

# **Implementation of the newest sea-ice model (CICE 6.0) for Baltic Sea area**

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# Outline:

- Motivation
- CICE v6 improvements
- Model configuration
- Results
- Future plans

## Motivation:

- Currently we have operational version of the coupled ocean-ice model, but this model has been published in 2008 (CICE v4)
- Baltic Earth Working Group on the "Baltic Sea Model Intercomparison Project (BMIP)" – sea ice part of the project

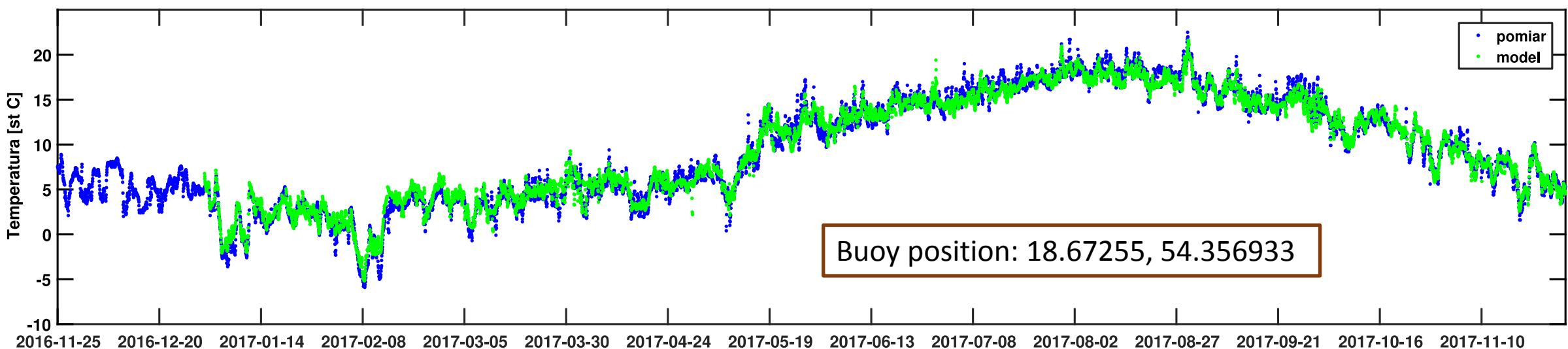
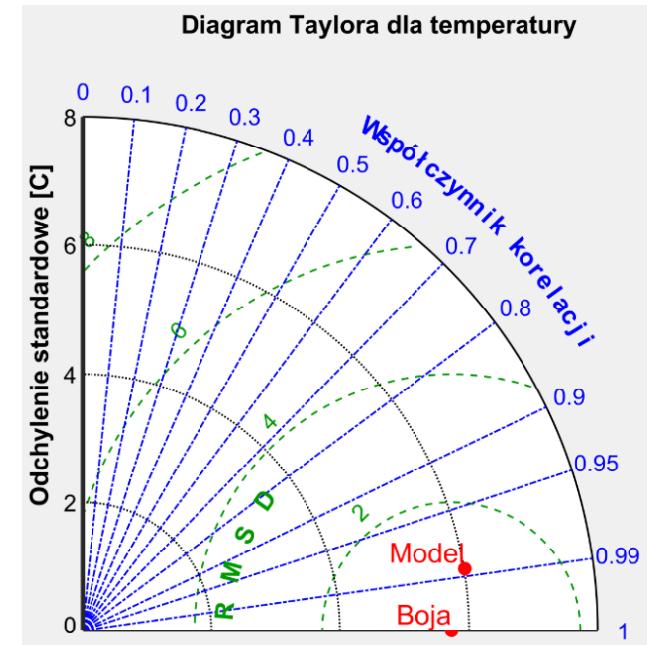
**THIS WORK IS ONGOING**

# CICE model improvements

- There is not a lot of information about changes, they introduced ice pack column physics which currently part of the CICE model
- Both parts – CICE and ice pack are treated separately
- Fast ice is implemented in the keel form
- Under development thus we assume
  - ... but maybe it will not have old bugs such as ice creation in the land mask area – we will see

# Model configuration

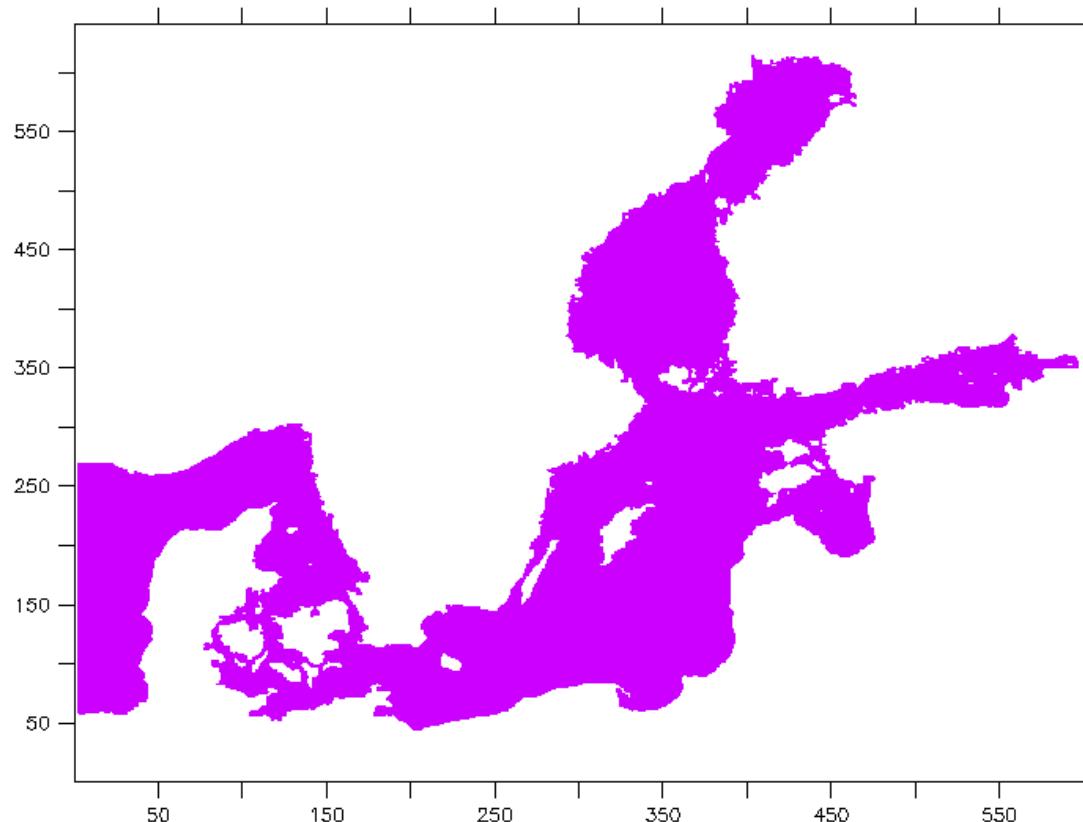
- Currently we are working on stand alone version
- Atmospheric data from our operational WRF model
- Bottom boundaries from eBalticGrid system  
(almost operational, validated and published)



# Results

Divided in there scales:

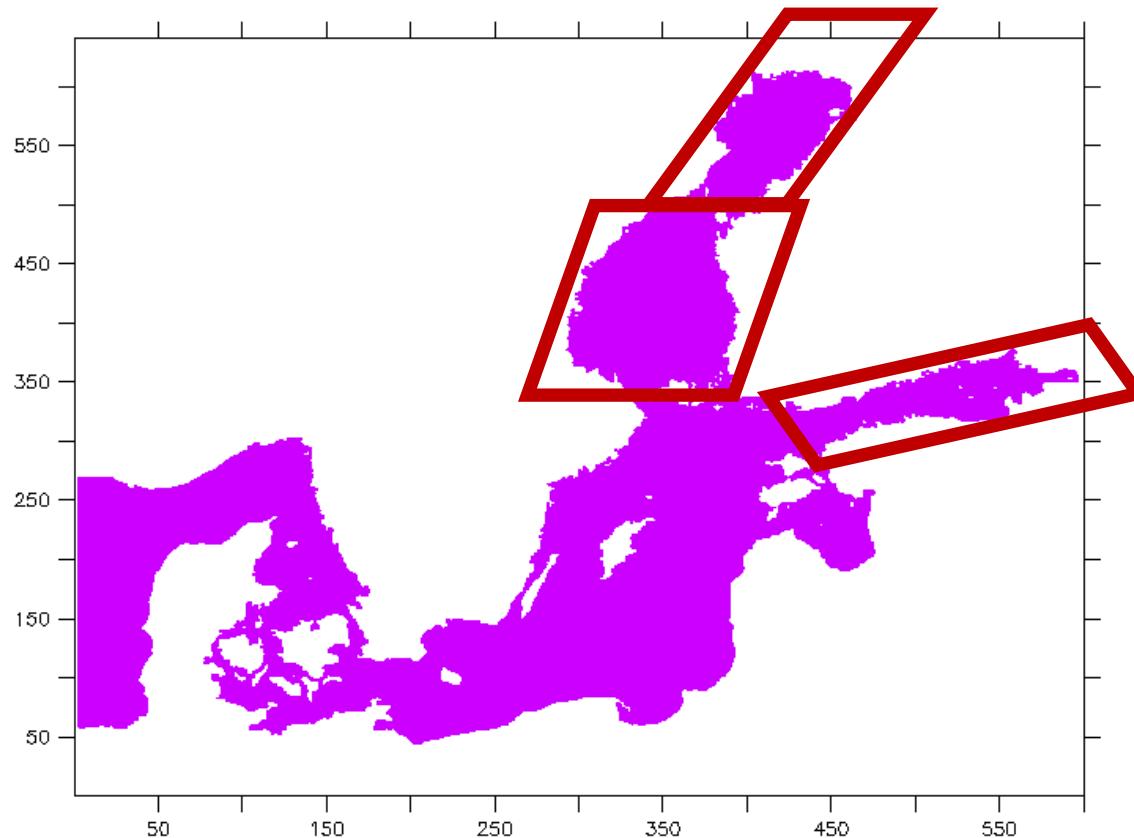
- global
- regional
- local



# Results

Divided in there scales:

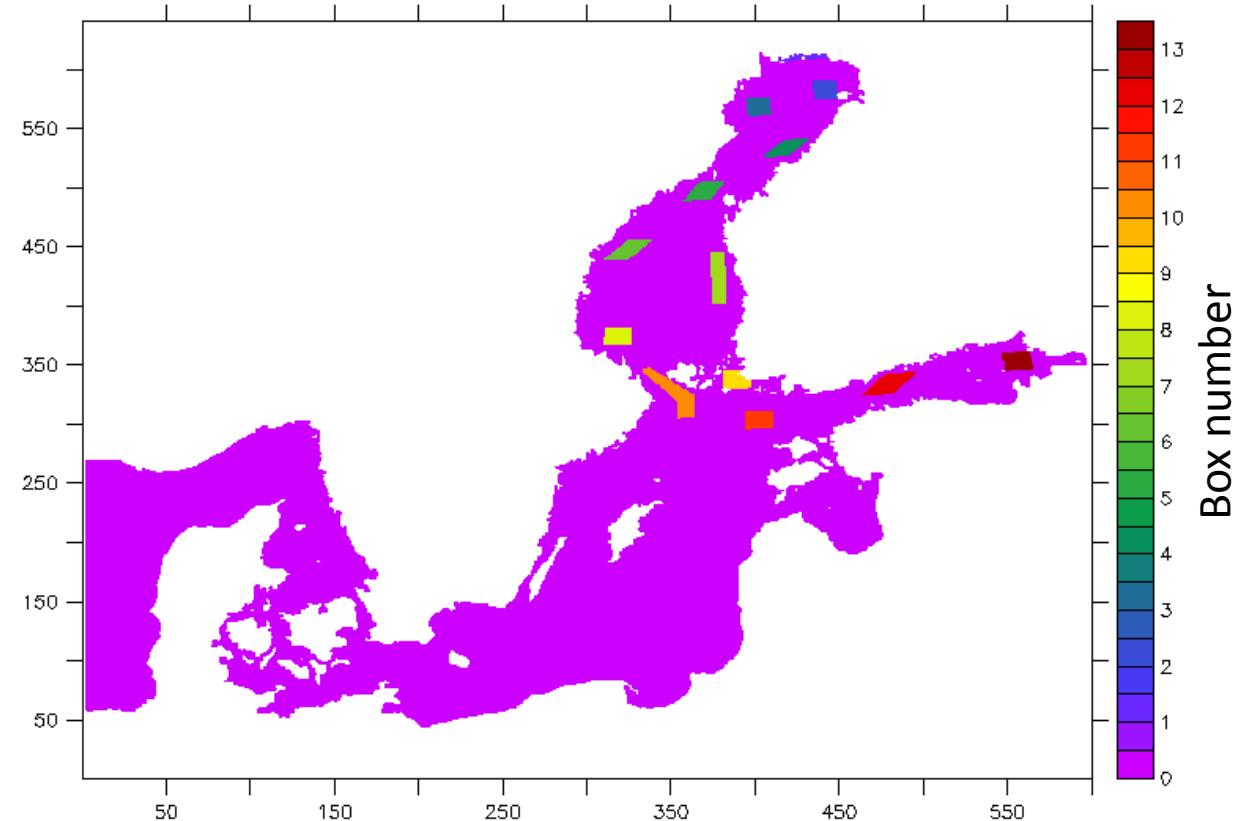
- global
- regional
- local



# Results

Divided in there scales:

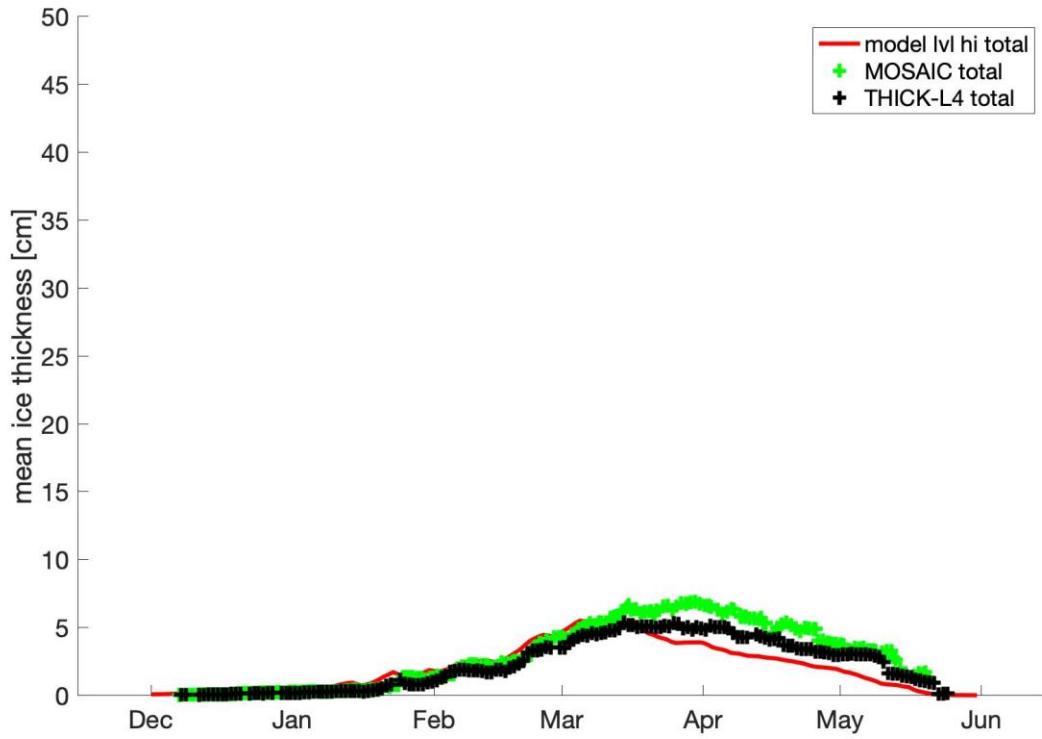
- global
- regional
- local



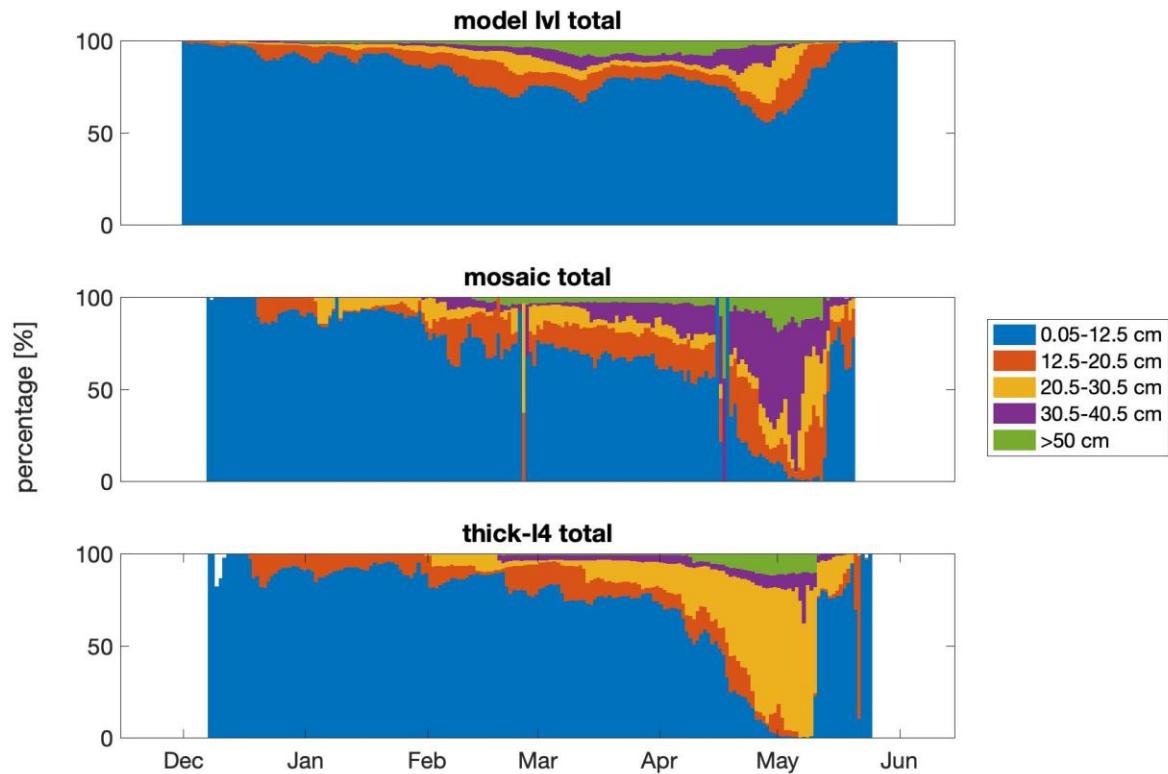
Comparison with satelite data from marine.copernicus.org – combined (global and regional) and not combined (local)

All of the results are for the winter 2017-2018

# Baltic Sea ice cover (total area)



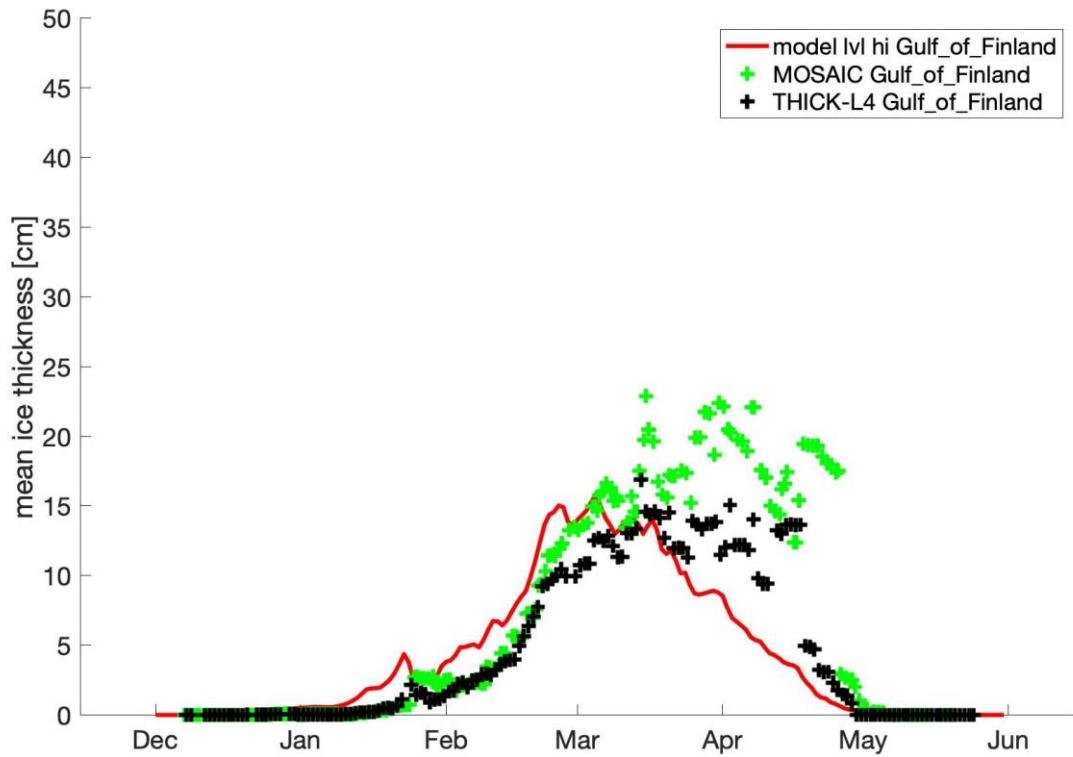
mean ice thickness



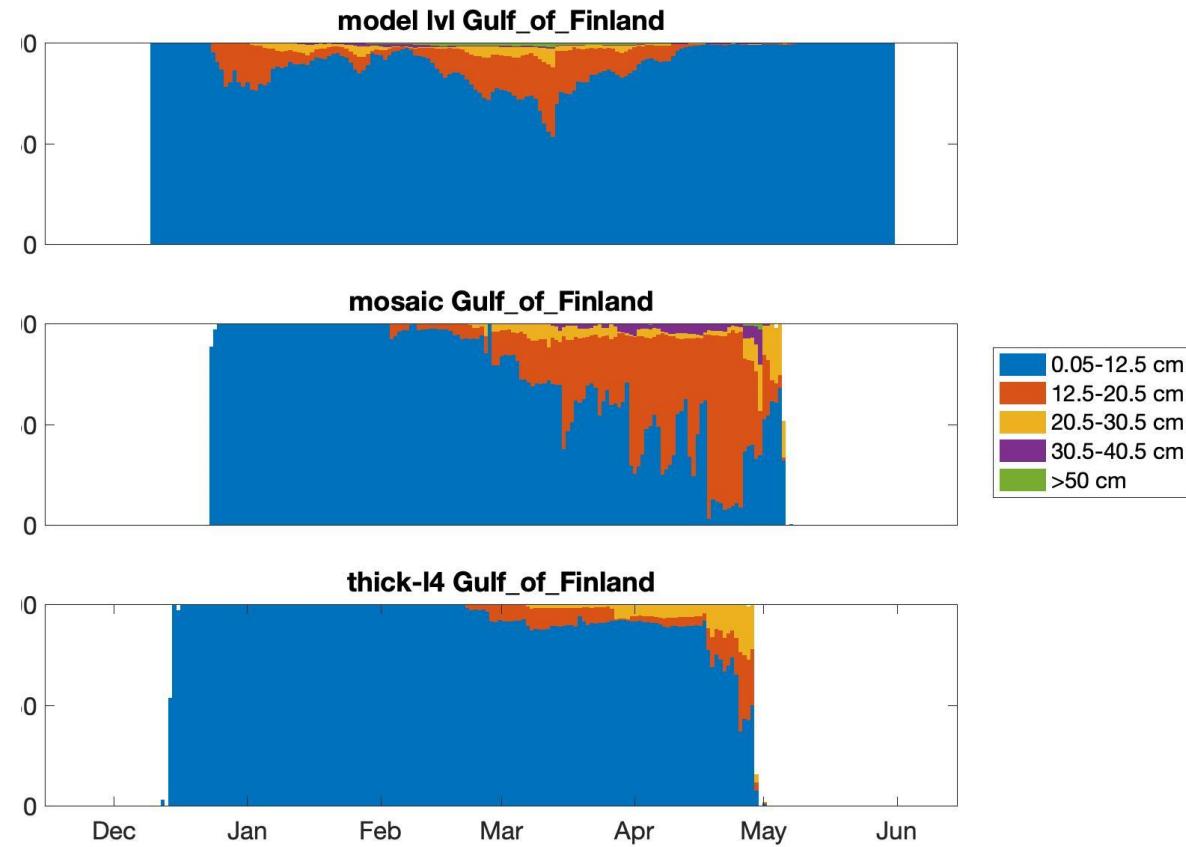
Sea ice thickness distribution

# Selected regions of the Baltic Sea area

## Gulf of Finland



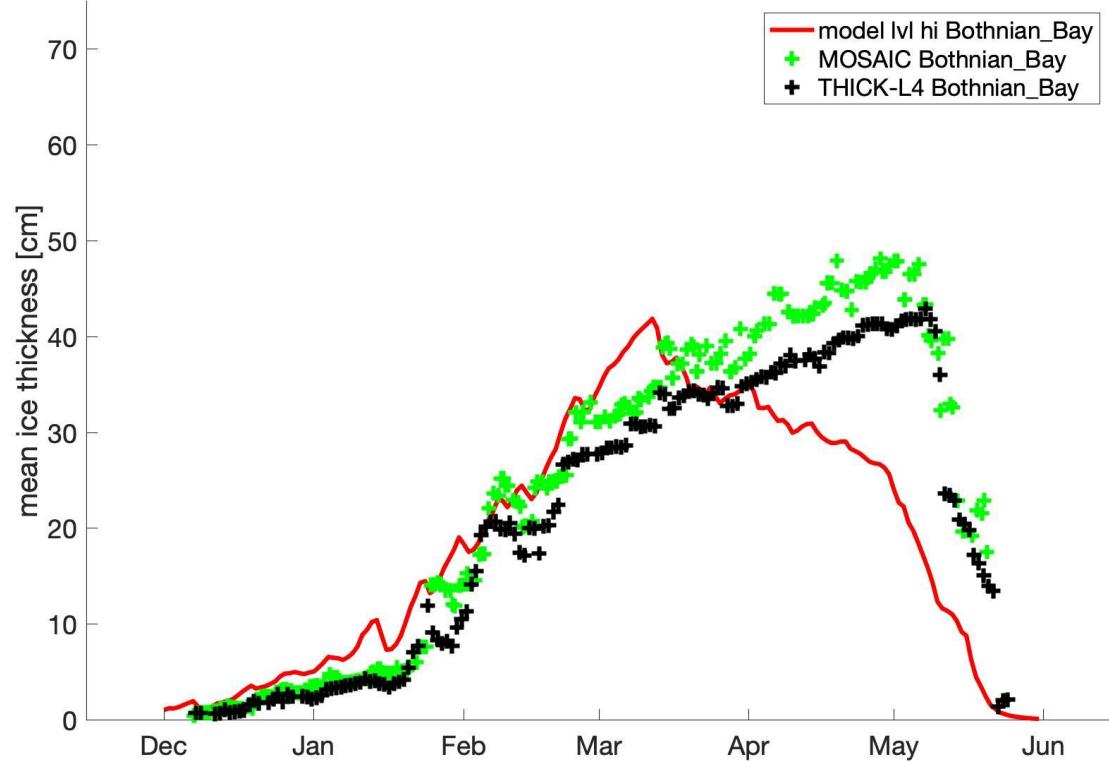
mean ice thickness



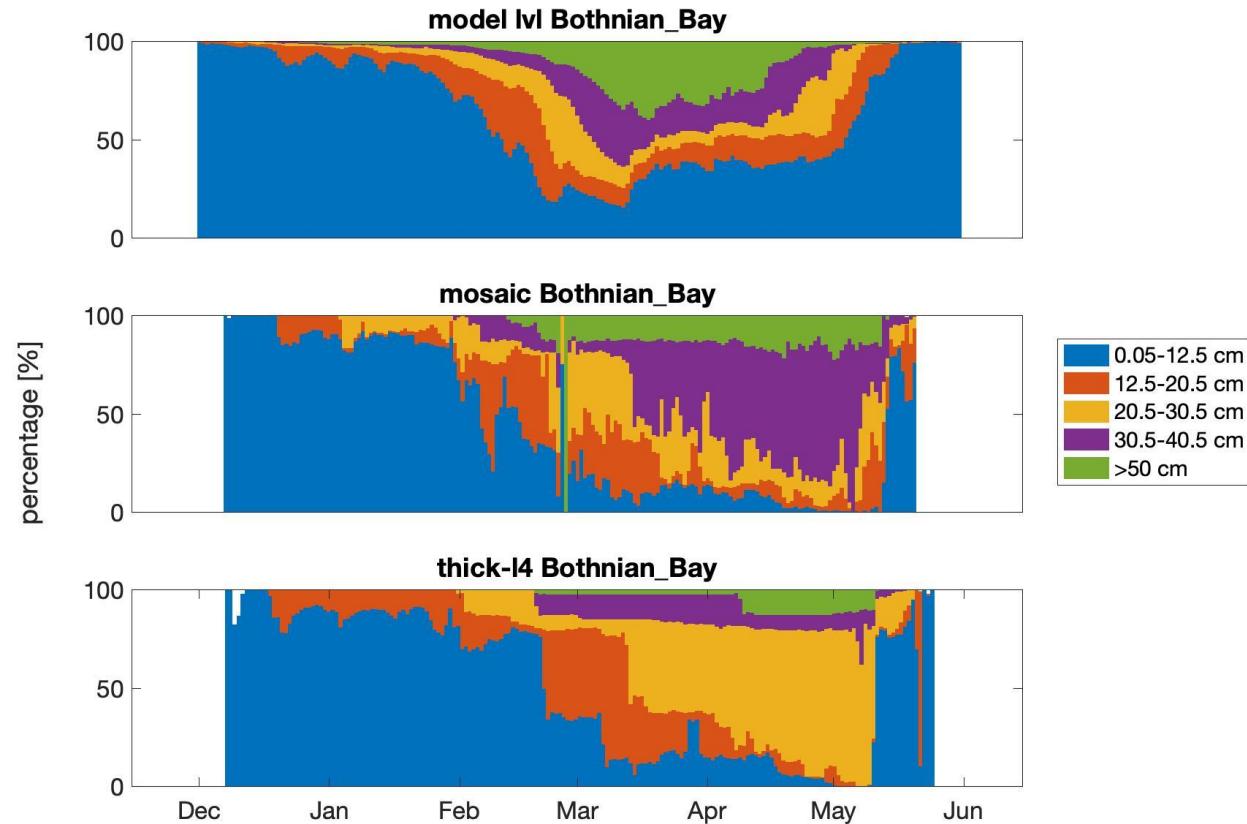
Sea ice thickness distribution

# Selected regions of the Baltic Sea area

## Bay of Bothnia



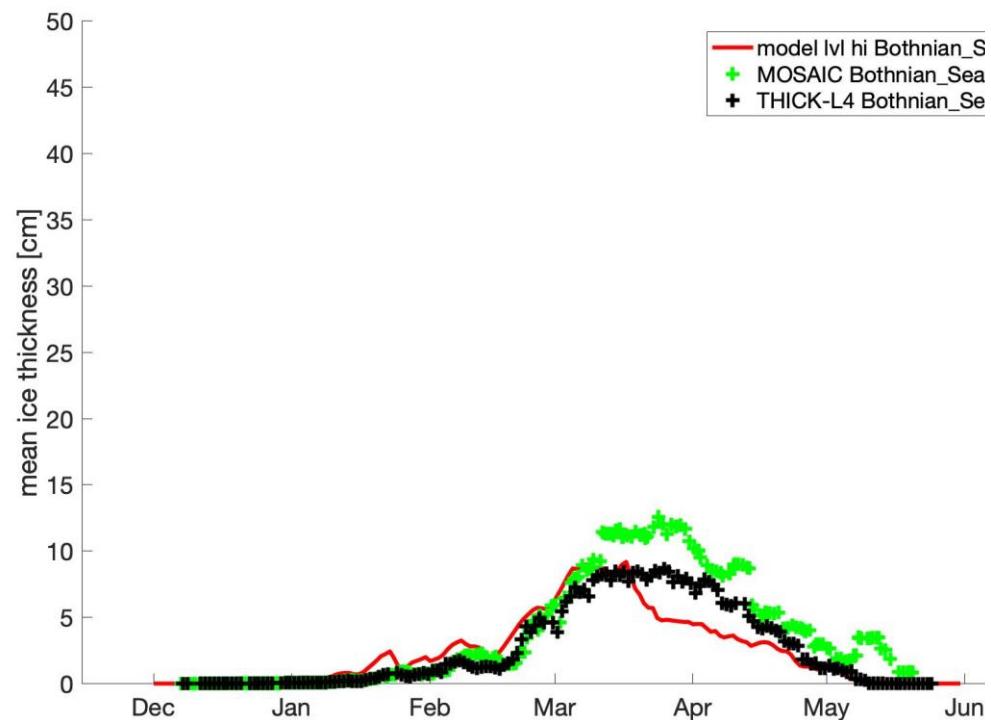
mean ice thickness



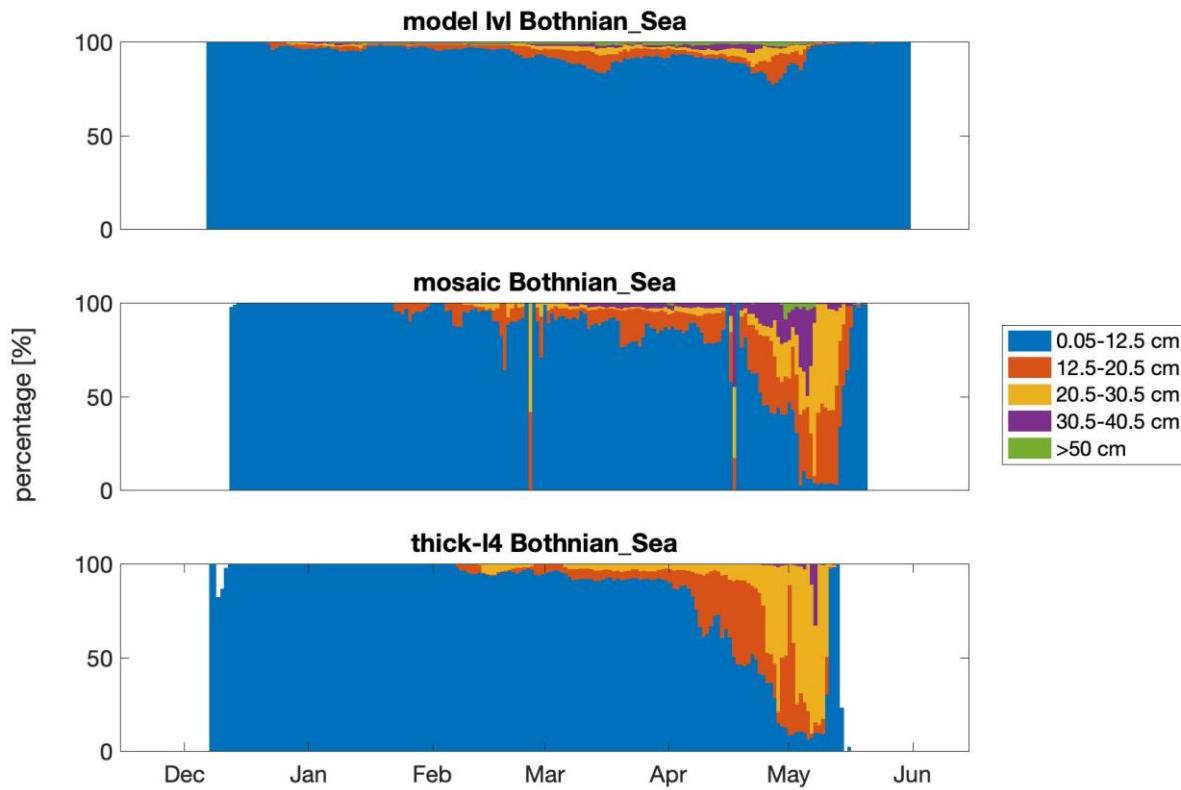
Sea ice thickness distribution

# **Selected regions of the Baltic Sea area**

## **Bothnia Sea**

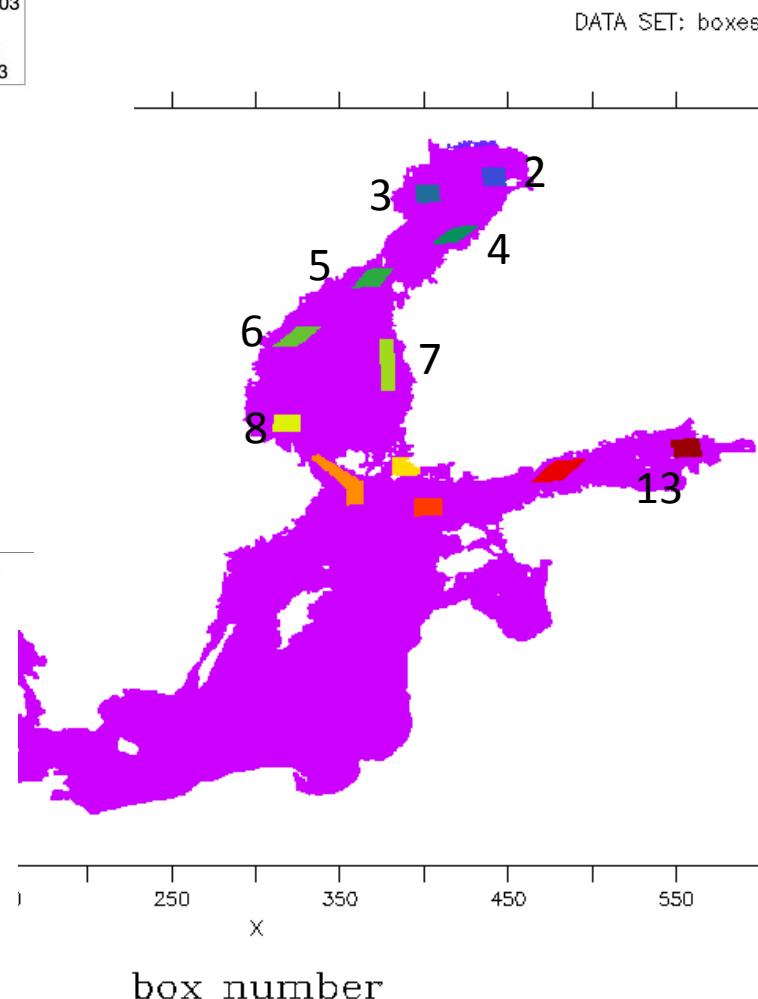
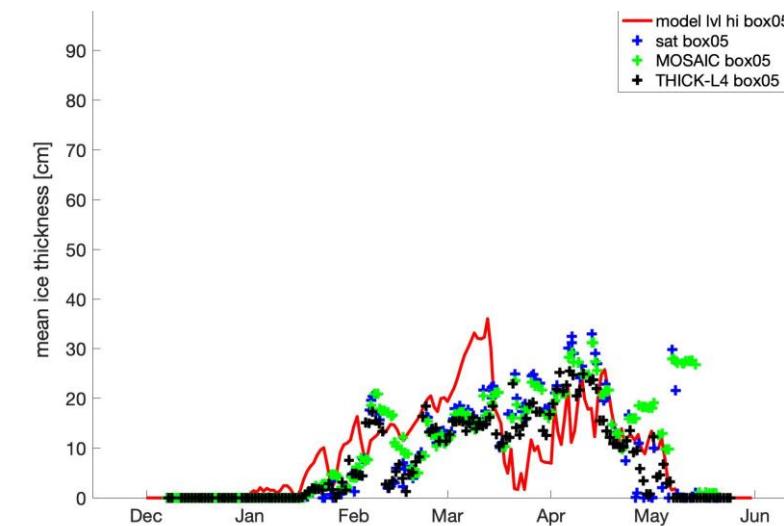
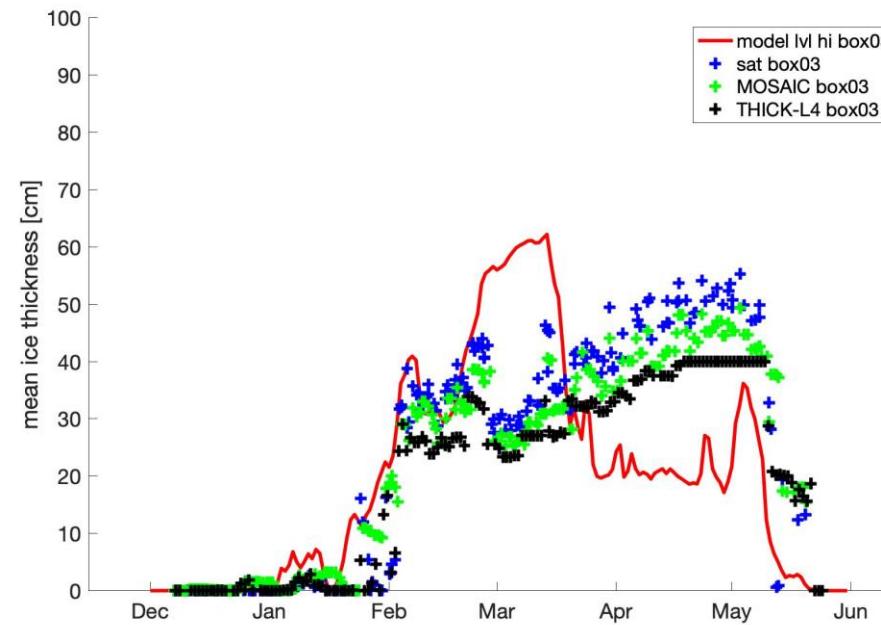
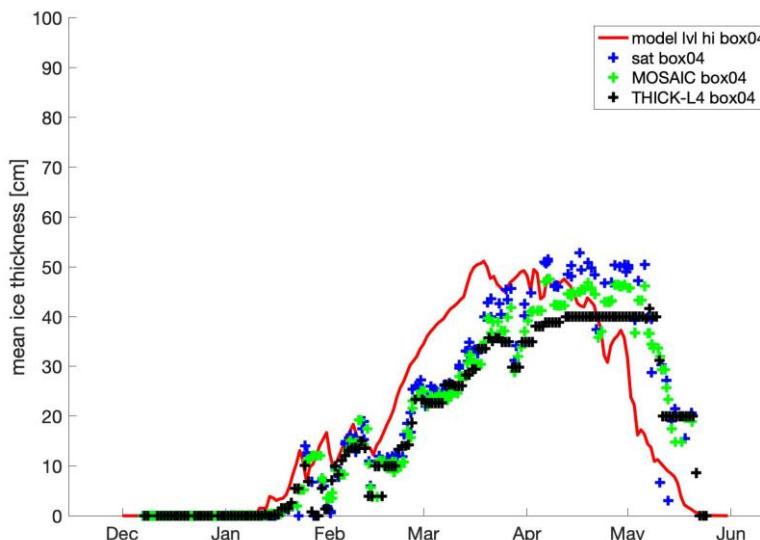
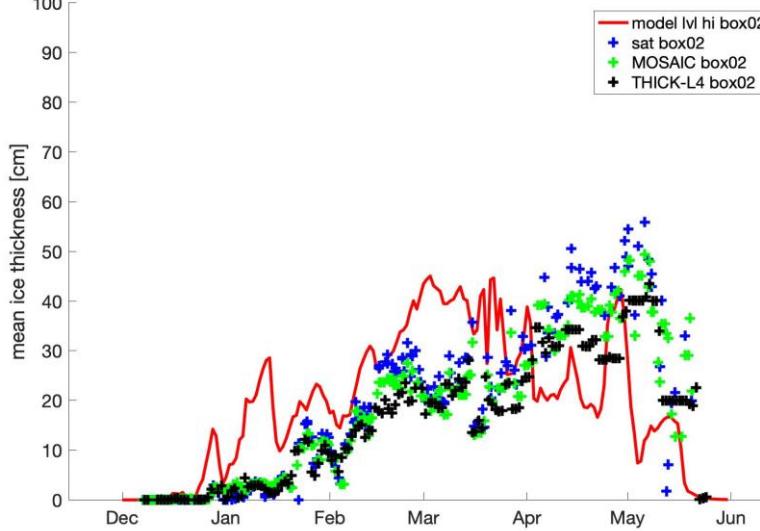


## mean ice thickness

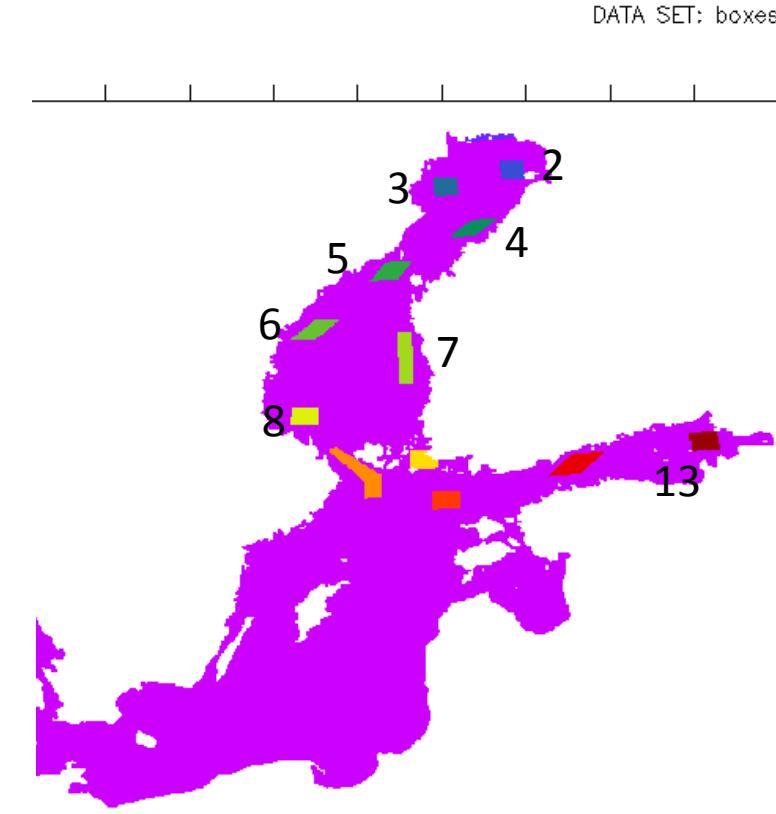
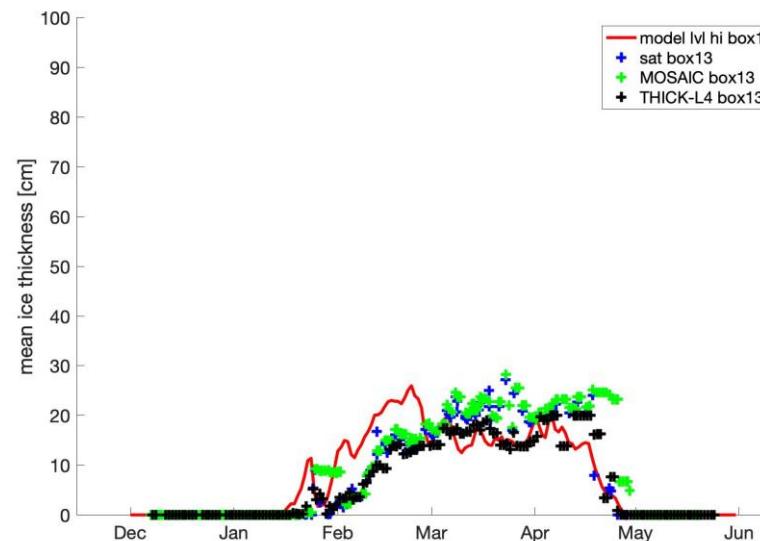
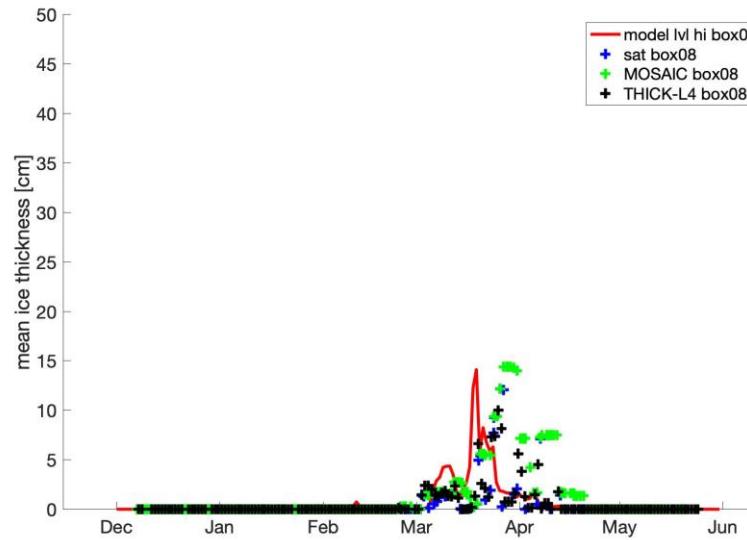
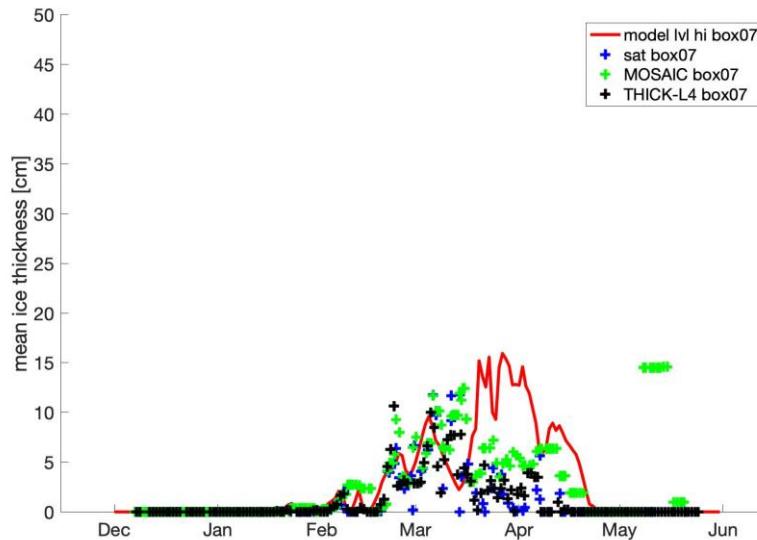


## Sea ice thickness distribution

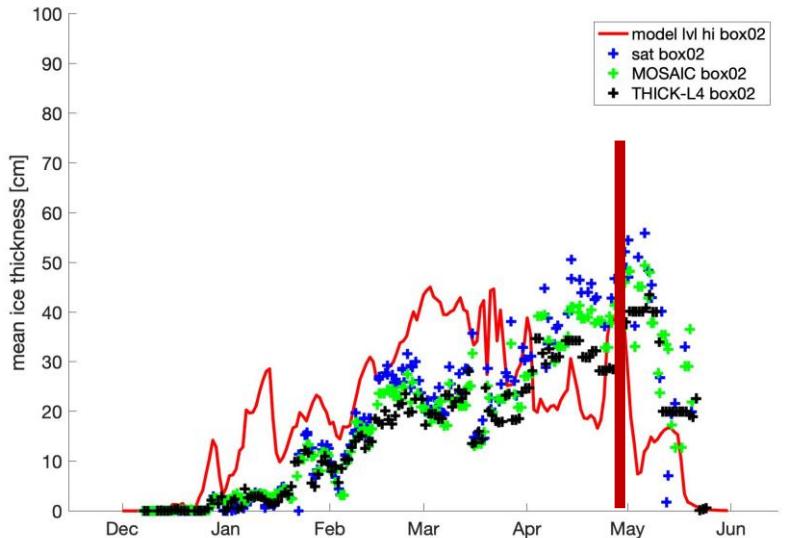
# Local scale comparison - average ice thickness



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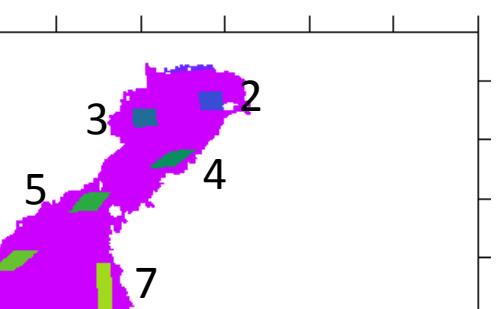
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30 of APRIL

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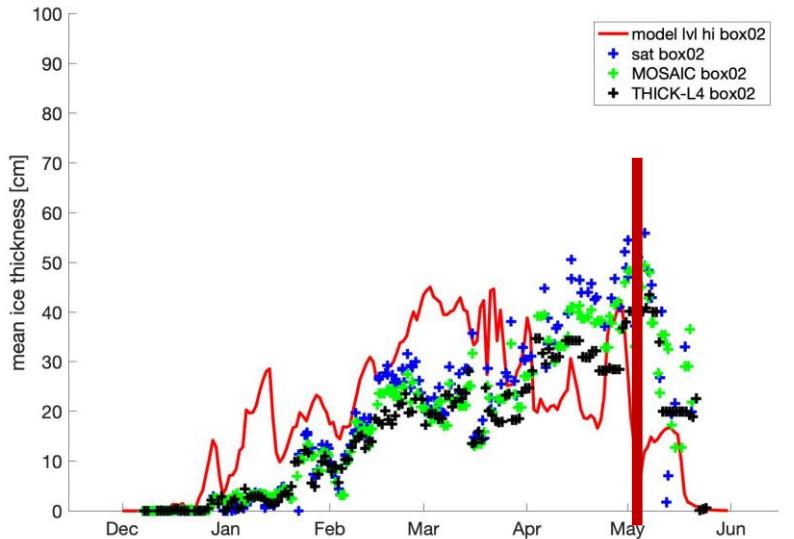


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**SMHI**

Ice type Jästyp	Concentration Konsentration Peittävyys	Symbols Symboler Merkitäyt
Ice free Jäsfri	-	▼ Jammed brash barrier Stängsmäll
New ice (< 5 cm) Nyis (< 5 cm)	7 - 10/10	▲ Ruffed ice Ruffat is
Used ice (< 5 cm) Vain jää (< 5 cm)	7 - 10/10	■ Hopskypäjä Hopskypäjä
Thin ice (5-15 cm) Tunn jää (5-15 cm)	9 - 10/10	▲ Rugged or hummocked ice Rugig eller hummockat jää
Other thin ice (5-15 cm)	9 - 10/10	▲▼ Valler eller utprömad is Altuturantti tai röykskyntti jäät
Fat ice Fasti	10/10	△ Strangler avdrift Åtsjänare avdrift
Rotten fast ice Rottet fastis	< 1/20	▲ Hårbatt, flobberg Hårbatt, flobberg
Open water Öppet vatten Avovesi	< 1/20	→ Åtsjänare Åtsjänare
Very open ice Mycket öppet vatten Myvin havue avovesi	1 - 3/10	— Fracture zone Fräckzon med sprickor Repärmbytyle
Open ice Havue avovesi	4 - 6/10	— Estimated ice edge Uppskattad iskant Repärmbytyle
Close ice Tätt is Titaavat jää	7 - 8/10	— Isobreaker (* coordinating läbiväylä (* koordinerande läbiväylä) (1 - 2)
Very close ice Mycket tätt is Titaavat jää	9 - 9/10	— Water temperature isotherm (°C) Vatten temperaturisoterm (°C)
Consolidated ice Sammantränt is Sammantränta avovesi	10/10	— Main water temperature Vattenhettemperatur Sammantränta avovesi (1971 - 2000)
Ice thickness (cm) Isdjupet (cm)	20-40 100-150 150-200 200-250 250-300 300-350 350-400 400-450 450-500 500-550 550-600 600-650 650-700 700-750 750-800 800-850 850-900 900-950 950-1000 1000-1050 1050-1100 1100-1150 1150-1200 1200-1250 1250-1300 1300-1350 1350-1400 1400-1450 1450-1500 1500-1550 1550-1600 1600-1650 1650-1700 1700-1750 1750-1800 1800-1850 1850-1900 1900-1950 1950-2000 2000-2050 2050-2100 2100-2150 2150-2200 2200-2250 2250-2300 2300-2350 2350-2400 2400-2450 2450-2500 2500-2550 2550-2600 2600-2650 2650-2700 2700-2750 2750-2800 2800-2850 2850-2900 2900-2950 2950-3000 3000-3050 3050-3100 3100-3150 3150-3200 3200-3250 3250-3300 3300-3350 3350-3400 3400-3450 3450-3500 3500-3550 3550-3600 3600-3650 3650-3700 3700-3750 3750-3800 3800-3850 3850-3900 3900-3950 3950-4000 4000-4050 4050-4100 4100-4150 4150-4200 4200-4250 4250-4300 4300-4350 4350-4400 4400-4450 4450-4500 4500-4550 4550-4600 4600-4650 4650-4700 4700-4750 4750-4800 4800-4850 4850-4900 4900-4950 4950-5000 5000-5050 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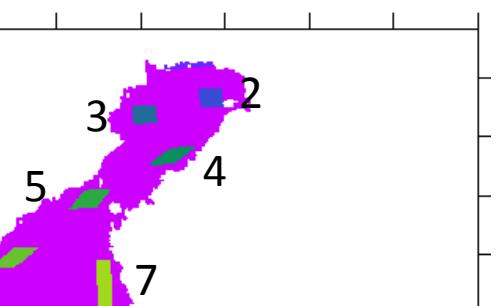
# Box 02 (6th of MAY)



6 of MAY

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11-JUN-2018 13:57:28

DATA SET: boxes



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**SMHI**

Ice type Jästyppi	Concentration Konsentrasjon	Symbols Symboler Merkinnot
Ice free Jäsfri		▼ Jammed冰 barrier Stängt isbarriär
New ice (< 5 cm) Ny is (< 5 cm)	7 - 10/10	▲ Refused ice Refusad is
Usko jää (< 5 cm) Usko jäät (< 5 cm)		● Broken or hummocked ice Bryggt och hummockat is
Usko jää (5-15 cm) Usko jäät (5-15 cm)	9 - 10/10	▲ Vallar eller uppströndat is Altströmt och rökskyndigt jäät
Tunne jää (5-15 cm) Tunn jäät (5-15 cm)	9 - 10/10	▲ Vallar eller uppströndat is Altströmt och rökskyndigt jäät
Other taasainen jäät (5-15 cm)		
Fast ice Fastis	10/10	◆ Stronger avdrift Ärgerligare avdrift
Rotten fast ice Rotten fastis		▲ Fracture zone Fracturzon med sprickor Röppämbyxle
Open water Öppet vatten	< 1/20	— Estimated ice edge Uppslag om iskanten
Open water Öppet vatten		— Fracture line Fractur linje
Very open ice Mycket öppet vatten	1 - 3/10	— Water temperature isotherm (°C) Vatten temperaturisoterm (°C)
Mycket öppet vatten		— Main water temperature Sammanslutna medeltemperaturer Vatten temperaturer (1975 - 2000)
Close ice Tät is	4 - 6/10	— Isobraker (°C) koordinater Isobräckor (°C) koordinater
Tät is Tätta isjäät		— Min. iskonsentrasjon Min. iskonsentrasjon
Very close ice Mycket tät is Mycket tätta isjäät	7 - 8/10	— Min. vatten temperatur Min. vatten temperatur
Consolidated ice Sammanflutet is Sammanflutet isjäät	9 - 9/10	— Min. vatten temperatur Min. vatten temperatur
Consolidated ice Sammanflutet is Sammanflutet isjäät	10/10	— Isopakhet (cm) Isopakhet (cm)
Ice thickness (cm) Isopakhet (cm)		— Jäät pakhet (cm)

Restrictions to Navigation, SWEDEN	
Trafikrestriktioner, Sverige – Likennemerkintulokset, Ruotsi	
Port	Hämeenlinna
Hämeenlinna	Minska lastvikt Minsta lastvikt
Satama	Minska lastvikt Minsta lastvikt
Tammerfors	Värmavarningsläge Värmavarningsläge
Kemi-Tornio	Port
Skeletterhamn	Port
Angermanälven	IC 2000
	2018-04-29
	Swedish Maritime Administration (Sjöfartsverket)

Restrictions to Navigation, FINLAND

Trafikrestriktioner, Finland – Liikennemerkintulokset, Suomi

Port Hämeenlinna Satama Tornio, Kemi, Oulu Rauma Kalajoki Kokkola, Pietarsaari Vaasa

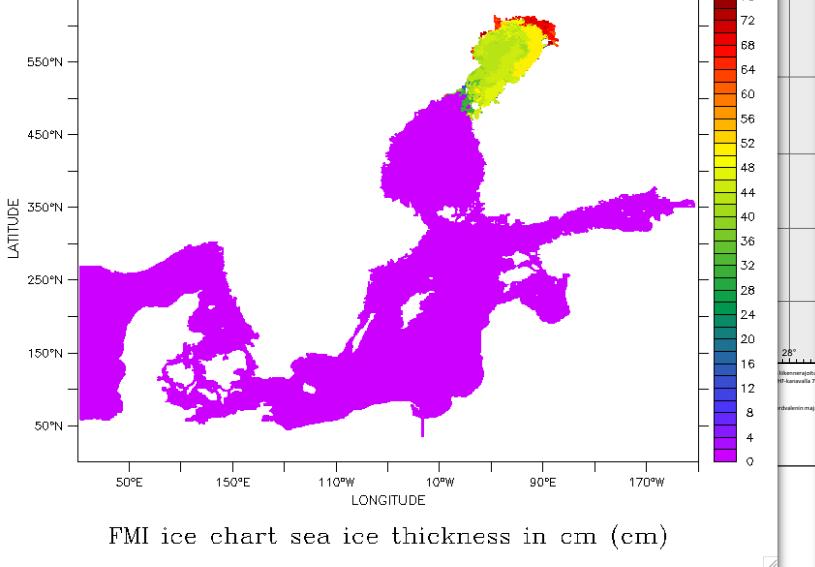
Kaskinen, Kristinestads, Porvoo, Rauma, Rovaniemi, Naantali, Turku, Taalintehtaid, Fortum, Loviisa, Kotka, Helsinki, Imatra, Kärsön, Helsingi, Sköderö, Lovisa, Virolahti, Pietarsaari, Vaasa, Kajaani, Rovaniemi

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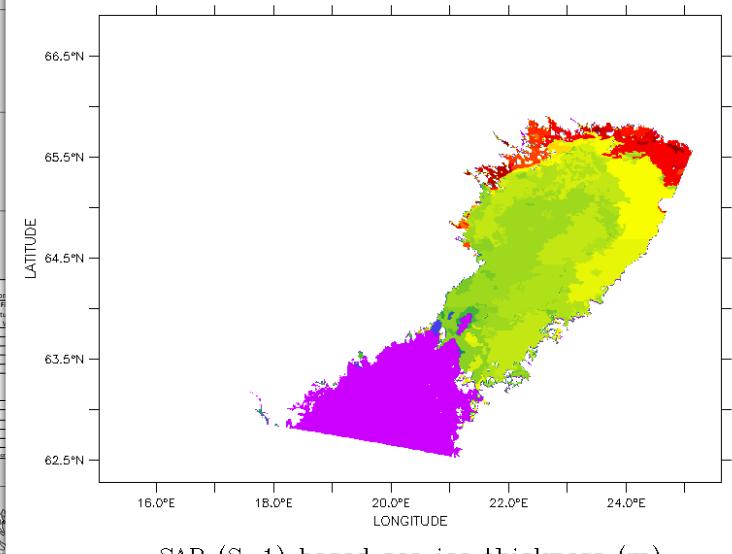
FERRET Ver. 0.83 NOAA/PML TMAP 10-JUN-2018 10:20:22



2018  
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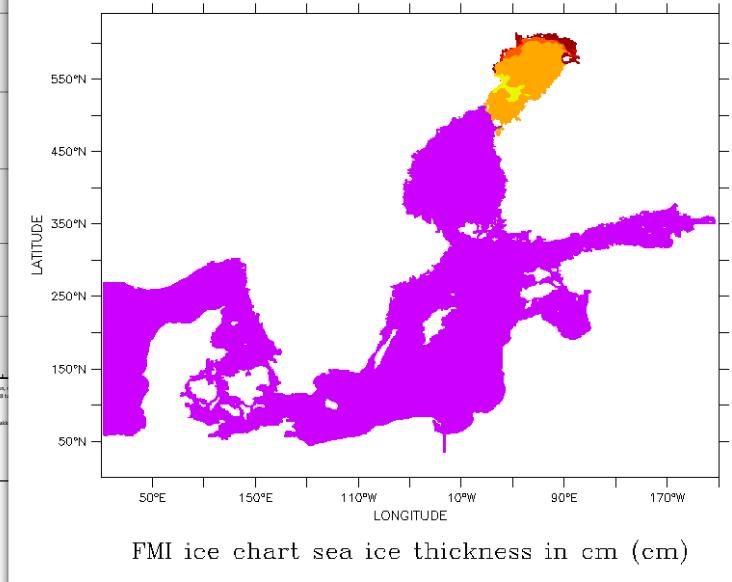
TIME : 06-MAY-2018 05:12 DATA SET: ice\_thickness\_baltic\_20180506051228  
Baltic Ice Thickness, L4 SAR, 0.5km daily (FMI-BAL-SEICE\_THICK-SAR-NRT-OBS)

FERRET Ver. 0.83  
NOAA/PML TMAP  
10-JUN-2018 09:30:26



TIME : 06-MAY-2018 13:00 DATA SET: 201805061300\_interp

FERRET Ver. 0.83 NOAA/PML TMAP 10-JUN-2018 10:20:22



# Conclusions and future plans

- We have the real problem with finding proper ice cover data for validation of the model
- It is planned to extend our work for having sea ice distribution in the local scale too
- In next step we are going to compare ice drift with satellite data
- After accepting the stand alone results we will tune the model internal bottom boundaries for getting similar results
- Then we are planning to make influence of different bottom boundaries on the Baltic Sea ice conditions

**Thank you for your attention**