Discussion !	
References.	169
Frontal zones in the Norwegian, Greenland, Barents and Bering Seas.	171
Audrey G. Kostianoy and Jacques C.J. Nihoul	
Introduction	171
Definitions ;	
Frontal zones in the Norwegian and Greenland seas.	
Frontal zones in the Barents Sea	
Frontal zones in the Bering Sea	
Conclusions	
References. '	189
How do the very small-sized aquatic microbes influence the very	
large-scale biogeochemical cycles?	191
Louis Legendre and Richard B. Rivkin	
Microbes in pelagic systems	191
Physiological characteristics, large standing stocks, and unique	
positions of microbes in pelagic food webs	192
Food-web functioning	
Biogeochemical roles of microbes.	
Environmental effects, including climate change	
General conclusions.	205
References	206
Social, economic, legal and political issues of the Russian Arctic	209
Igor S. Zonn	207
The Arctic Zone of Russia (AZR)	
The population of Russian Arctic	
Oil and gas of Russian Arctic	
Russian Arctic economy	
Arctic regional direction	214

Contents

Legal regional of Arctic	215
Sectoral principle	
The second "Internationalization" principle that was proposed	
still in the early 1970s is supported by USA, Norway, Denmark	216
Legal hot spots in Arctic.	216
Struggle for the Lomonosov Ridge	
Conclusions	219
References	
Two US programs during IPY	221
William J. Wiseman, Jr., Martin O. Jeffries, Clarence Pautzke	
william J. Wiseman, Jr., Martin O. Jeffries, Clarence I autzke	
and Francis Wiese	
and Francis Wiese	221
and Francis Wiese Introduction	
IntroductionThe Arctic Observing Network	222
Introduction. The Arctic Observing Network. Background.;,'	222 222
Introduction The Arctic Observing Network Background;' The NSF Arctic Observing Network,	222 222 223
Introduction The Arctic Observing Network Background;' The NSF Arctic Observing Network,	222 222 223 226
Introduction The Arctic Observing Network. Background;,' The NSF Arctic Observing Network. International relationships;	222 223 226 227
Introduction	
Introduction The Arctic Observing Network Background;,,' The NSF Arctic Observing Network International relationships	
Introduction	