

Ice Overview

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and Liis Sipelgas



Linking Estonia and Latvia
Part-financed by the European Regional Development Fund

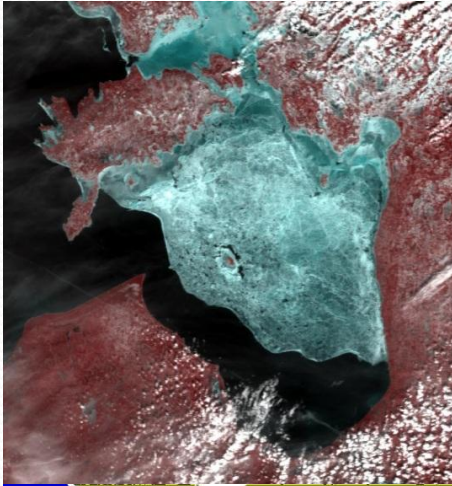


European Union

Introduction

- Definition of winter scenarios
- Percentage of time that each pixel was covered by ice for different winter scenarios (ice probability)
- Ice formation date
- Ice melt date

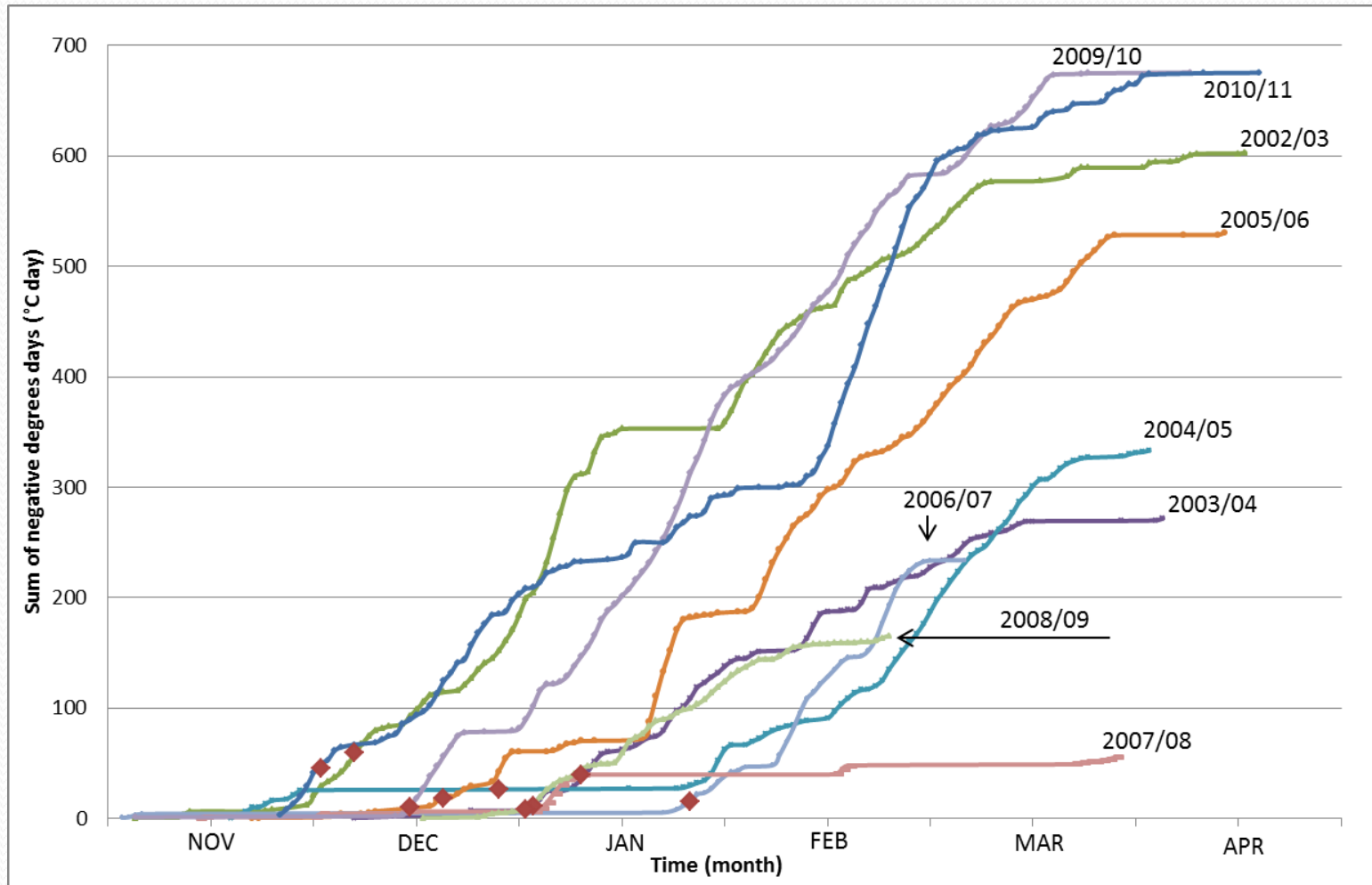
Methods and Image analysis



- Satellite image(MODIS Terra and Aqua) analysis was performed for years 2002-2011.
- Ice was distinguished from open water using reflectance value .
- Based on the bimodal histogram the water and Ice are classified.



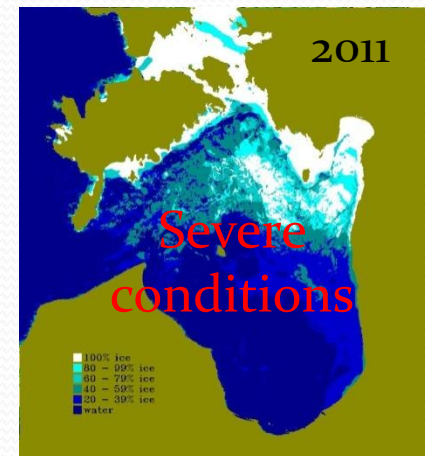
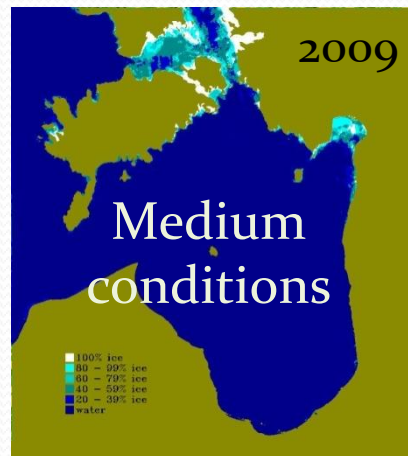
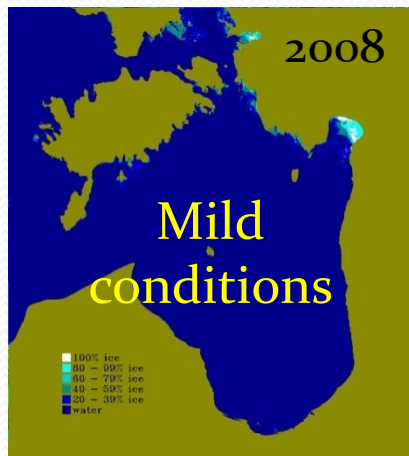
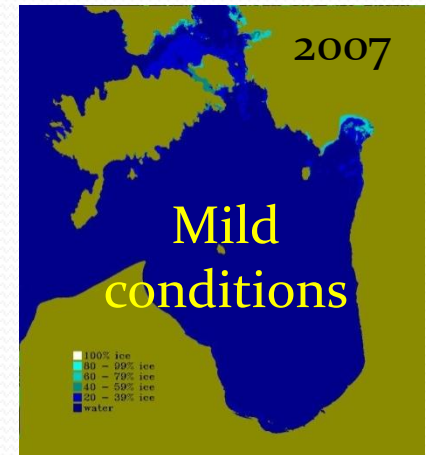
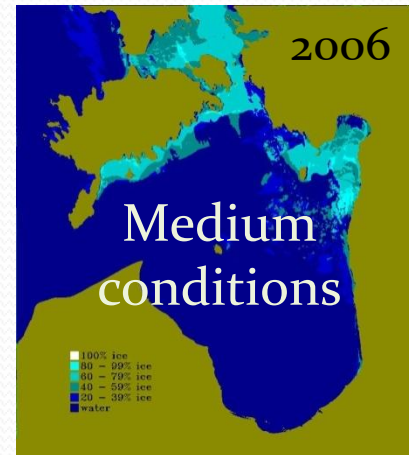
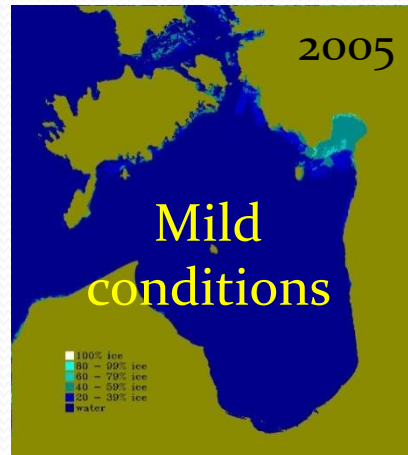
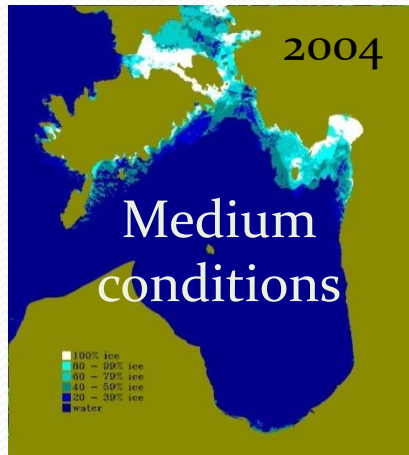
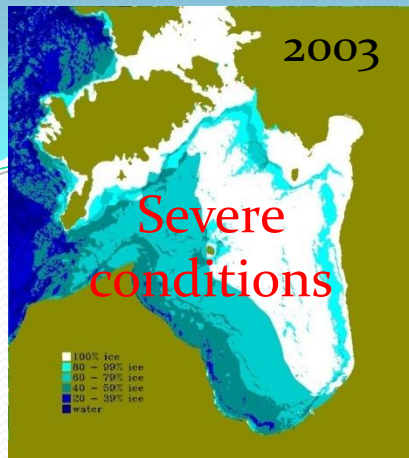
Sum of negative degrees days



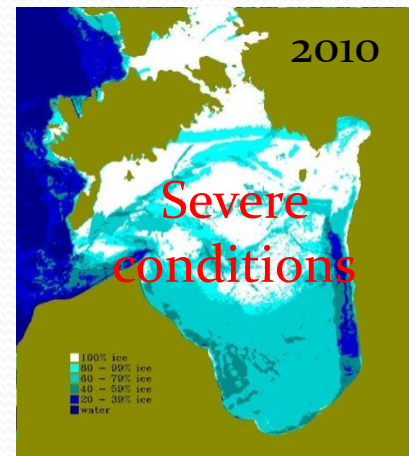
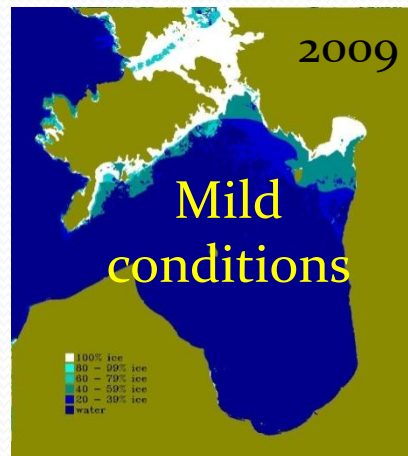
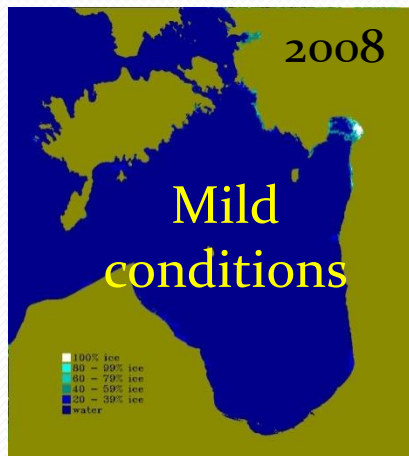
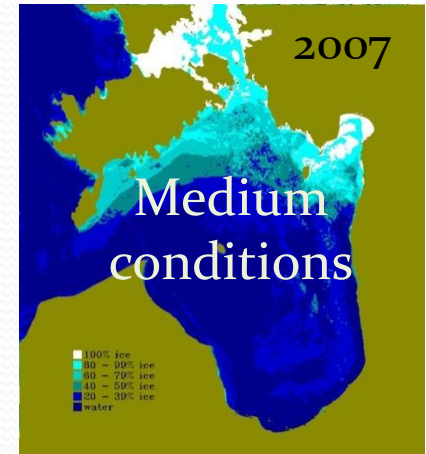
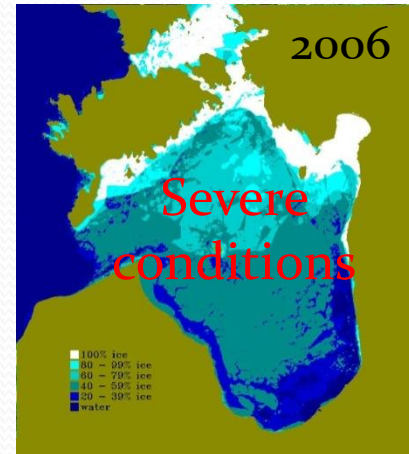
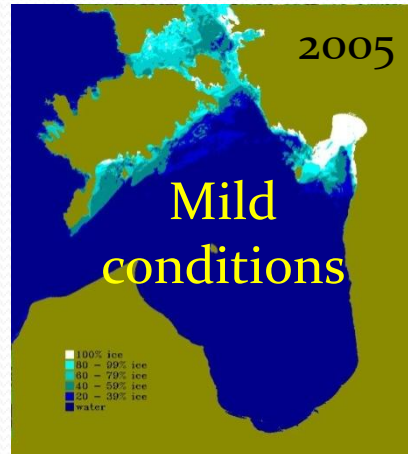
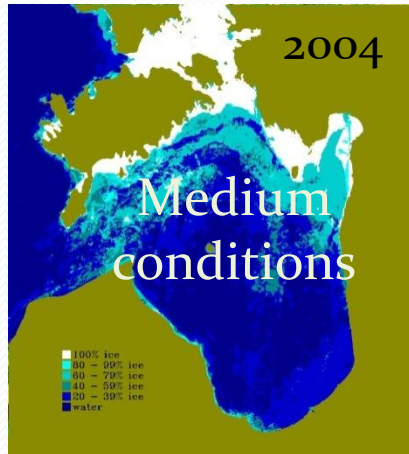
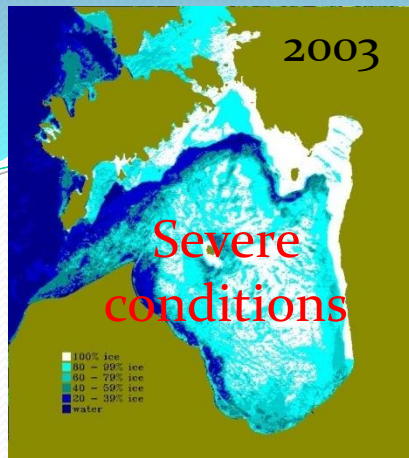
Ice seasons during 2002-2011

Winter	First ice	Last ice	Length of the ice season (days)
2002/2003	06.12.2002	30.04.2003	145
2003/2004	01.01.2004	12.04.2004	102
2004/2005	21.12.2004	17.04.2005	117
2005/2006	19.12.2005	30.04.2006	132
2006/2007	24.01.2007	01.04.2007	67
2007/2008	14.01.2008	19.04.2008	96
2008/2009	01.01.2009	08-04-2009	97
2009/2010	14.12.2009	28.04.2010	135
2010/2011	01.12.2010	28.04.2011	148

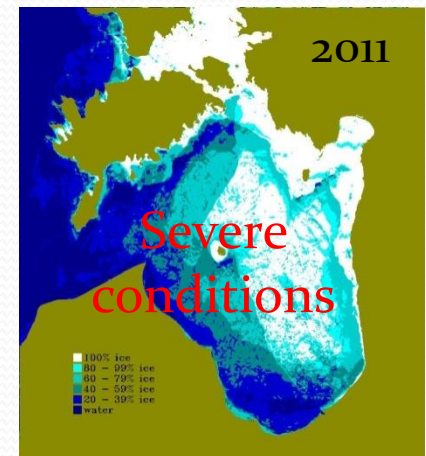
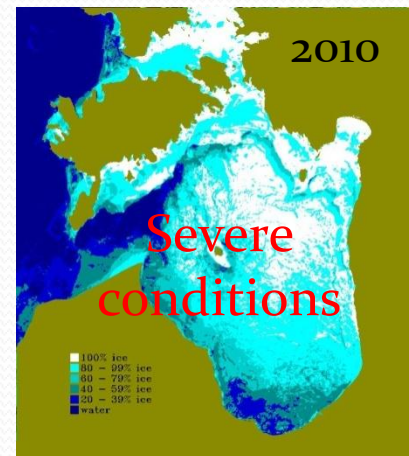
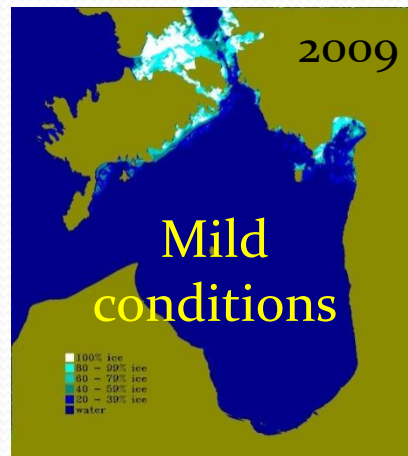
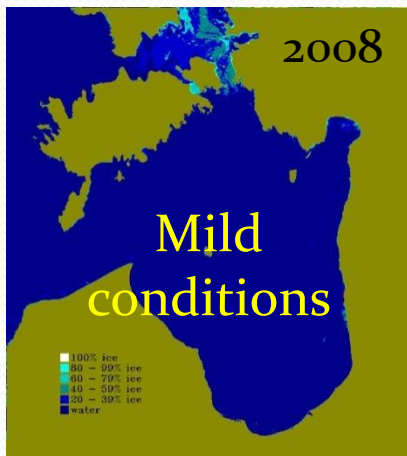
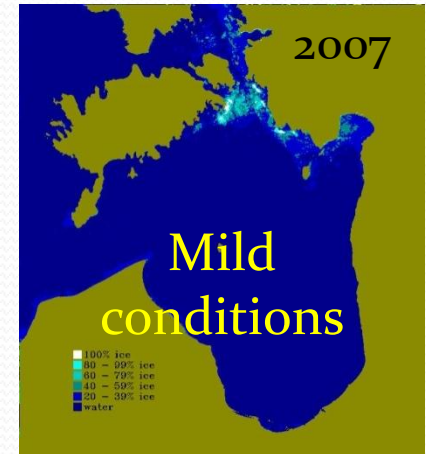
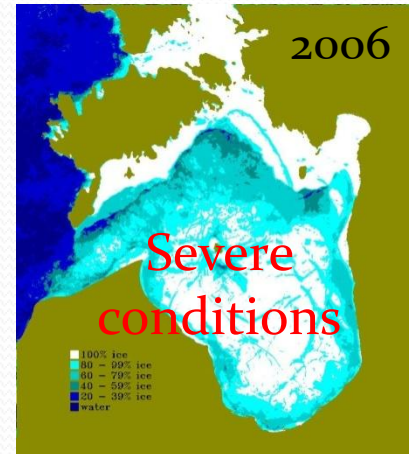
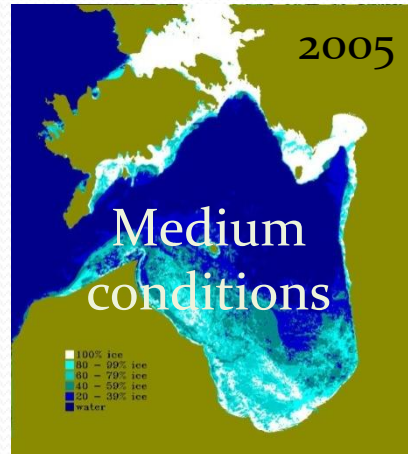
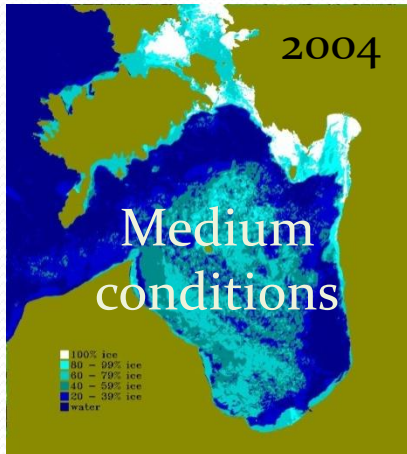
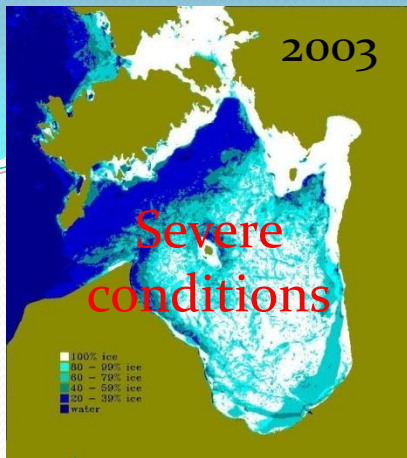
January average ice coverage



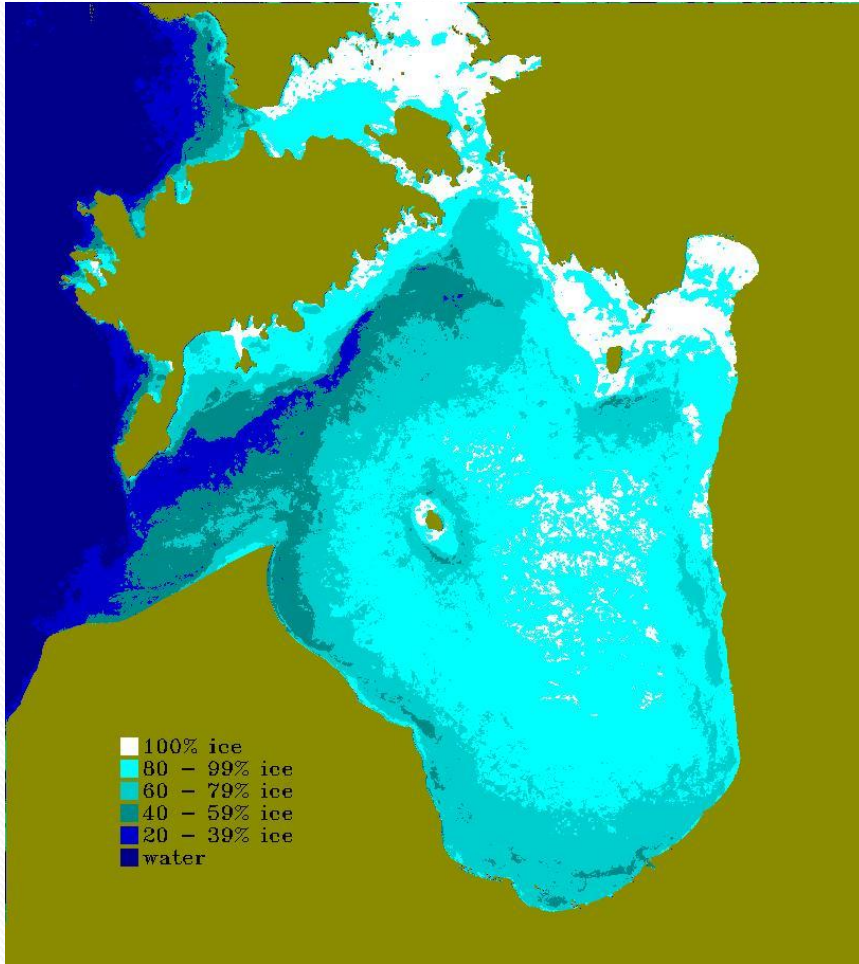
February average ice coverage



March average ice coverage



Severe winters



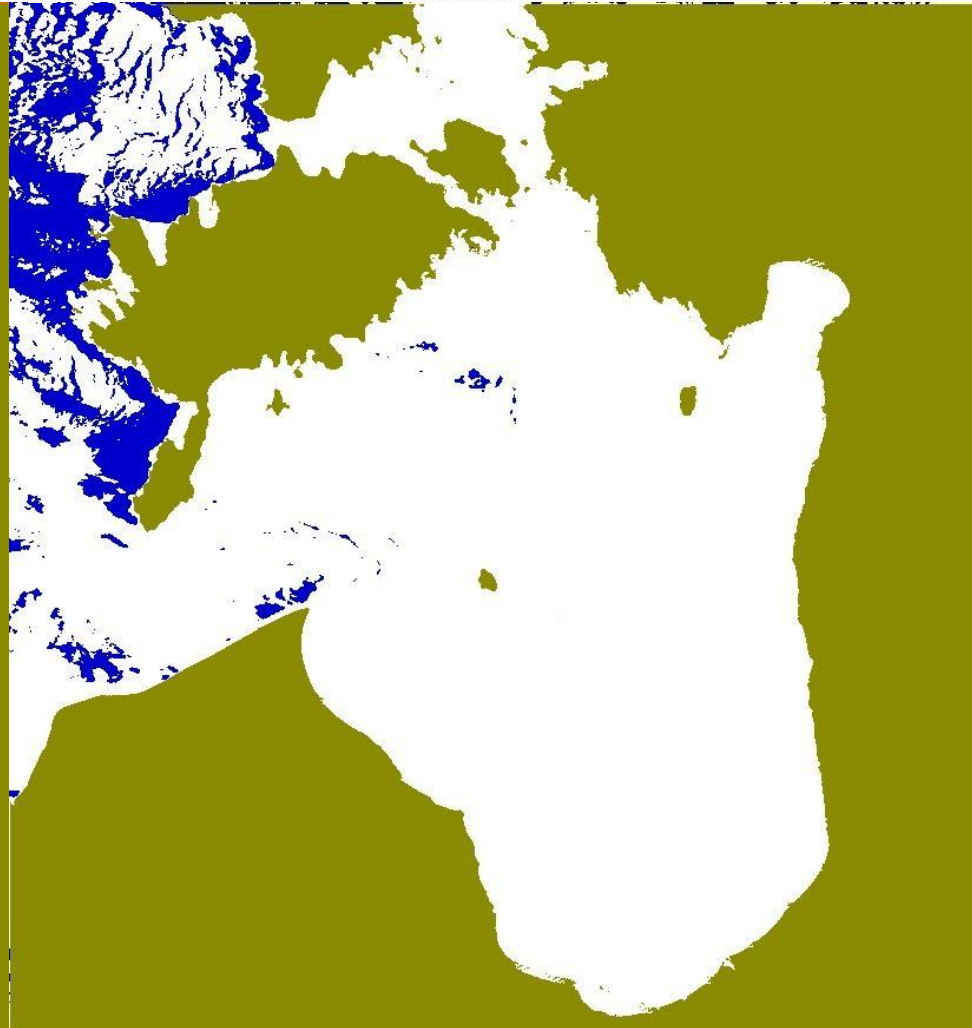
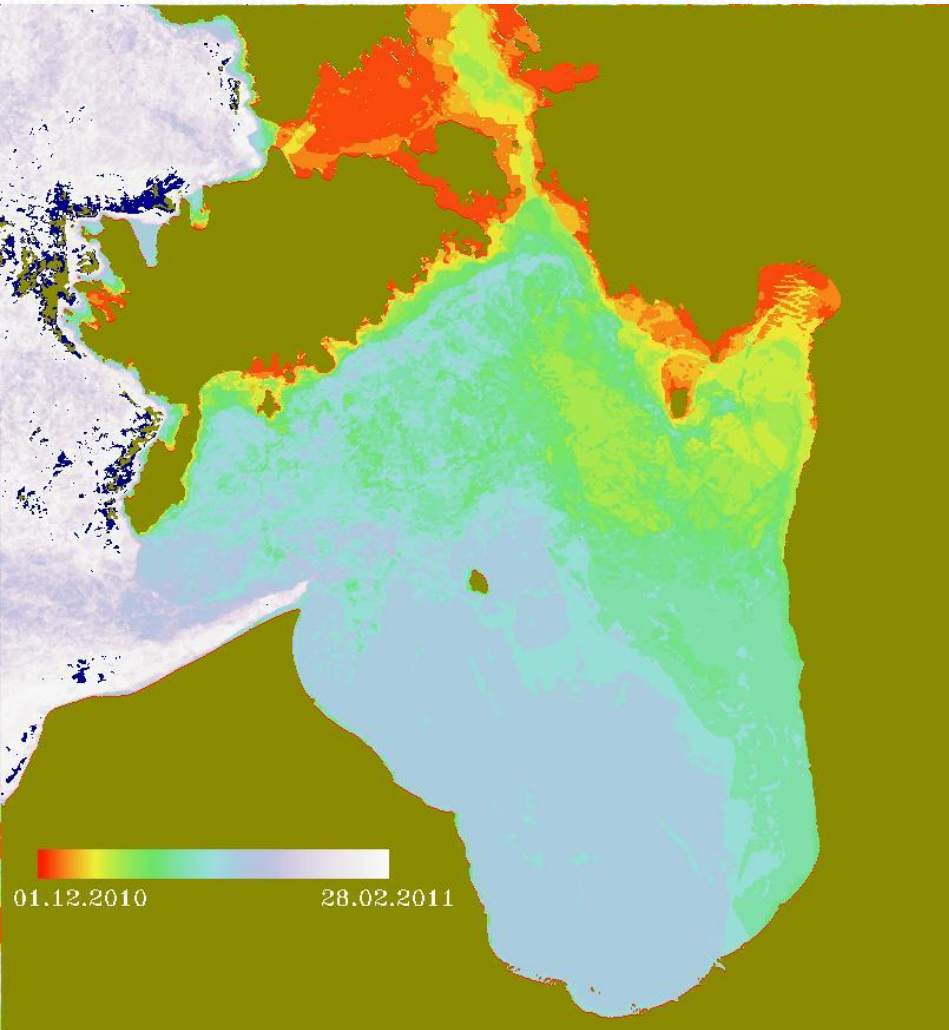
Severe
2003,2006,2010,2011

Ice coverage	Area (km ²)	Percentage of study area
100%	2173,8	9,6%
80-99%	8340,4	36,9%
60-79%	4716,6	20,8%
40-59%	2177,6	9,6%
20-39%	1246,3	5,5%
Water	3979,9	17,6%

Image showing the percentage of time that each pixel was covered by ice

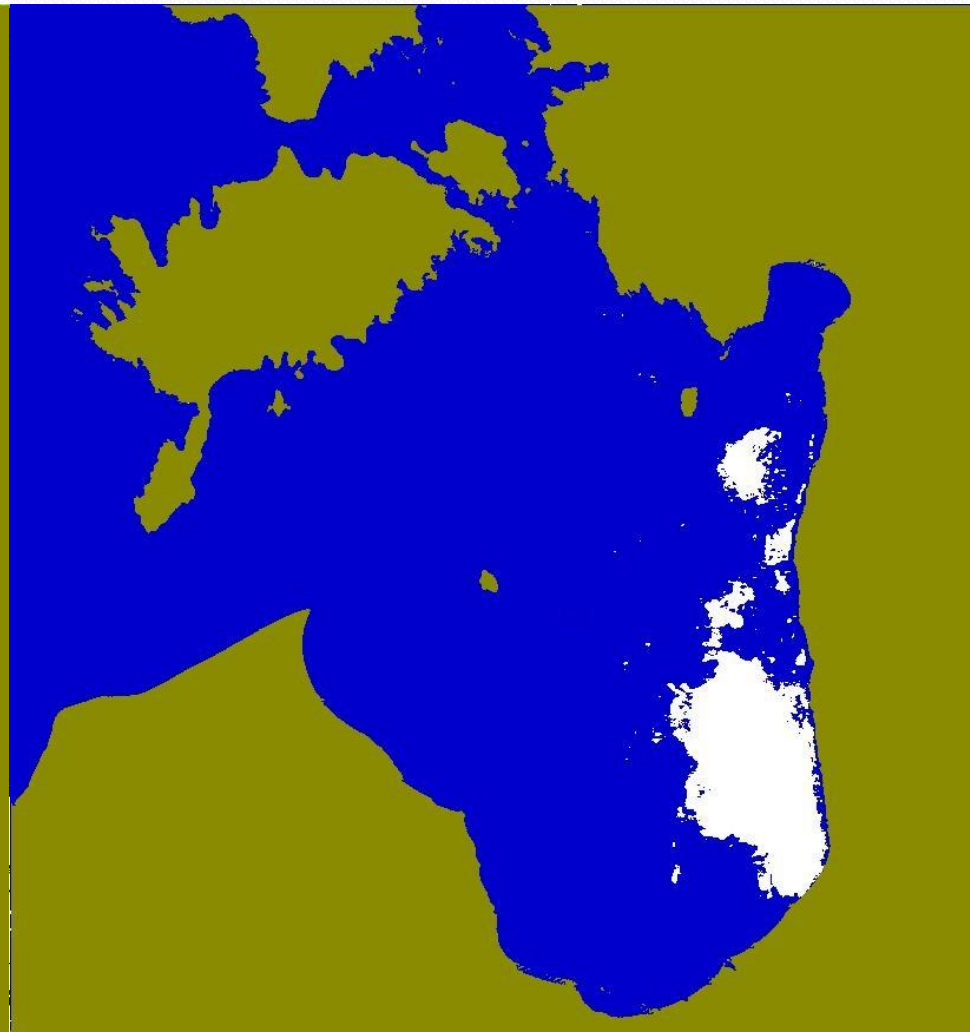
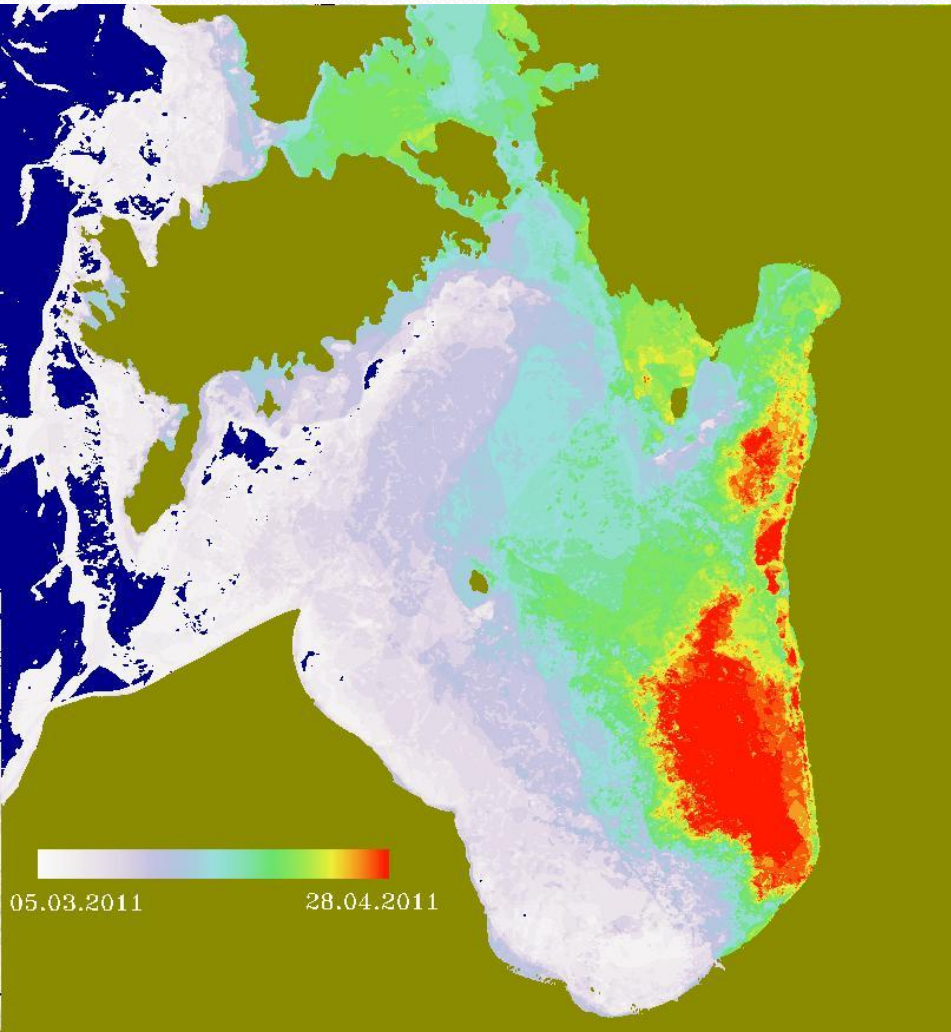
Ice formation:

01.12.2010-28.02.2011

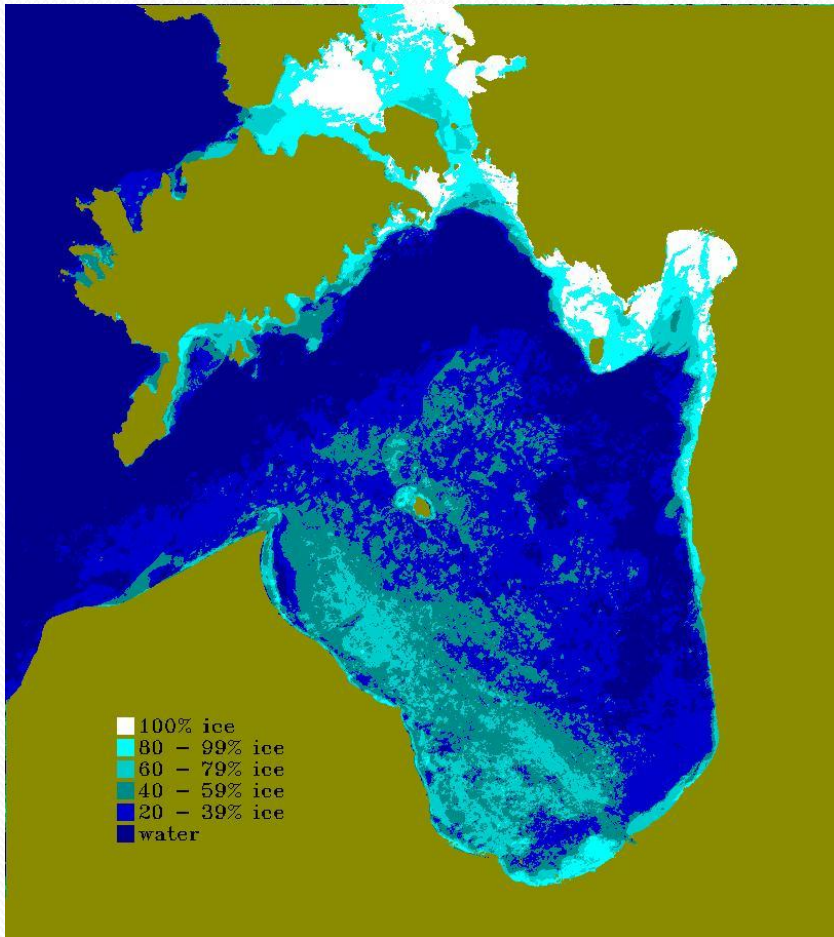


Ice melt:

05.03.2011-28.04.2011



Medium winters



Medium
2004,2005







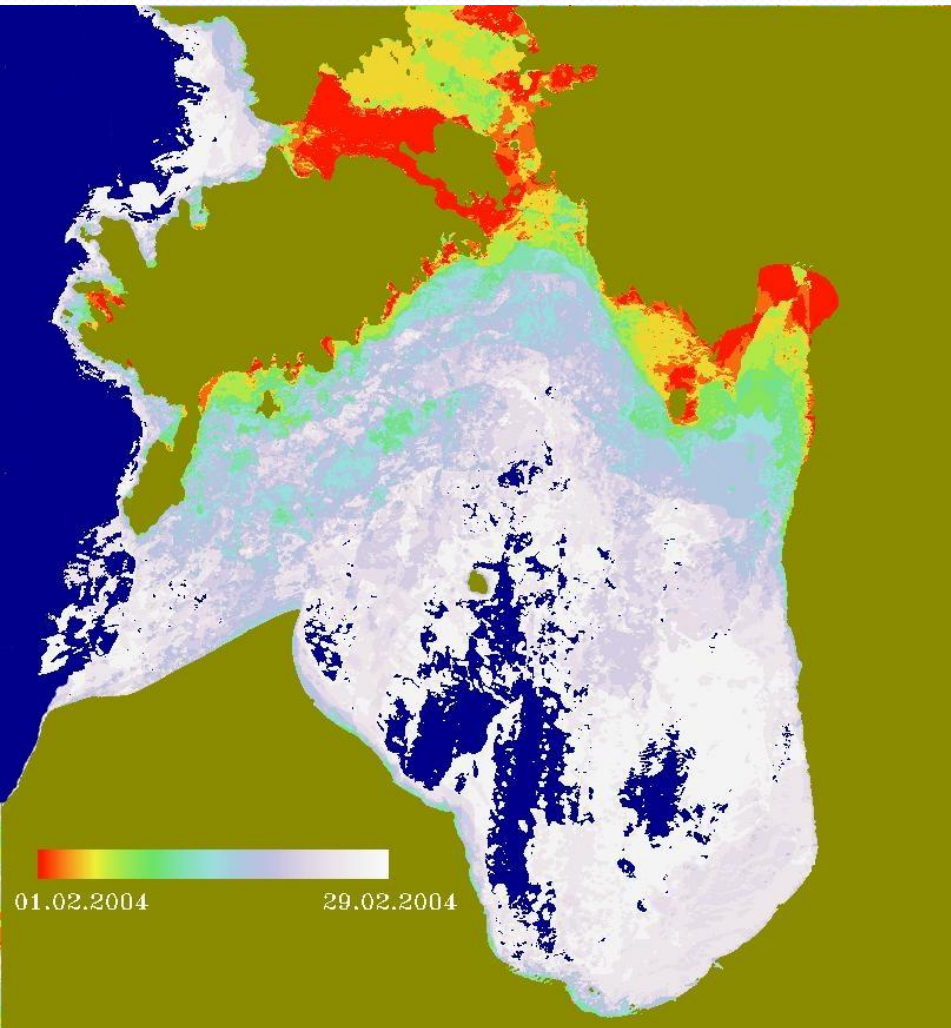
	Ice coverage	Area (km ²)	Percentage of study area
	100% ice	1070,6	4,7%
	80-99% ice	1480,9	6,5%
	60-79% ice	1791,9	7,9%
	40-59% ice	3703,6	16,3%
	20-39% ice	5415,7	23,9%
	Water	9218,5	40,7%

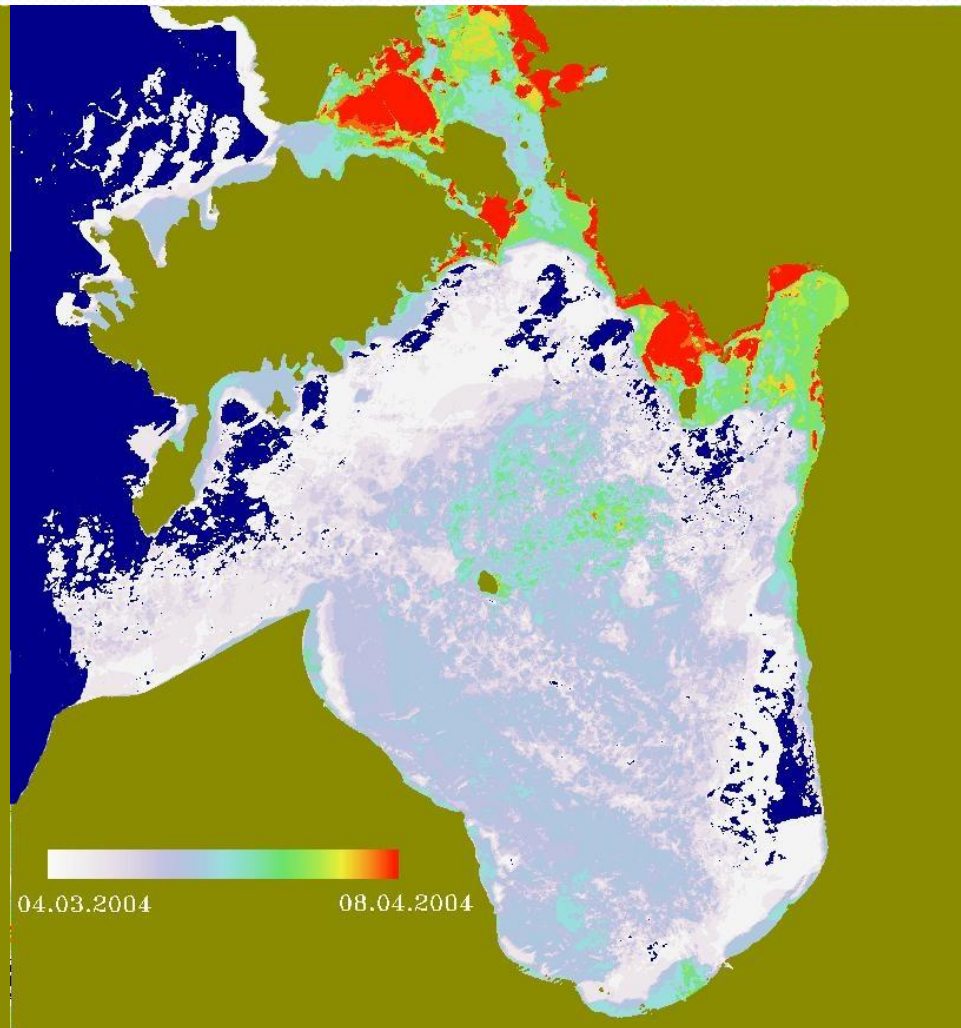
Image showing the percentage of time that each pixel was covered by ice

01.01.2004-08.04.2004

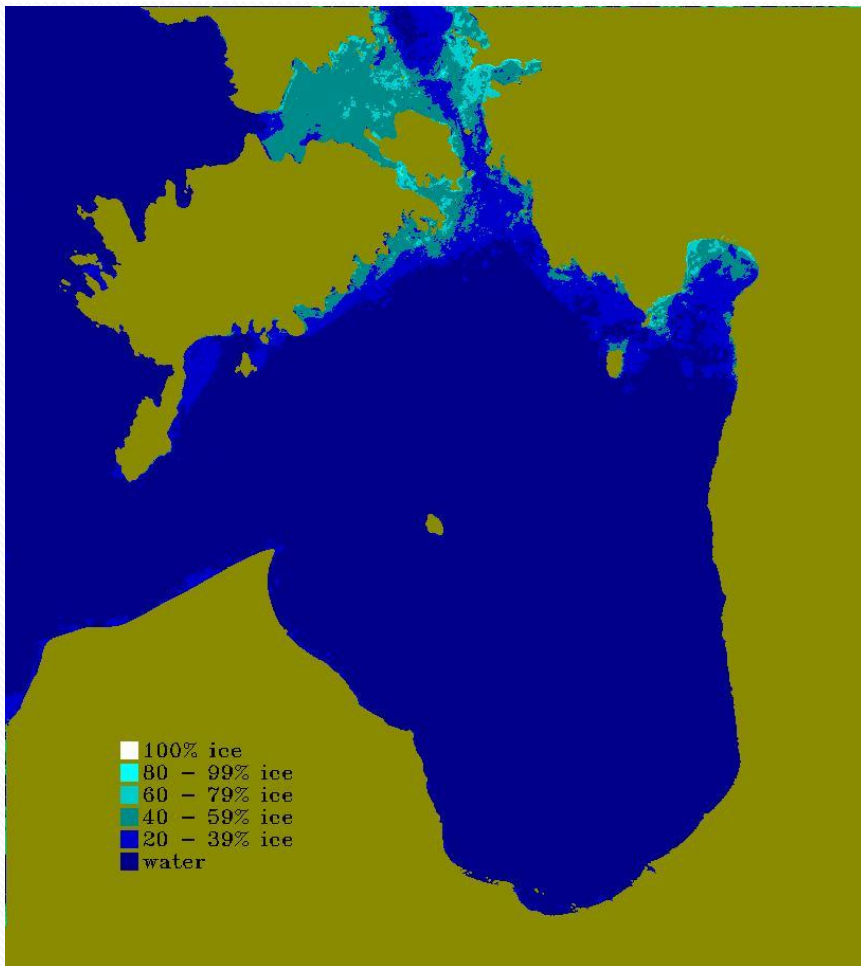
Ice formation:



Ice melt:



Mild Winters



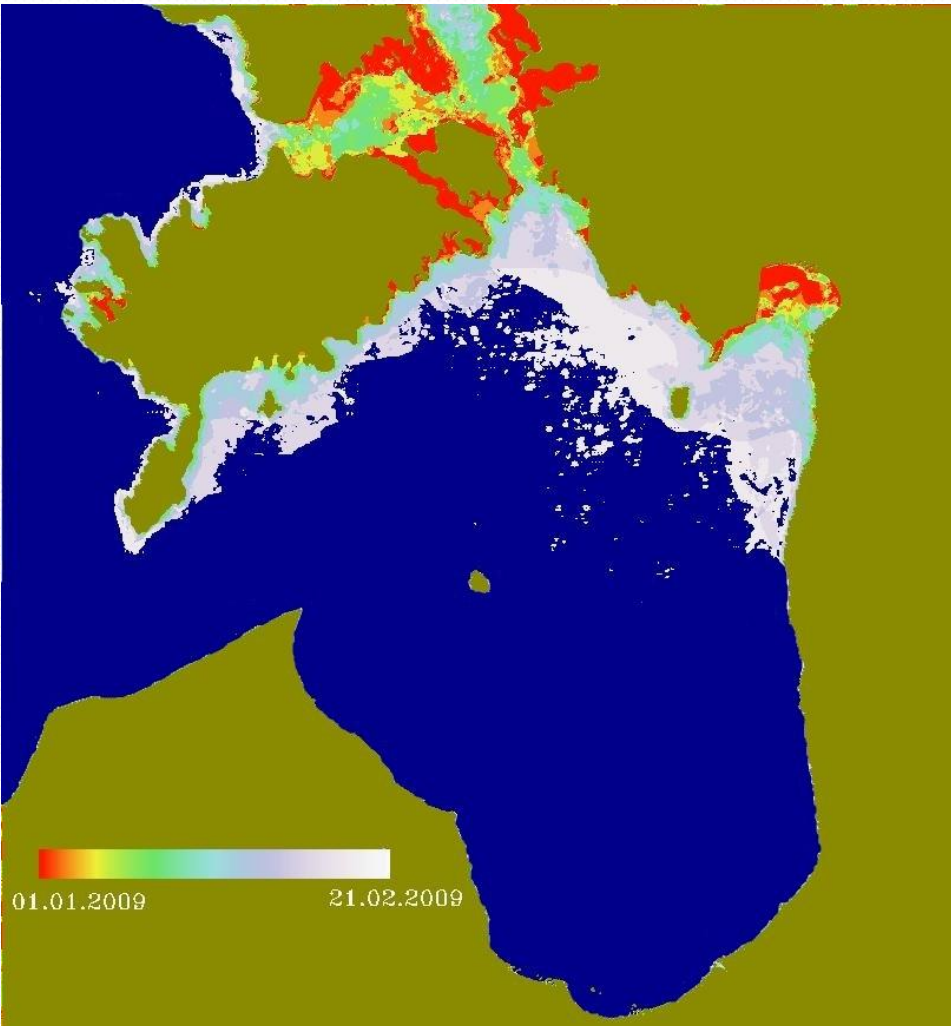
Mild
2007,2008,2009

Ice coverage	Area (km ²)	Percentage of study area
100%	0,0625	0,0%
80-99%	15,2	0,2%
60-79%	266	1,2%
40-59%	1317,1	5,8%
20-39%	1607,1	7,2%
Water	19373,7	85,6%

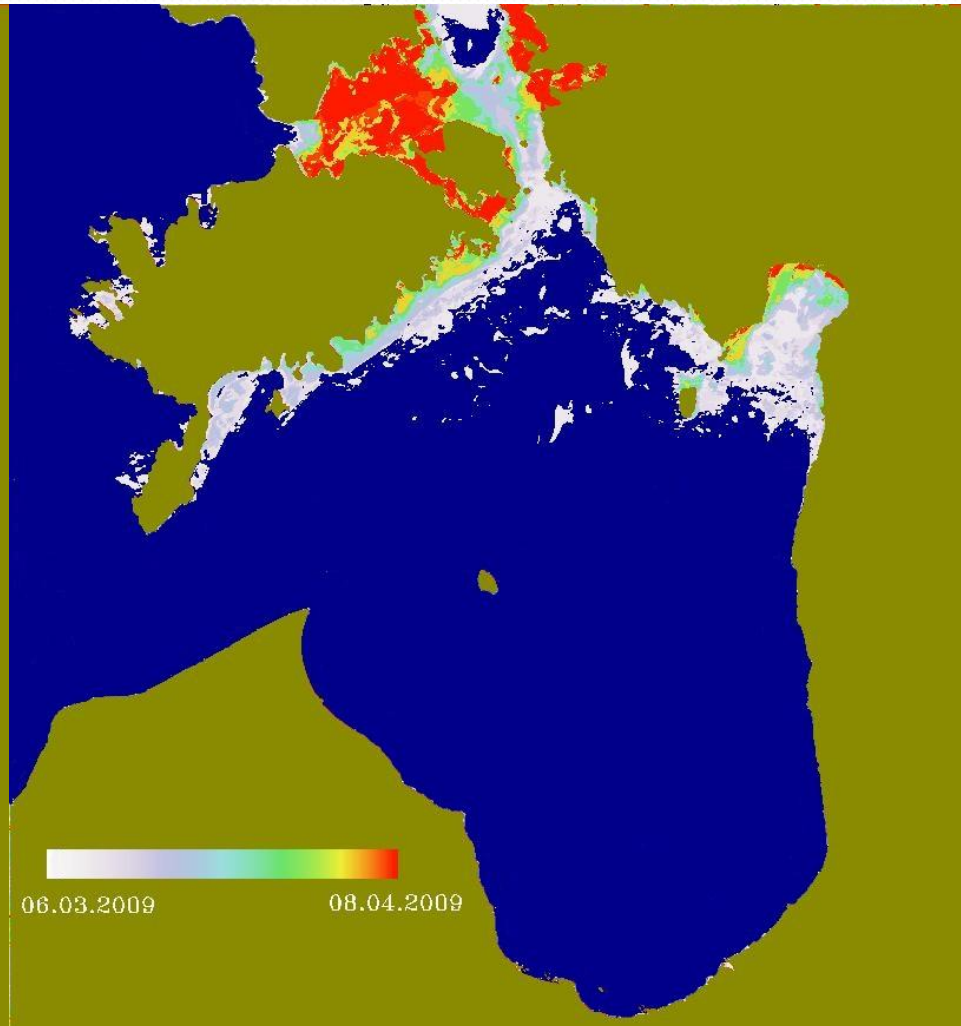
Image showing the percentage of time that each pixel was covered by ice

01.01.2009-08.04.2009

Ice formation:



Ice melt:



Ice seasons during 2002-2011

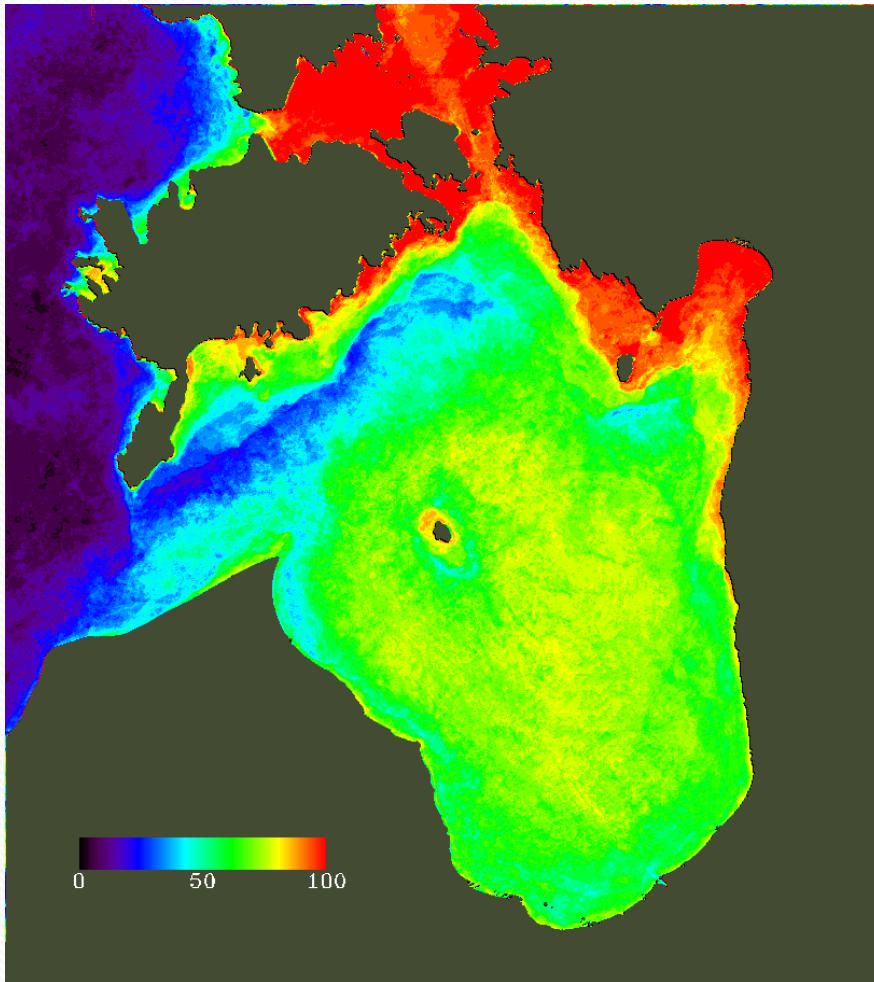


Image showing the percentage of time that each pixel was covered by ice during ice season

Conclusions

- Ice conditions are variable
- During mild winters only 14,4% is ice covered
- During medium winters 59,3% is covered by ice
- During severe winters the ice covered area is 82,4%



Thank You for listening!

Questions?