

Author response

"An improved sea ice detection algorithm using MODIS: application as a new European sea ice extent indicator", by Joan A. Parera-Portell, Raquel Ubach, and Charles Gignac

Dear editor and referees,

On behalf of all co-authors I want to thank you for the helpful advice and comments you provided. I hope you find the revised manuscript a substantial improvement from the initial submission. This document is divided in two sections: first the editor's comments are answered, and then the major changes in the revised manuscript are summarized.

Response to editor's comments

-The caption of Figure 1 and line 102 have been corrected.

-Regarding the VIS mask threshold value, clear areas are those where $VIS < 0.5$. I assume this question is because in the description of the previous IceMap250 (Gignac *et al.*, 2017) it is written as $VIS > 0.5$, which Dr. Gignac confirms is a typo.

-Table 5 (now Table 4) has been changed so monthly commission and omission errors are shown to support the results in the text. The caption has also been rewritten, so now it indicates what kappa coefficients are and why there are two accuracy results per month. Each number corresponds to a different scene, so four scenes were validated each year (two per month).

-Much of the manuscript has been rearranged. Now inconsistencies between IceMap500 and the Sea Ice Index are discussed in a more detailed way, and a September 2013 figure is included. We also discuss the effect of the sea ice presence likelihood threshold on the agreement between both datasets.

Changes in the manuscript

-Abstract: minor corrections and changes. IceMap250 is not cited before introducing it. The last sentences, which the referees found confusing, were also changed.

-Introduction: the referees found this section poorly structured and lacking some recent references, so it has been largely rewritten and updated. A brief summary of sensors used in sea ice remote sensing and an introduction to MODIS is included. Limitations of existing MODIS sea ice extent products are also highlighted.

-Materials and Methods: minor changes in subsection 2.1 (Study area), related to the subdivision of the study area in Baltic and NE Atlantic-Barents regions for the sea ice trends analysis. Subsection 2.2 (selected data) has been reduced, as most text has been moved to the Introduction. A new section 2.3 (Overview of previous MODIS sea ice extent algorithms) is included where IceMap and especially IceMap250 are introduced, thus making easier to explain the workflow of IceMap500 in later sections. Subsection 2.4

(IceMap500: challenges and improvements) was rearranged due to the new subsection 2.3. Minor changes and corrections were done in the text where the masking, the classification tests and the MOD35 correction are explained. However, the text explaining the map aggregation method has been expanded, including two new figures: a step-by-step example of IceMap500 and a four-panel figure with sea ice presence likelihood examples already shown in the responses to the reviewers.

-Results: the former Figure 7 and Table 4 (sea ice trends) have been merged in a single figure. Table 5 (now Table 4) has been expanded as indicated in the response to the editor's comments. An equation for IceMap500-Sea Ice Index agreement is now given as suggested by the referees.

-Discussion: this section has been rearranged and considerably expanded. Now it consists of two subsections (4.1 Sea ice trends and 4.2 Applicability of IceMap500). In 4.1 a more detailed comparison of the sea ice trends is given, including more recent references and numerical comparisons. In 4.2 we discuss the major error sources of the algorithm and the effect on the overall accuracy and on the IceMap500-Sea Ice Index agreement. We also discuss the potential of IceMap500 as a sea ice monitoring tool, taking into account its resolution and processing times. We also compare the results of IceMap500 to similar existing products (including a figure), and discuss the application of IceMap500 to other sensors.

-Conclusions: minor corrections.