



Validation of the Sea-Ice Thickness simulated in an Coupled Ocean-Sea Ice Model

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INTRODUCTION

In recent several decades, we witnessed a dramatic decrease in both extent and thickness of Arctic sea ice ($>50^{\circ}\text{N}$) in response to atmospheric greenhouse gas (GHG) loading. The rapid decline, especially ice extent, has been reproduced by numerical models (e.g. Figure 1^[1]).

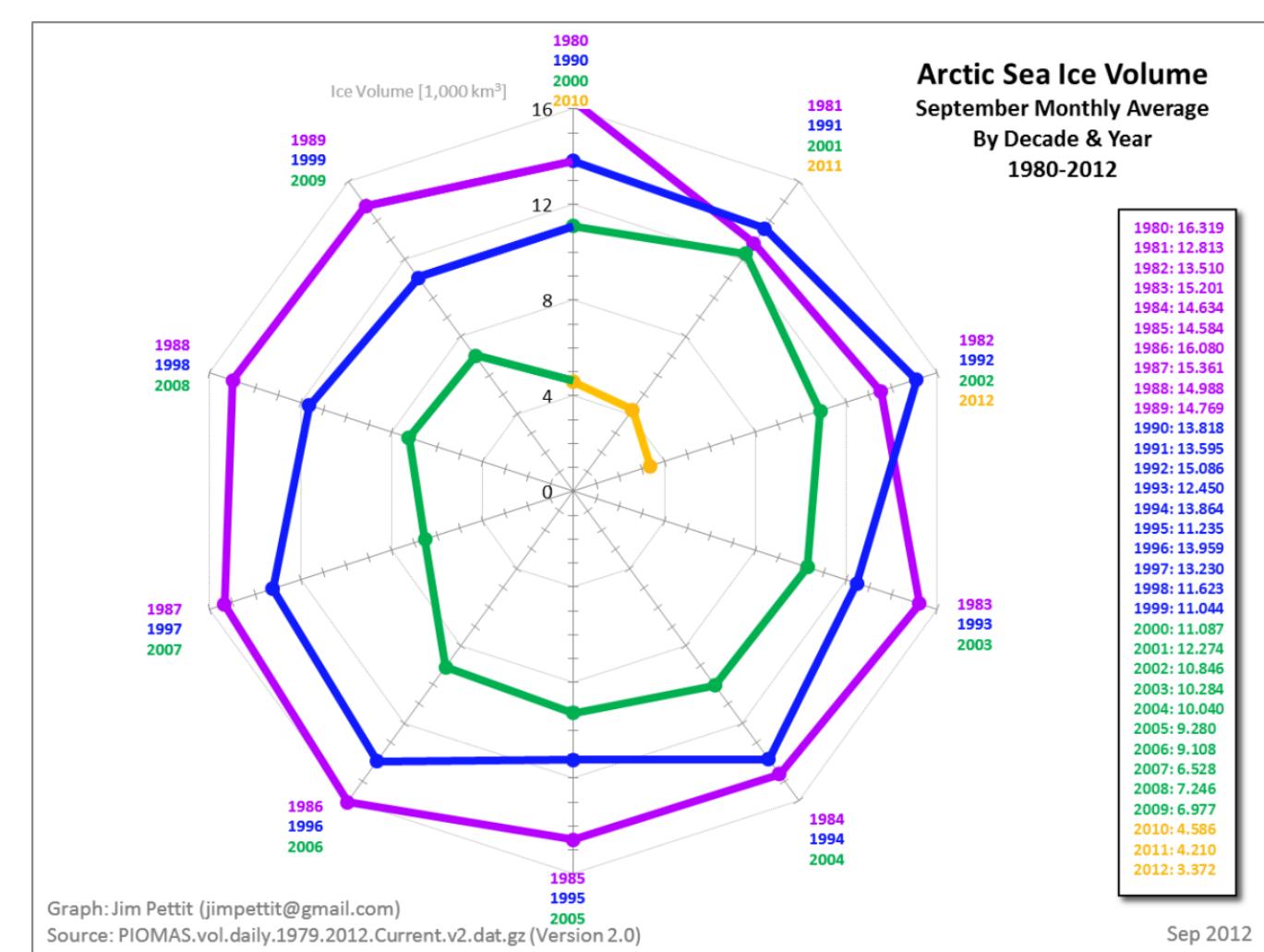
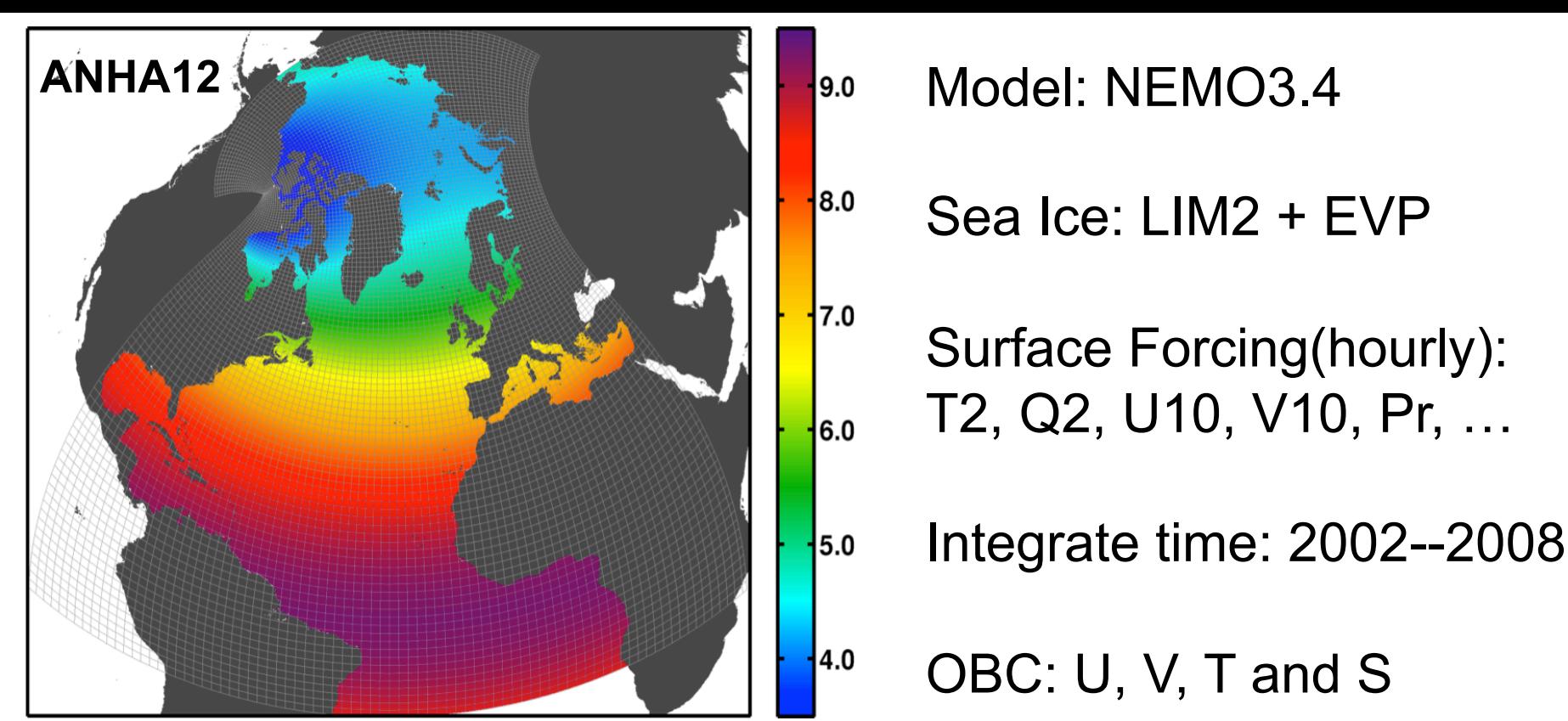


Figure 1. Arctic Sea Ice Volume Change 1980-2012

To validate and improve the accuracy and reliability of the model, it is crucial to compare with observations including sea-ice characteristic like ice thickness. The thickness estimates probability of sea ice survival over the melt season and its distribution appears to be undergoing rapid changes. The focus of this research is to validate the model by comparison and finally help refine the model.

[1] Pettit Climate Graphs. <https://sites.google.com/site/pettitclimategraphs/pettit-climate-graphs>

MODEL DESCRIPTION

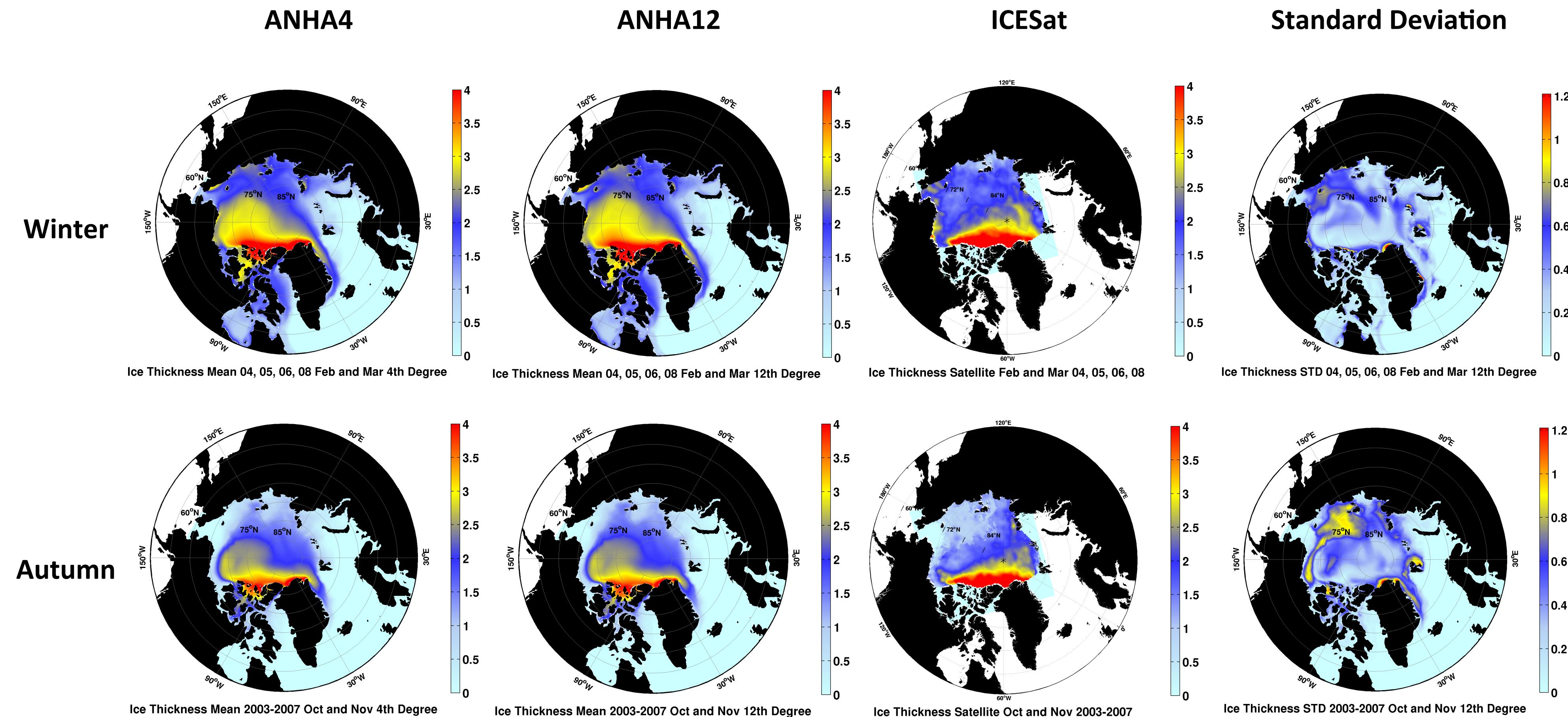


	ANHA4	ANHA12
Domain	Arctic and Northern Hemisphere Atlantic	
Horizontal Resolution	< 15km (Arctic)	< 5km (Arctic)
Horizontal Mesh Grid	544 x 800	1632 x 2400
Vertical Levels	50	

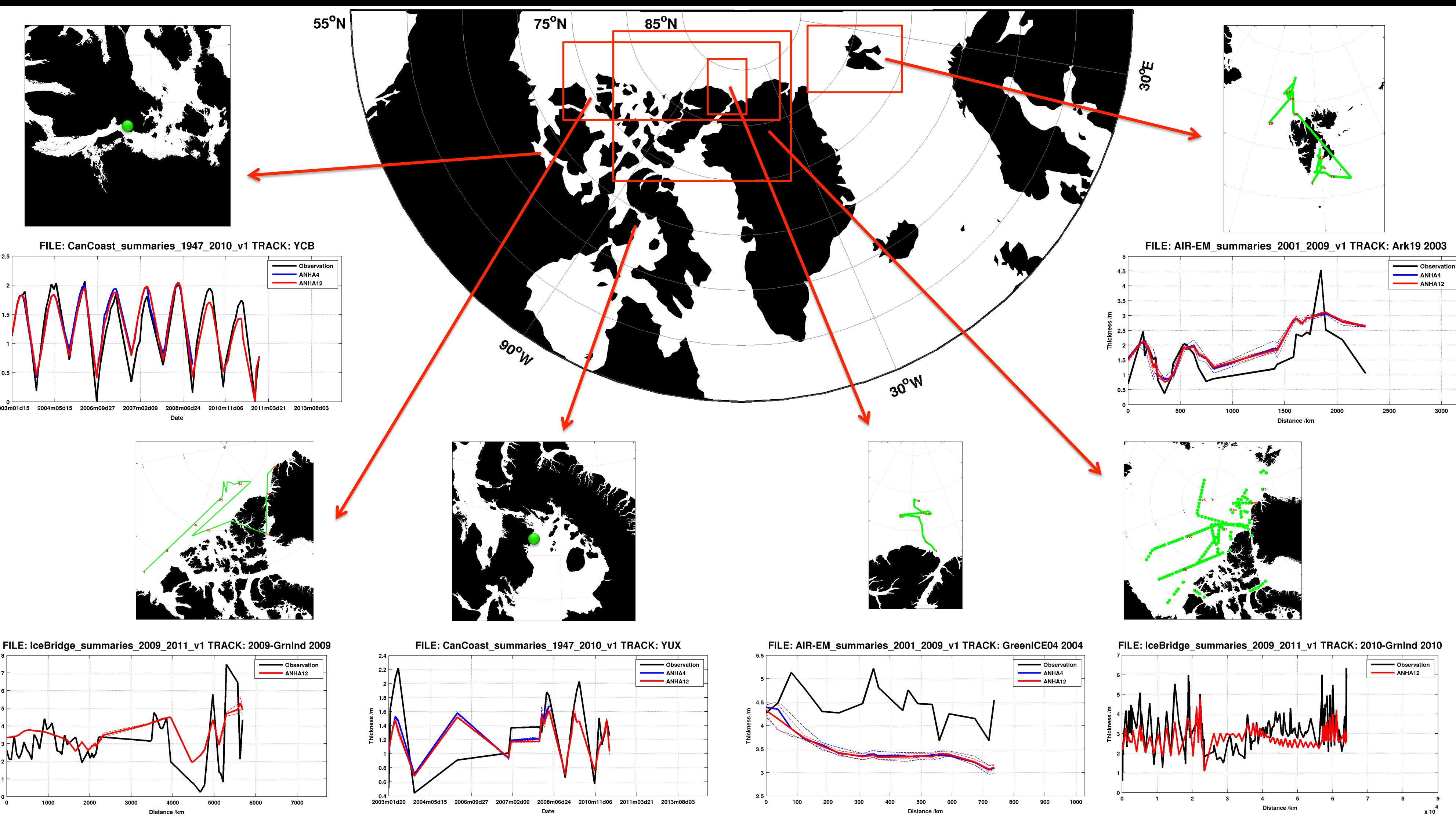
NEMO: Nucleus for European Modeling of Ocean

LIM: Louvain-La-Neuve Sea Ice Model
EVP: Elastic-Visco-Plastic
OBC: Open Boundary Condition

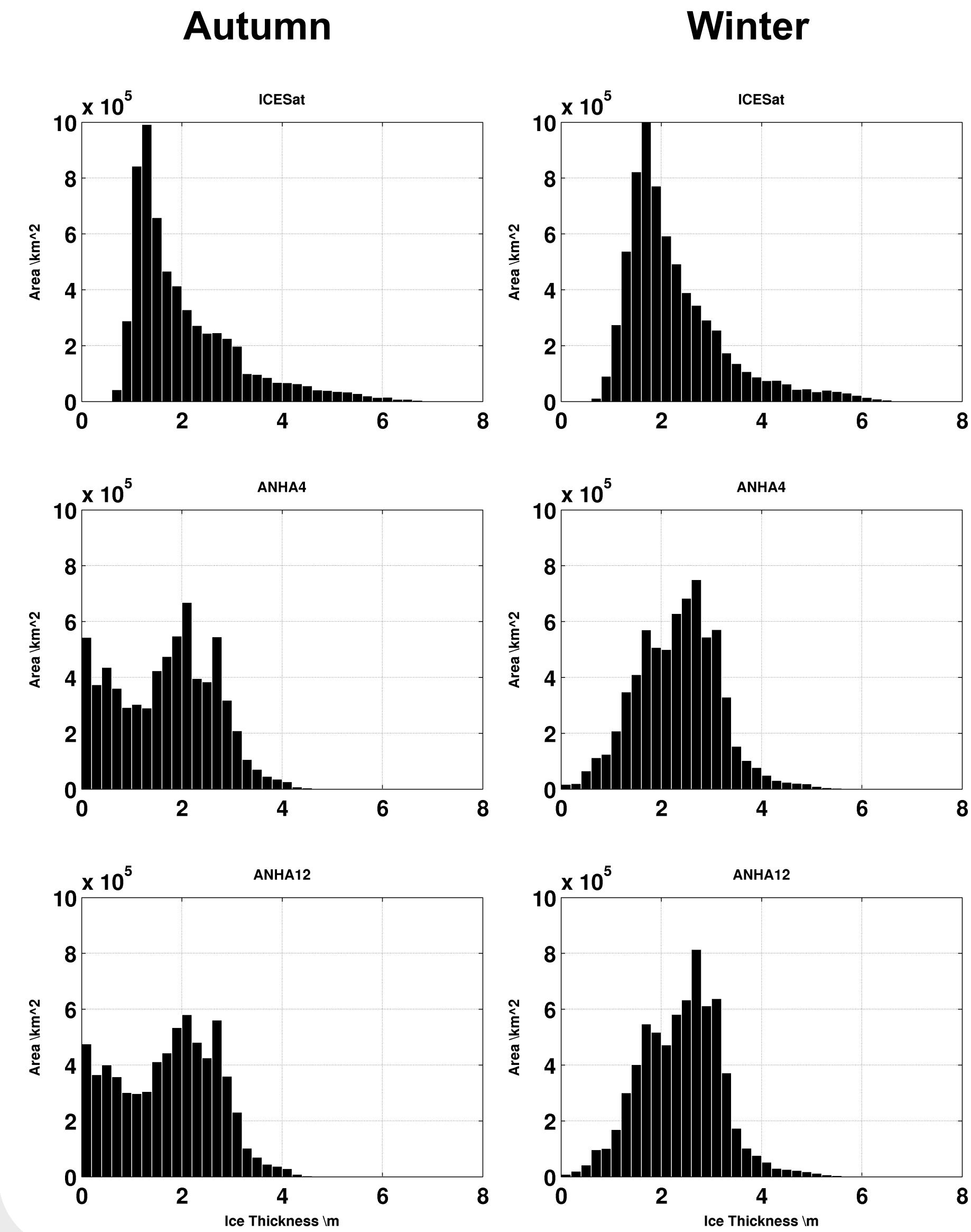
GENERAL ANALYSIS



OBSERVATION COMPARISON



THICKNESS DISTRIBUTION



SUMMARY & FURTHER STUDY

- Both ANHA4 and ANHA12 produce similar spatial pattern of the Arctic sea ice.
- Larger ice thickness changes (STD) occur in Pacific sector in Autumn.
- Model results agree well with observations in the spatial or temporal variation at select locations.
- Model produces a shifted thickness distribution with more mid-thick (2-3m) and less hi-thick (>4m) ice. ICESat does not capture thin ice and has a large uncertainty of $\pm 0.7\text{m}$.

Future work: We will study the thermodynamic and dynamic components of the thickness growth in the Arctic, especially at the locations with available observations, to better evaluate the model's capability in sea ice simulation.

ACKNOWLEDGE

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