

# 30 Years of Progress in Radar Altimetry Symposium

2-7 September 2024 | Montpellier, France

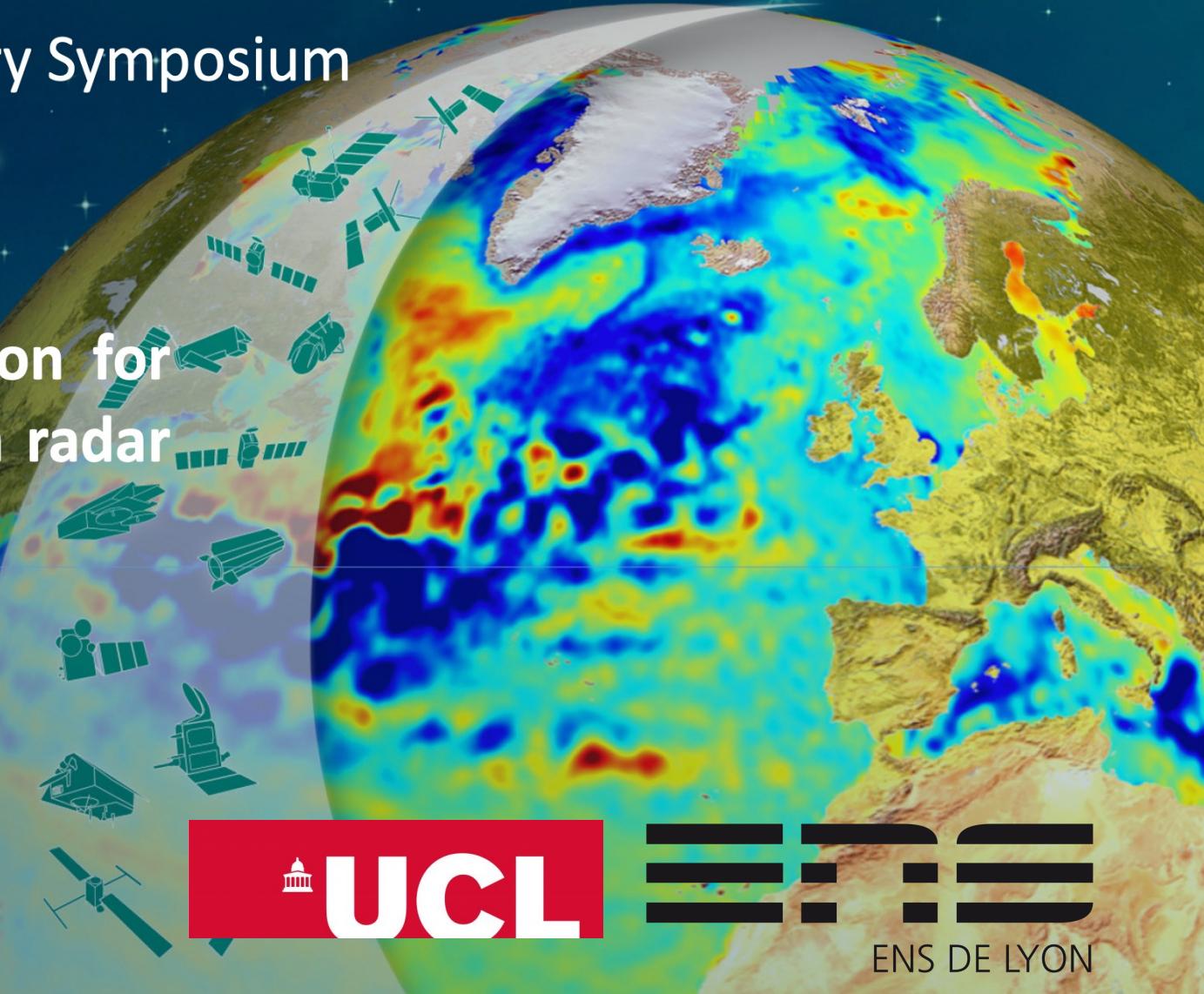
## Bayesian trans-dimensional inversion for Arctic ice and snow retrievals from radar and laser altimetry

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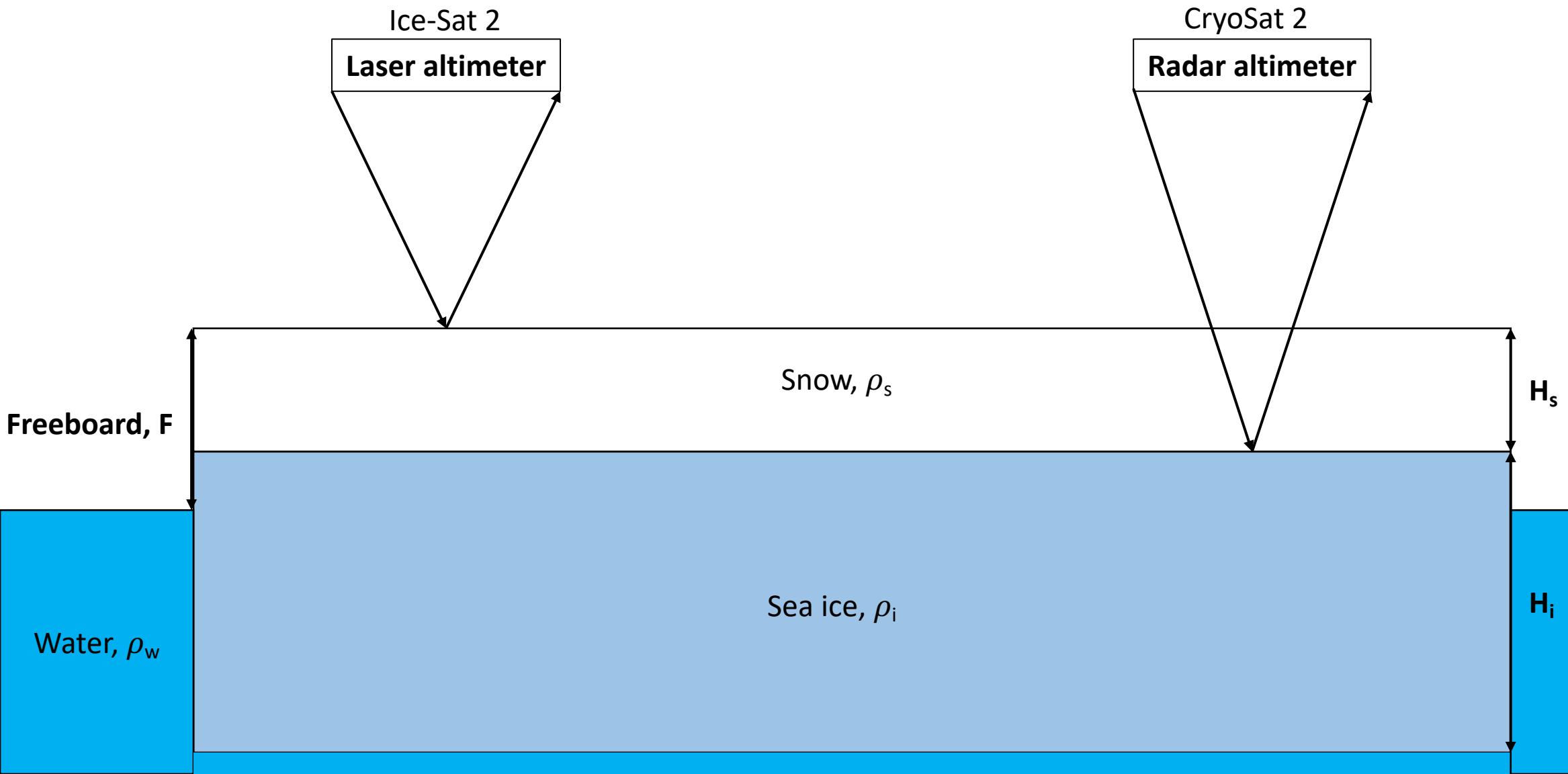
<sup>1</sup>Département de Sciences de la Terre, Ecole Normale Supérieure Lyon, France

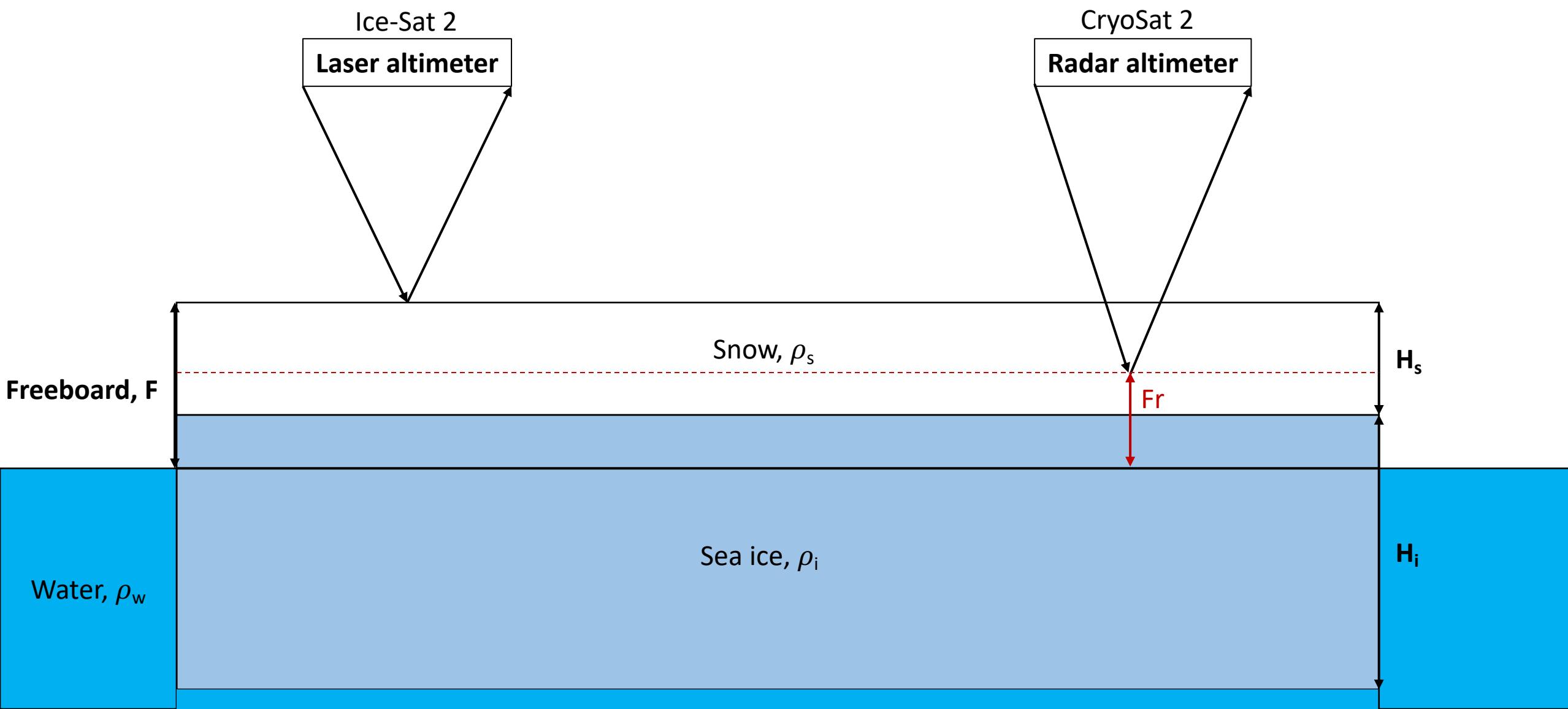
<sup>2</sup>University College of London, Center for Polar Observation and Modelling, UK

<sup>3</sup>Department of Physics and Technology, the Arctic University of Norway, Tromso, Norway



→ : Radar/laser pulse





## Forward Model

$$F_r^{cs2} = \frac{\rho_w - \rho_i}{\rho_w} H_i + \left(1 - \alpha_{cs2} \frac{c}{c_s} - \frac{\rho_s}{\rho_w}\right) H_s$$
$$F_l^{is2} = \frac{\rho_w - \rho_i}{\rho_w} H_i + \left(1 - \alpha_{is2} \frac{c}{c_s} - \frac{\rho_s}{\rho_w}\right) H_s$$

Input data

Speed of light in a vacuum

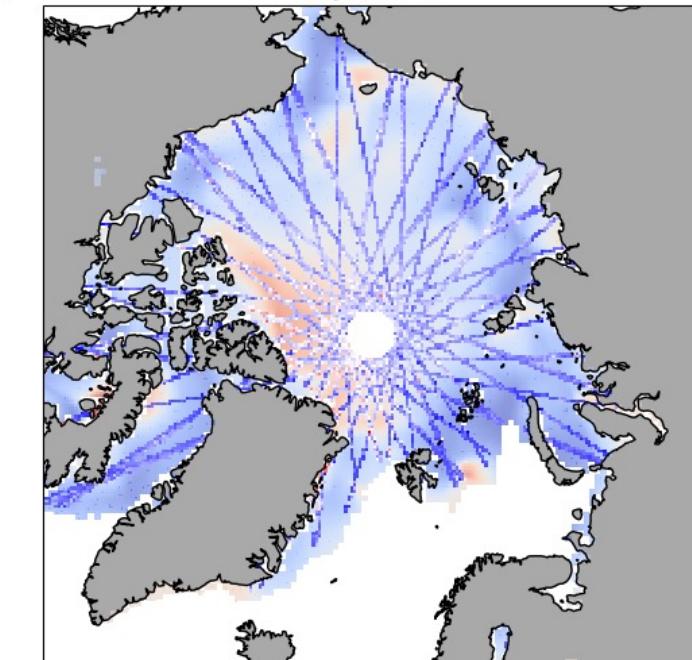
Speed of light in the snow



: Solutions of the inversion

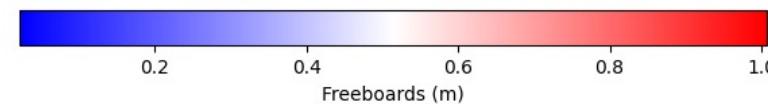
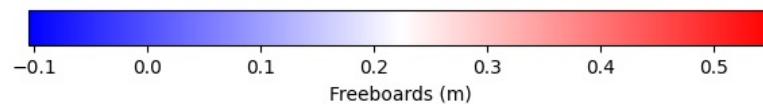
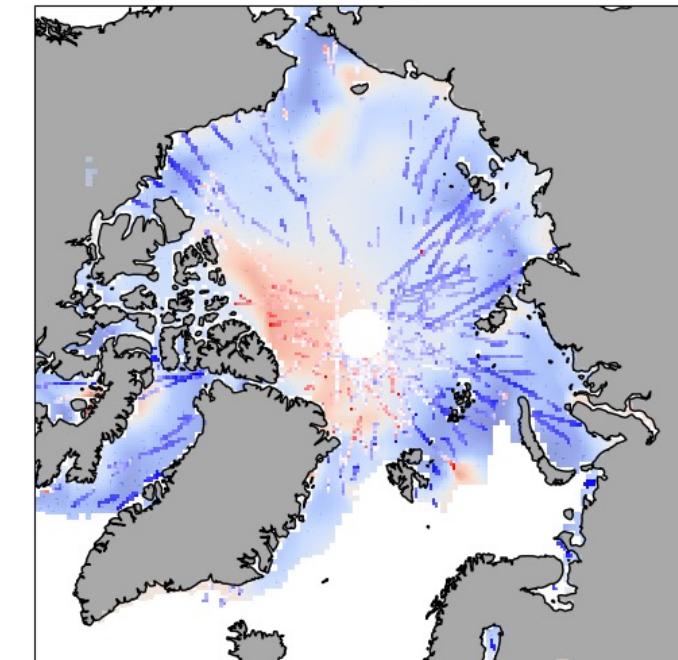
(a)

CryoSat-2



(b)

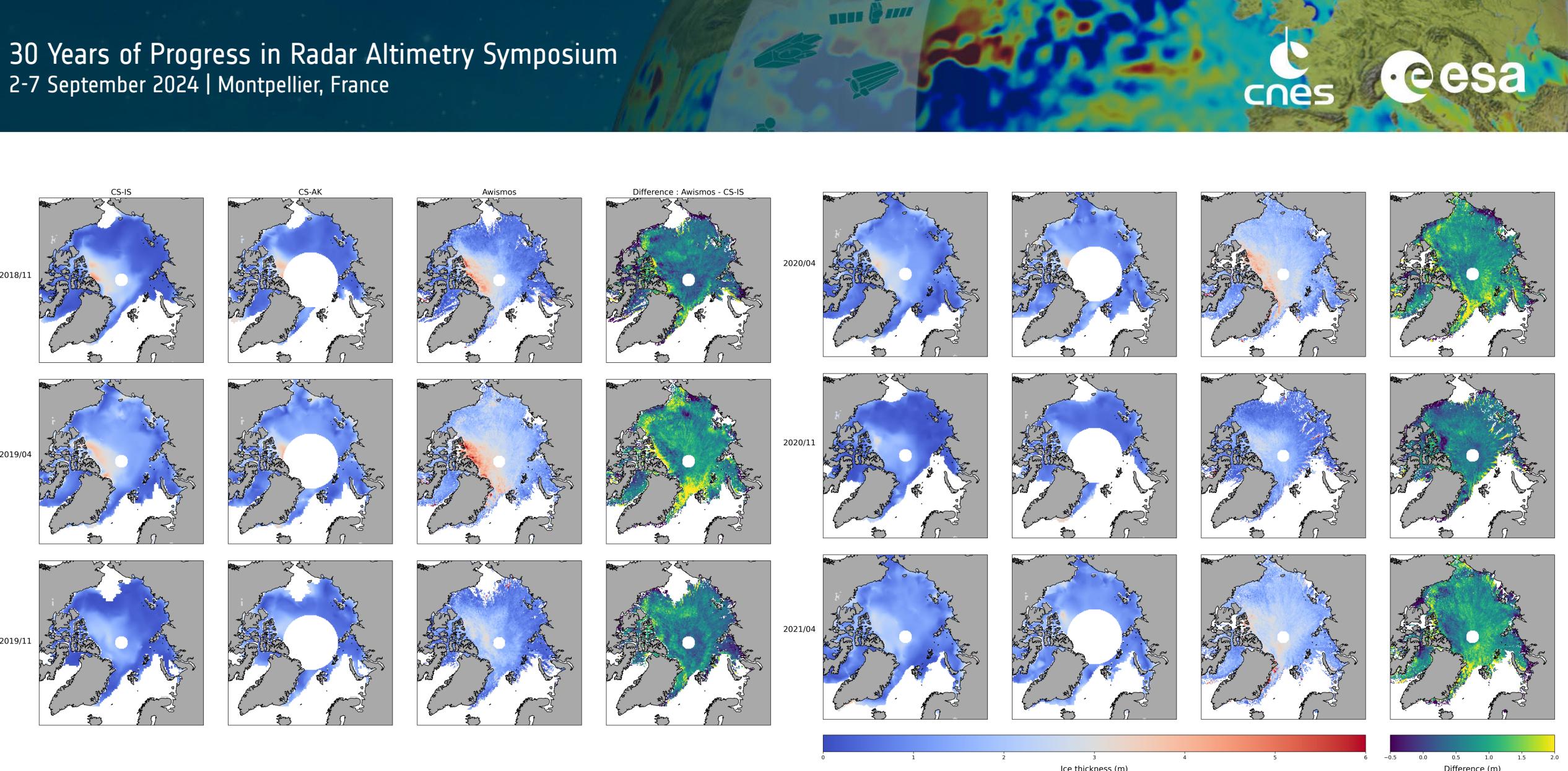
IceSat-2



Along track freeboards used for the inversion. The background represents the inverse solution for these freeboards.

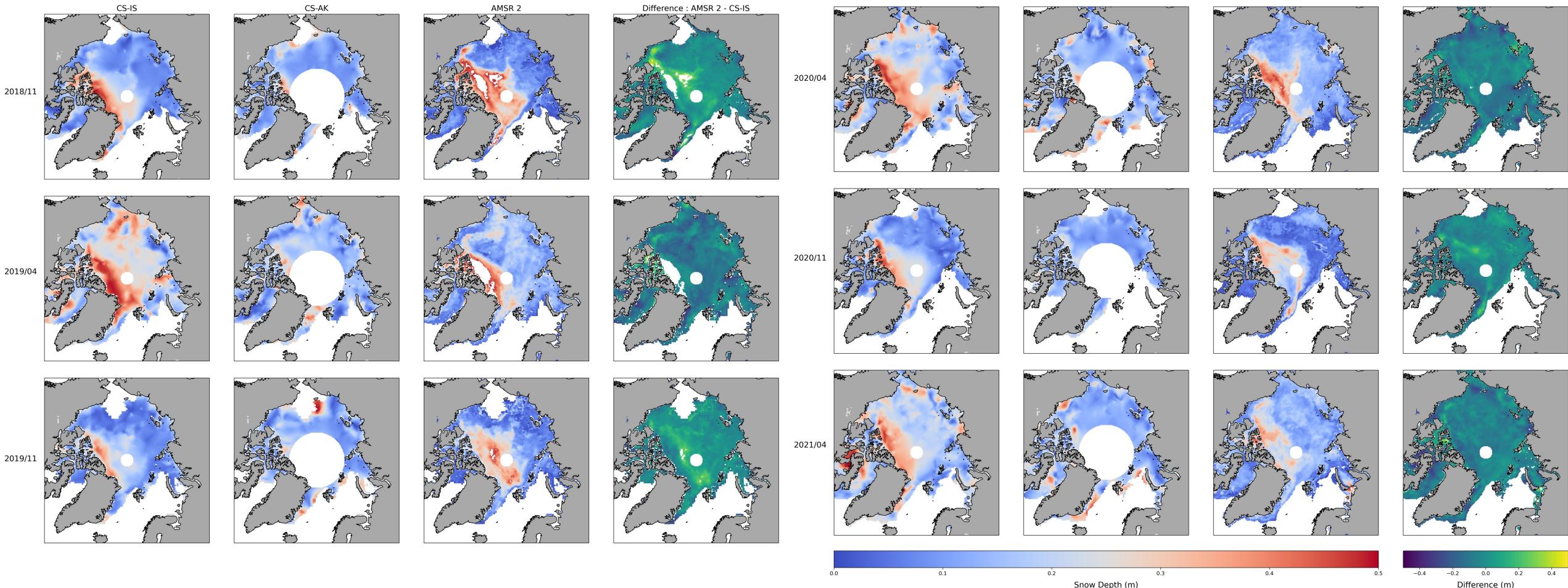
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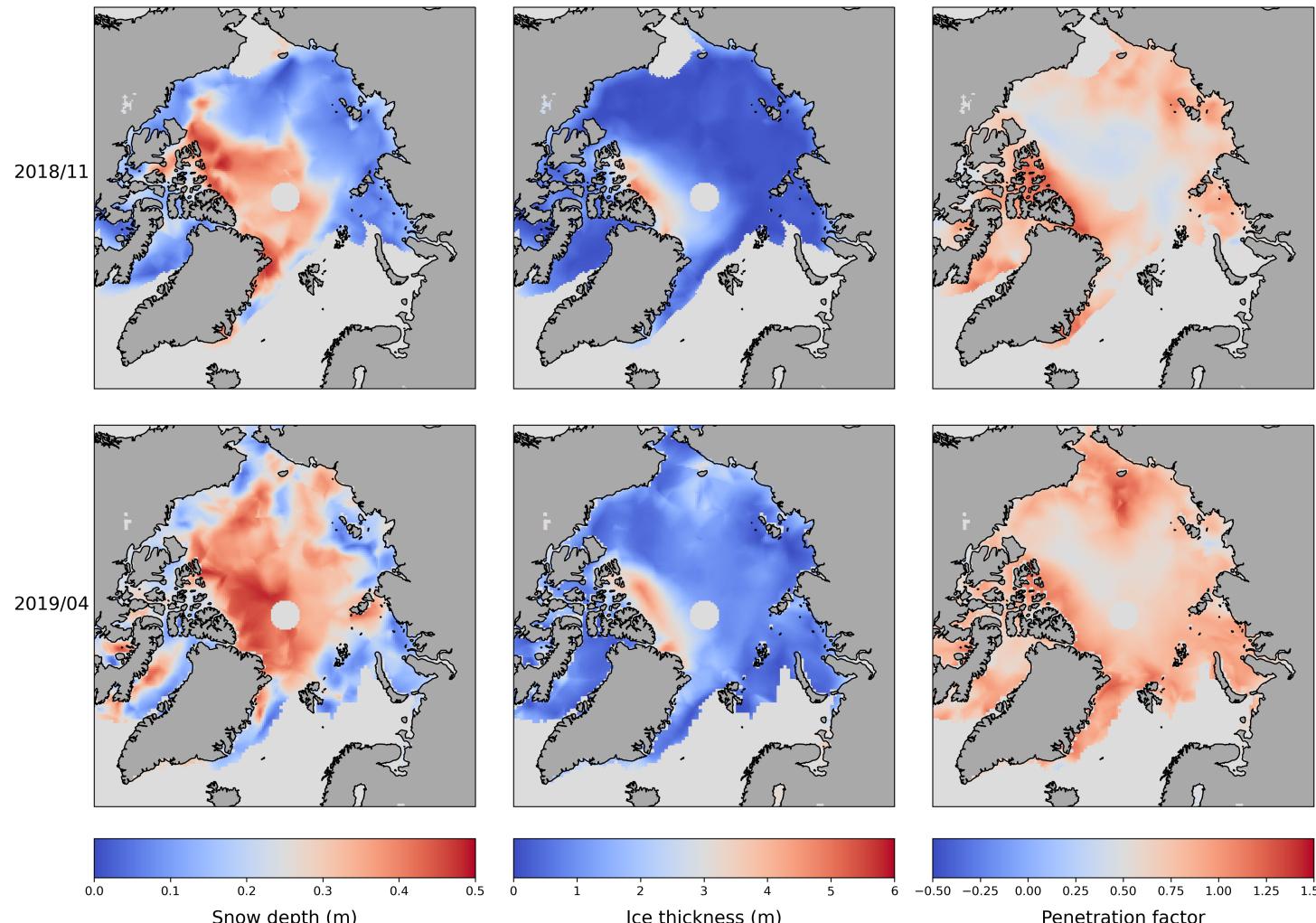
Result for ice, for 2 altimeters combination (CryoSat-2/IceSat-2 and CryoSat-2/AltiKa).

$$\alpha_{CS2} = 0.75 \text{ and } \alpha_{IS2,AK} = 0$$

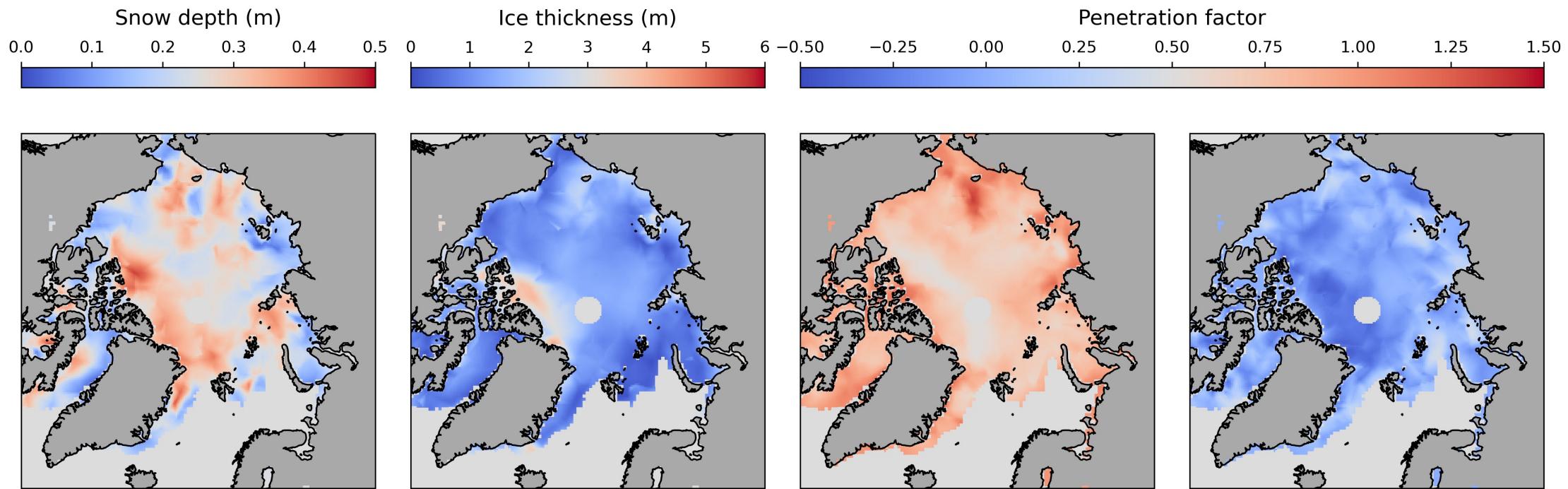


Result for snow, for 2 altimeters combination (CryoSat-2/IceSat-2 and CryoSat-2/AltiKa).

$$\alpha_{CS2} = 0.75 \text{ and } \alpha_{IS2,AK} = 0$$



Results of the inversion for the CryoSat-2/IceSat-2 combination, for April 2019. The results for snow, ice and  $\alpha_{CS2}$



Results of the inversion for the CryoSat-2/IceSat-2 combination, for April 2019. The results for snow, ice,  $\alpha_{CS2}$  and  $\alpha_{IS2}$