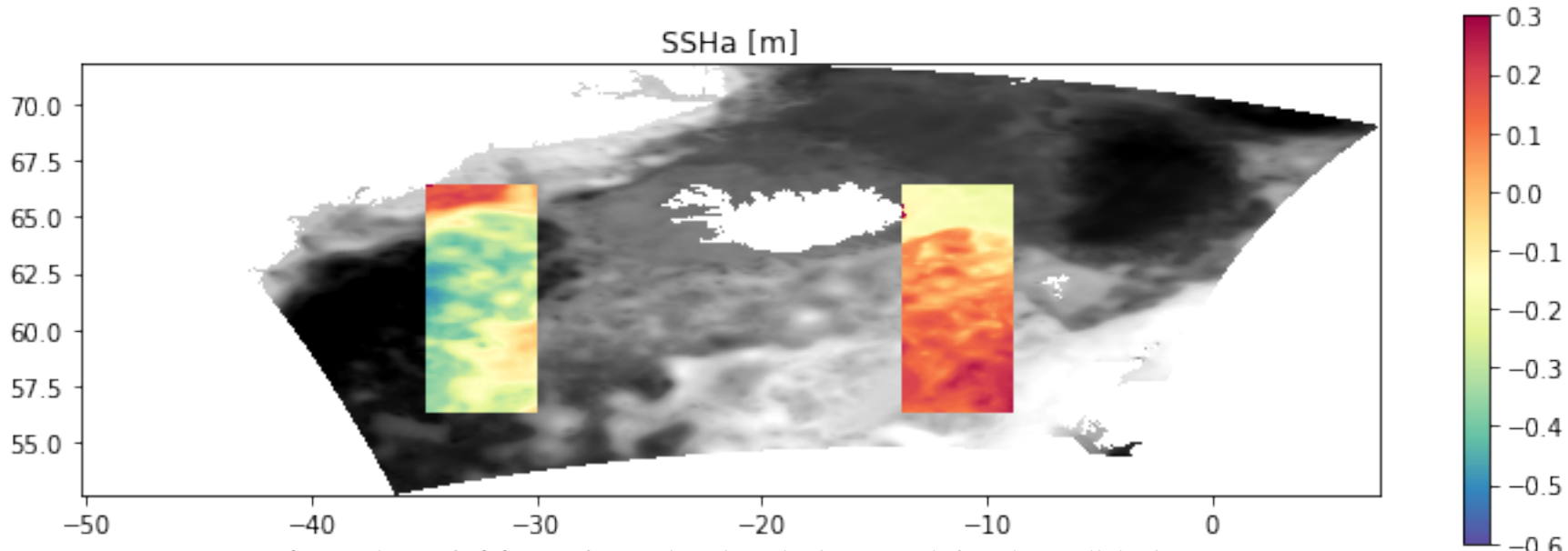
Inpainting method validation using HR mesoscale resolving numerical simulation

1- Validation based on GIGATL1 simulation, dx= 1 km, 100 z-levs, resolving the mesoscale in the area of interest (we use 2 areas in supbpolar Atlantic, where Rd=O(10-15) km, see de Marez et al. 2025)

2- Interpolation on a 2-km grid, (decrease resolution), to match SWOT's resolution



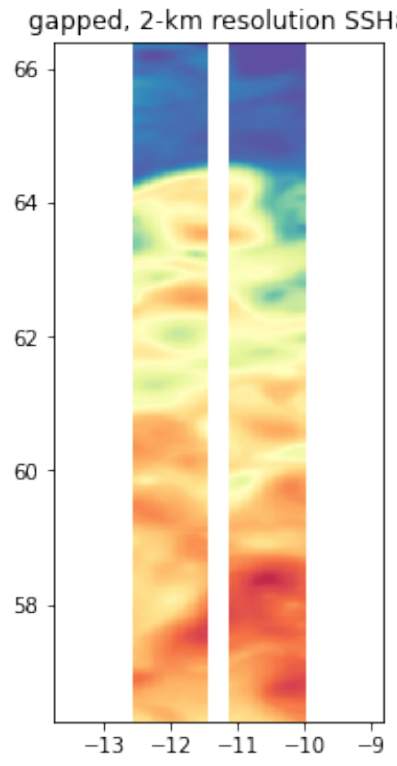
Snapshot of SSHa from the simulation used for the validation

3- Extract a N x 128 domain

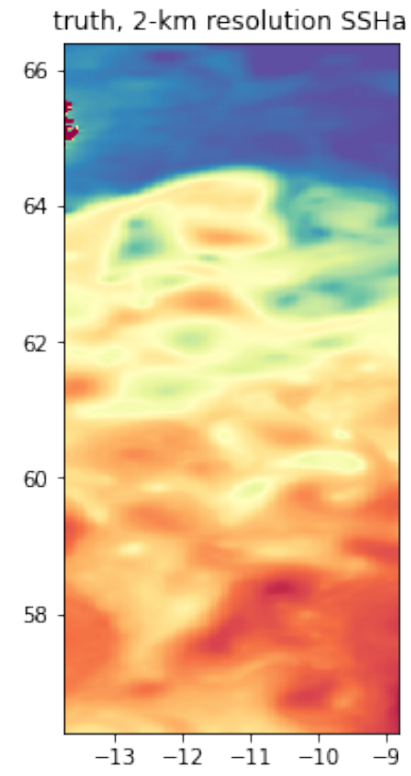
→ We call this array the **"truth"**

4- Create a SWOT-like pass by adding NaNs in the nadir and at the edge

→ This gives the same array shape/grid as the one used in our SWOT-based detection method



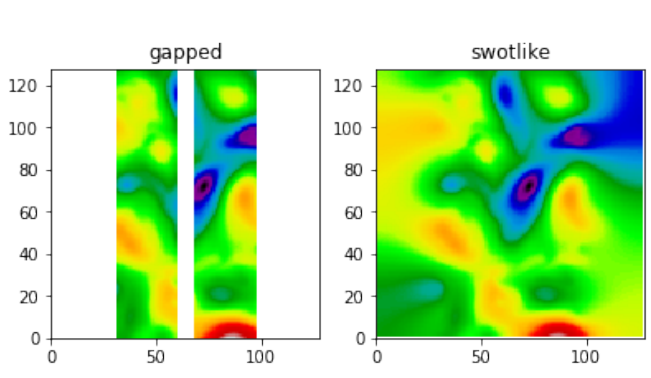
"gapped" SSHa



"truth" SSHa

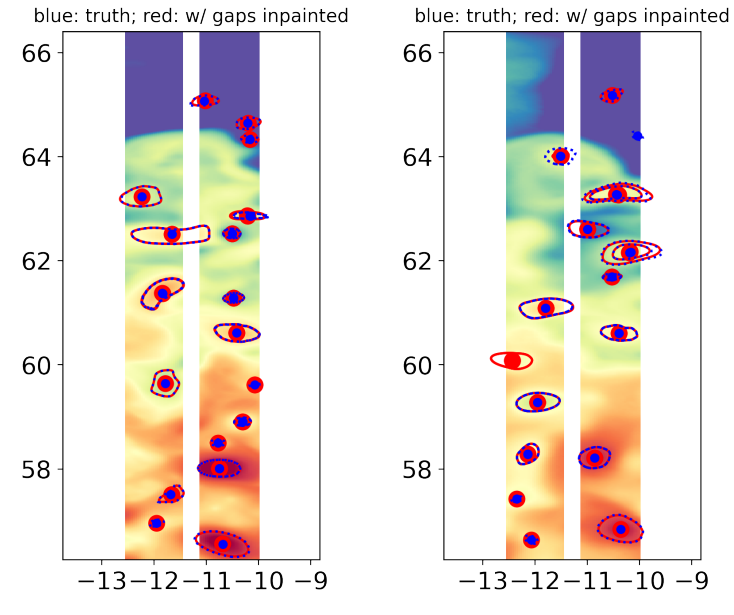
5- Use the inpainting method to fill gaps

→ We call this array the **"swotlike"**



"swotlike" SSHa

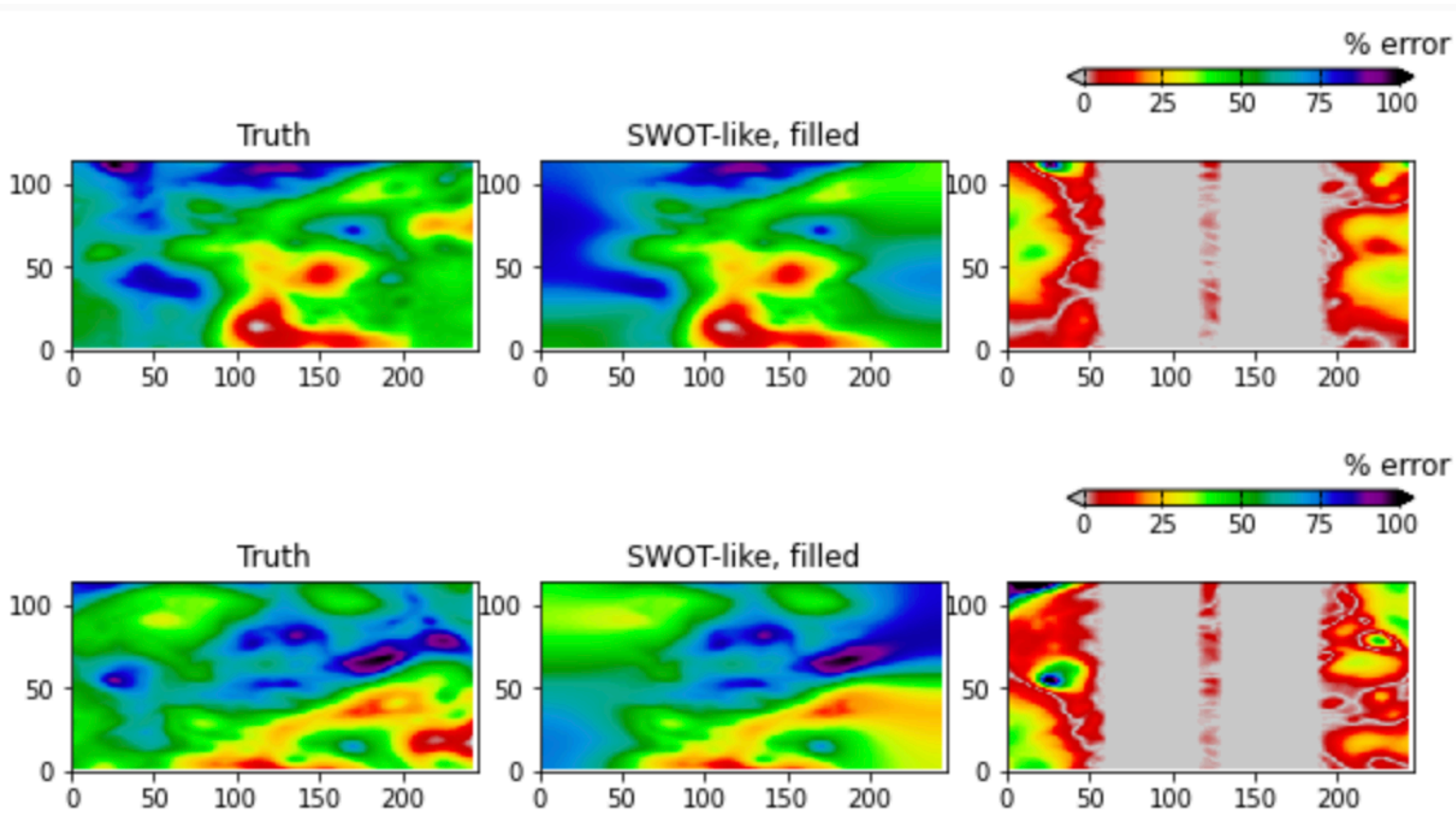
6- Detect eddies over the truth and the swotlike arrays, and compare the result. We do that for the two synthetic passes, for 1 year long, every weeks



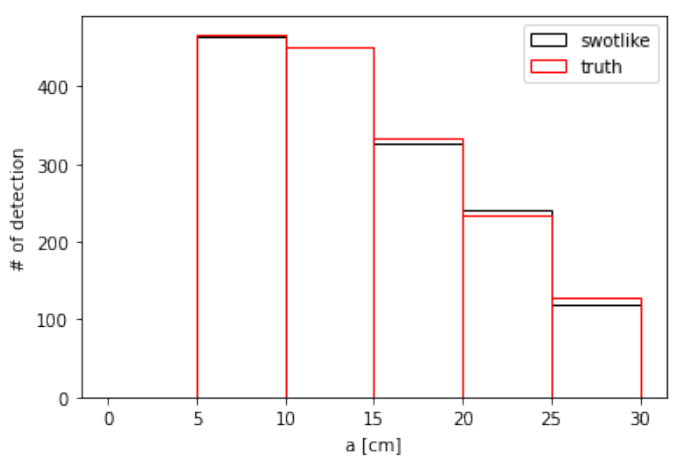
Superposition of eddy detections from "truth" or "swotlike" SSHa (2 different times, in the Easternmost domain)

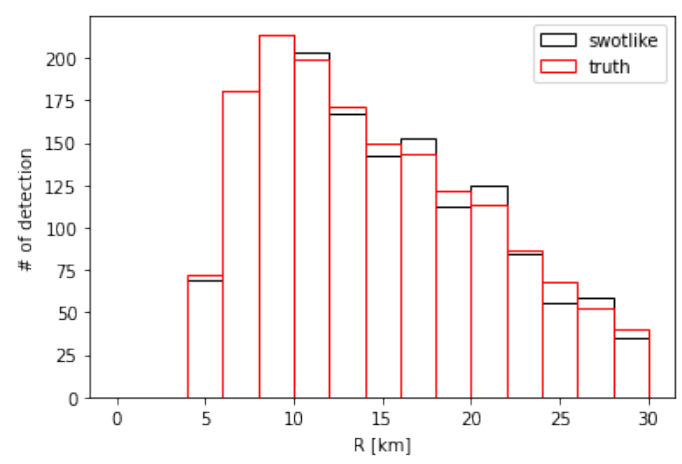
Comparison of statistics, *truth vs. swotlike*

Easternmost domain

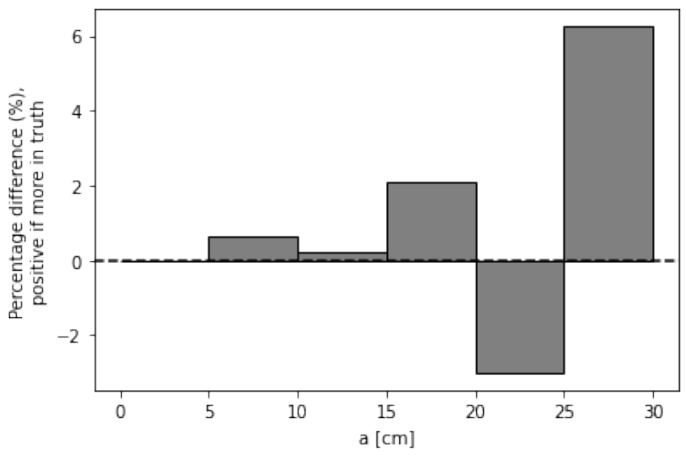


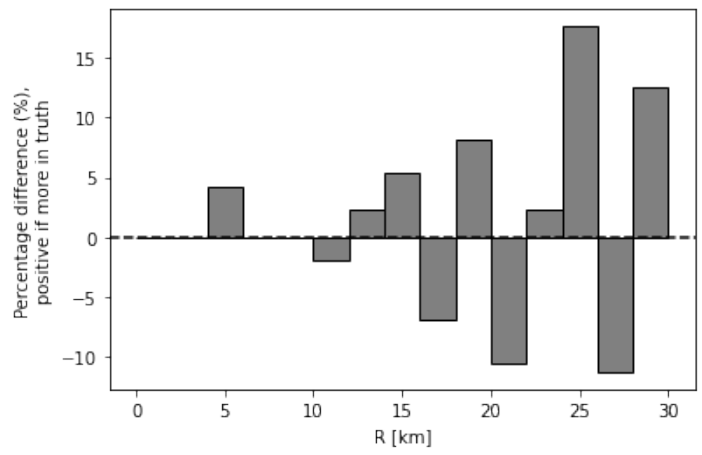
Error induced by the inpainting method for some example cases.





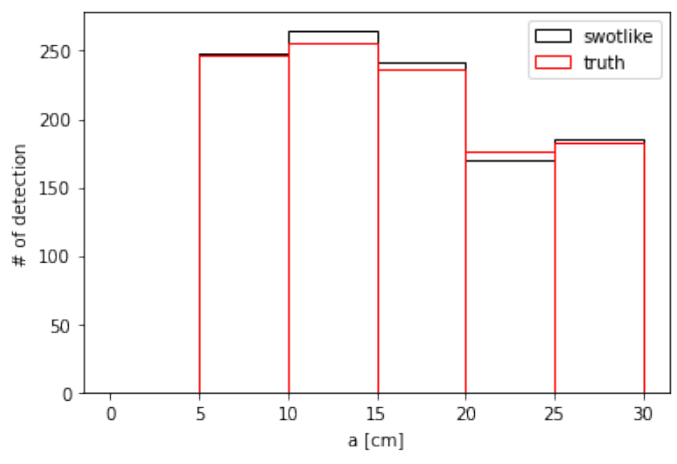
Histogram of detection numbers (radius and amplitude) over the year of study (weekly sampling) in the Easternmost domain.

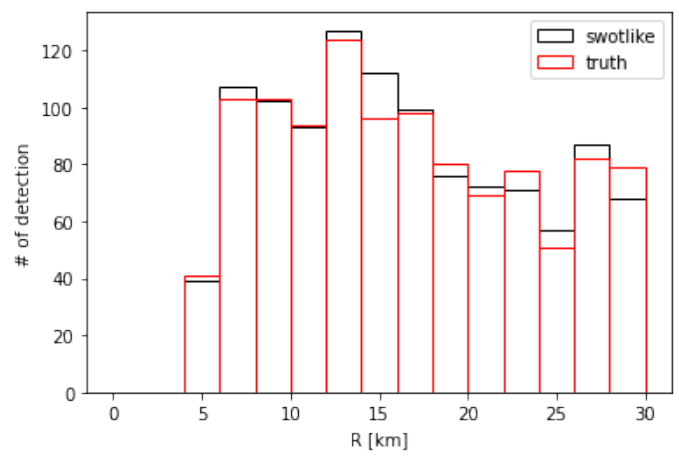




Absolute error histograms 100x(#truth-#swotlike)/#truth

Westernmost domain





Same in the Westernmost domain.