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The Cryosphere Discussions

Interactive comment on "Spaceborne infrared imagery for early detection and cause of Weddell Polynya openings" *by* Céline Heuzé and Adriano Lemos

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We thank the reviewer for their comments. The role of the reviewer has been duly acknowledged with the addition of this sentence in the acknowledgement section:

"We also thank the two anonymous reviewers 1 and 3 and Stephan Kern (reviewer 2) for their comments that greatly improved the clarity and quality of this manuscript"

R: The manuscript has serious weaknesses and is largely not reproducible. First and foremost, the aim of the study is unclear to me. Is it about improving remote sensing methodology or a forecasting system for the opening of the Weddell Polynya? Or both

at the same time? The not very scientific approach and the sloppy writing is bothering (e.g. "debate is closed", "infrared out of fashion").

» We are sorry to hear that the reviewer could not reproduce our results. We have now made our codes freely available on Github, and explained in the Code availability section. In response to reviewer 1's suggestion, we also made a flowchart to clarify our methods. Finally, sections 2 and 3 have been dramatically rewritten (and in the case of section 3, further split into sections 3 and 4) to increase their clarity. Following the reviewer's comment, our aim and working hypothesis are now clearly in the introduction and in the abstract. We do not understand what the reviewer means by "not very scientific" without more specific examples, but we have added a lot of information in response to reviewers 1 and 2. Colloquial sentences have been removed.

R: There is a lack of hypotheses, statistical tests for the significance and descriptions of the uncertainty. References are used in the wrong context and much of the existing literature is ignored. The description of the data is careless and incorrect in some places. If the goal were to analyze the AVHRR data using a new methodology, the question of cloud cover would first have to be analyzed more thoroughly. It remains e.g. unclear whether passive microwaves and AVHRR data give consistent results. This would be the first step towards a suitable long-term study.

» The working hypothesis is now clearly stated in the abstract and in the introduction. References cannot be corrected without more specific examples. We had preferred restricting the literature to that which is most relevant for increased readability, but have added the model-based studies suggested by the reviewer, to provide the wider context. Likewise, data description cannot be corrected without more specific information as to which is wrong. We suspect that our response to the comments from reviewer 1 and 2 and corresponding text modifications address this point. Finally, in response to the reviewer's suggestion as well as that of reviewer 2, a detailed analysis of the cloud cover has been added as appendix section A. In that appendix, we validate the (published) methods that we used for cloud masking against a reference cloud mask

product (MYD35_L2). We also added cloud cover information in Table B1 and added supplementary figure B1, to show that the cloud cover during and in the days leading to a polynya were within the usual “cloudiness” range of the region under non-polynya conditions.

R: An investigation into the causes is difficult to do with observational data alone. The Weddell Polynya is a phenomenon in the coupled system of ocean-ice-atmosphere and is based on feedback effects and tides. Forcings such as fresh water fluxes through precipitation or melting of meteoric ice and the heat reservoir in the deep ocean play a role. Without a coupled model system, causal research is inadequate or must remain empirical. The empirical aspects of the study are however not solid because of the lack of hypotheses, statistical testing and significance.

» We agree with the reviewer that the causes are difficult to investigate from observations alone as the observations are limited in this part of the world, both in terms of resolution and coverage. Using models is what the lead author and her colleagues normally do, for this exact reason. However here it would be beyond the scope of this paper. For once, we wanted to see how much could be achieved from observations alone. We have already addressed the specific reviewer’s comment in response to their previous comment.

R: However, the topic is very suitable for the journal and I suggest that the author should resubmit the work after a major revision. Because my concerns are about the main aim of the study I would encourage the author to withdraw the study and to resubmit it with better defined scopes, e.g. in two parts. First a validation of the AVHRR approach to detect the polynya, and a second part about the forecast method. The first part shall include a thorough error analysis about the influence of clouds. The second part should use advanced statistical methods.

» We thank the reviewer for their suggestion. In this revised version, we now mostly focus on the AVHRR approach. As suggested, we include a specific appendix validating

the cloud masking, along with extra figures and tables providing information about the cloud cover. We do not understand what the reviewer means with advanced statistical methods, considering that the reviewer correctly highlighted the limits of observational data. Advanced statistical methods that we commonly use on model output would unfortunately be irrelevant and insignificant here.

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