

# Contents

<b>Preface</b> . . . . .	vii
<b>List of figures</b> . . . . .	ix
<b>List of tables</b> . . . . .	xiii
<b>List of abbreviations and acronyms</b> . . . . .	xv
<b>Introduction</b> . . . . .	xvii
<b>1 Arctic sea ice as an element of the global climate system</b> . . . . .	1
1.1 Patterns of interaction among Arctic processes in the global climate system . . . . .	1
1.2 Major effects of Arctic sea ice on the climatic system . . . . .	2
1.3 Stability of the sea ice cover in polar regions . . . . .	5
<b>2 Long-term changes in Arctic Seas ice extent during the twentieth century</b> . . . . .	7
2.1 Characteristics of sea ice data in the Arctic Seas . . . . .	7
2.2 Seasonal and regional characteristics of ice extent trends in the twentieth century . . . . .	11
2.3 The polycyclic character of long-term changes in ice extent . . . . .	16
2.4 The “60-year” cycle and its role in ice extent changes in various regions . . . . .	19
2.5 20- and 10-year cycles and their role in ice extent changes . . . . .	23
2.6 Short-period variability of Arctic Seas ice extent . . . . .	23
<b>3 Variability of sea ice thickness and concentration in the twentieth century</b> . . . . .	29
3.1 Ice thickness variations . . . . .	29
3.2 Changes in ice concentration . . . . .	35

<b>4</b>	<b>Consistency among sea ice extent and atmospheric and hydrospheric processes</b> . . . . .	37
4.1	Long-term changes in Arctic air temperature . . . . .	37
4.2	Long-term changes in atmospheric pressure fields and atmospheric circulation indices . . . . .	42
4.3	Climatic changes in the Arctic Basin ice-drift pattern . . . . .	53
4.4	Changes in ice exchange between the Arctic Basin, marginal seas, and the Greenland Sea . . . . .	56
4.4.1	Ice export through Fram Strait . . . . .	56
4.4.2	Ice exchange between the Arctic Seas and the Arctic Basin . . . . .	62
4.5	Long-term changes in multiyear ice extent in the Arctic Basin . . . . .	69
4.6	Long-term changes in some water mass characteristics of the Arctic Ocean . . . . .	72
4.7	Long-term changes in river runoff . . . . .	83
<b>5</b>	<b>Possible causes of changes in climate and in Arctic Seas ice extent</b> . . . . .	89
5.1	To the question of anthropogenic impact on sea ice extent variability . . . . .	89
5.2	The influence of solar activity on climate and the ice cover . . . . .	94
5.3	Possible influence of self-oscillations in the ocean ice–atmosphere system. . . . .	105
5.4	Solar system disymmetry and its influence on solar energy flux to the Earth. . . . .	108
<b>6</b>	<b>Assessment of possible changes in air temperature and sea-ice extent in the Arctic Seas in the twenty-first century</b> . . . . .	113
6.1	Brief review of the methodologies applied . . . . .	113
6.2	Assessment of expected changes in air temperature and sea-ice extent based on cyclic fluctuations . . . . .	114
6.3	Sea-ice variability during 2003–2008 . . . . .	117
<b>7</b>	<b>Conclusions</b> . . . . .	131
<b>APPENDICES</b>		
<b>A</b>	Mean monthly ice extent values in April and August for the Eurasian Arctic Seas for 1900–2008. . . . .	135
<b>B</b>	Mean annual surface air temperature (SAT) in the zone from 70–85°N for 1900–2007. . . . .	141
<b>C</b>	Mean annual zonality index in the atmosphere of the zone from 40–65°N for 1900–2007 . . . . .	143
<b>References</b> . . . . .		145
<b>Index</b> . . . . .		161