We would like to thank the reviewer for the time and effort that was put into this review as well as the very constructive feedback. We will go through all the comments made and highlight our changes in accordance with the reviewers' suggestions.

**P3962,L20:** We changed *"ERA-Interim reanalysis data"* to read *"ERA-Interim atmospheric reanalysis data"*.

**P3963,L10-11: A more complete (but still brief) description of the TIT retrieval is required, particularly as the Adams et al paper may not be easily available to all readers.**

We appreciate the reviewers comment and added the following paragraph:

*"The derived thin-ice thickness (TIT) of up to 0.5m is calculated by using a~ surface energy balance model (Adams2013). This model utilizes the fact that the ice-surface temperature of thin ice is related to ice thickness via the energy balance equation (Drucker2003,Yu1996).*

*Since the total atmospheric flux (i.e. the energy loss to the atmosphere Qatm, Eq. \ref{eq:Qatm}) is balanced by the conductive heat flux through the ice (Qi, Eq. \ref{eq:Qice}), the ice thickness (hi) can be calculated from Equation \ref{eq:hice}. Here, Q0 is the net radiation balance, H0 and E0 are the turbulent fluxes of sensible and latent heat, ki is the thermal conductivity of sea ice (2.03W(m K)^-1) as well as Ts and Tfp which are the ice-surface temperature and the ice/ocean-interface temperature, respectively."*

**P3963,L16: Define what you mean by nighttime. April-September is mentioned elsewhere.**

We added the following clarification to the mentioned paragraph:

*"In addition, all processing is carried out for nighttime only, to avoid dealing with short-wave radiation and snow/ice-albedo effects. We therefore removed daytime pixels based on their solar-incidence angle. This was done on a per-pixel basis for all available MODIS swaths between 1 April and 30 September for the years from 2002 to 2014. Thereby, we also simplify the net radiation to long-wave radiation terms."*

**P3963,L20-22: Why not use downward longwave radiation from ERA.**

We added the following paragraph to this section in order to clarify why we chose to not use the available ERA-Interim data set of downward longwave radiation:

*"Studies of the ERA-Interim downward long-wave radiation data revealed that ERA-Interim overestimates the cloud-cover fraction of low clouds (Zygmuntowska et al., 2012). We found this effect also to appear in*

*clear-sky situations diagnosed from visual screening of the corresponding MODIS imagery for the Antarctic. Overestimated cloud-cover fractions lead in turn to too high downward long-wave radiation values (Tastula et al., 2013). Tastula et al. (2013) found a large positive bias in incoming long-wave radiation for ERA-Interim in their analysis of different atmospheric reanalysis data sets over Antarctic sea ice. Hence, we decided against the use of long-wave radiation data from ERA-Interim reanalyses."*

**P3964,L7-9: What is the resolution of the common grid? Given that the ERA grid is much coarser than the MODIS grid, is it really justified not to interpolate the ERA data?**

Together with the reviewers' remark on **P3962,L20-22** we changed the mentioned paragraph in order to clarify our processing steps to read:

*"First, all MODIS swaths were projected onto a common equirectangular grid with an average spatial resolution of 2km x 2km using a nearest-neighbor approach. The spatial resolution of this type of grid decreases slightly with decreasing latitude and vice versa. No interpolation between projected MODIS pixels was applied (i.e. data gaps are possible). Subsequently, ERA-Interim data, which exhibit a much coarser spatial (0.75°) and temporal (six hourly) resolution than the MODIS data, were linearly interpolated to spatially and temporally fit the MODIS data on the common reference grid.*

*Based on these adjusted swath-based data sets, TIT is calculated pixel-wise and daily TIT composites are calculated based on the median thin-ice thickness and corresponding ice-surface temperature of all available swaths per pixel. The resulting composites comprise TIT and IST data together with the daily swath-based median energy-balance components of each thin-ice pixel. In the next step, cloud-covered data was identified and flagged as will be described in the following subsections."*

**P3965,L12-13: Maybe better to say "cloud-contaminated MODIS data"?**

We changed that.

**P3965,L22-25: Some expansion and clarification of the method is required - giving a reference is not sufficient.**

We added the following explanation to clarify the procedure:

*"Employing the above mentioned two procedures of cloud-cover dependent classification and persistence index calculation, we are able to identify cloud-contaminated MODIS data in each daily TIT composite. These are then complemented by a two-step procedure utilizing a combination of spatial feature reconstruction (SFR, Paul2015a) and proportional extrapolation (PE, Preusser2015).*

*In the SFR approach, the information of a 7-day interval ($doi_\textrm{-3...-1}$ and $doi_\textrm{1...3}$) centered around the day of interest (doi) is weighed directly proportional to its temporal proximity to the* initial day of interest. This yields a~probability of thin-ice occurrence for the day of interest based on the surrounding six days. (Eq. \ref{eq:sfr}).

Information about polynya area is on average significantly correlated within at least three days and $>$90\,\unit{\%} per-pixel gaps are shorter than four days (Paul2015a). We decided to utilize the set of weights ($w_3$ = 0.02, $w_2$ = 0.16, $w_1$ = 0.32) and probability threshold (th = 0.34) of this study, which featured the highest spatial correlation but is less restrictive in the analysis of \citet{Paul2015a}. A~detailed description and analysis of the SFR approach and its setup is given in \citet{Paul2015a}.

The PE approach on the other hand assigns thin ice to cloud-covered areas in the same proportion as it is detected in the cloud-free area. For example, if a~region is 80% cloud free and 50% of the cloud-free area features a~thin-ice signal, then 50% of the cloud-covered region is considered as thin ice.

In the two-step procedure, we first apply the SFR approach to all cloud-free pixels (i.e. pixels in the ccs class and mcp class where the majority of pixels show clear-sky conditions) that also feature a PIX value greater than 0.5 (i.e. pixels with a thin-ice thickness $\leq$ 0.2m present in more than 50% of the swaths covering that pixel) in the 7-day interval and are covered by at least three swaths. Pixels that do not match these two criteria are considered of minor quality and are discarded from the SFR approach.

Based on Equation \ref{eq:sfr}, the binary information (i.e. thin-ice or no thin ice) of the six days surrounding the day of interest is matched with their corresponding weights and the polynya probability estimated. A probability value above 0.34 is classified as polynya area in a resulting binary image.

Subsequently, cloud-contaminated pixels with a probability above 0.34 are assigned a~pixel-wise weighted average ice-thickness and ice-surface temperature value based on the six days surrounding the initial day of interest (doi) (TIT$_{\text{add}}/$IST$_{\text{add}}$, Fig.~\ref{fig02}). Weights are applied in the same configuration as for the SFR approach itself. Additionally, pixels categorized as lesser quality that feature a probability above 0.34 can be up-valued and are assigned their original thin-ice thickness and ice-surface temperature values.

The remaining coverage gaps that could not be corrected for by this approach, e.g. due to temporal gaps longer than three consecutive days, are corrected for by the proportional extrapolation (PE) scheme (Preusser2015).

This way, we achieve a full cloud-cover correction by minimizing the drawbacks of solely using proportional extrapolation. These drawbacks comprise a lack of knowledge about the spatial distribution of thin-ice occurrences as the procedure just gives a bulk value for a region per day as well as the potential to allocate thin-ice areas to regions that are very unlikely to feature a coastal polynya.

In the rare case, that after the application of the SFR approach more than 50% of the investigated sub region is cloud-contaminated, daily estimates of polynya area and ice production will be interpolated between neighboring days with sufficient (i.e. above 50%) cloud-free coverage."

**P3966,L1: Change "this" to "the cloud-free"**

We changed that.

**P3966,L7: You have not defined polynya area anywhere. I assume that you mean all area covered by ice of thickness 0-0.2m, but this needs to be stated explicitly.**

We added the following clarification to the mentioned paragraph:

*"From our cloud-cover corrected daily thin-ice thickness composites, we then derive daily polynya area (POLA, defined as area with open water and thin-ice between 0.0m and 0.2m thickness) as well as the accumulated winter-time ice-production (IP) from heat loss (e.g. Tamura et al., 2011, Willmes et al., 2011) for each POLA pixel."*

**P3971,L23: Change "negligence" to "neglect".**

We changed that.

**P3974,L21-27: It is possibly stretching things a bit far to assume similar biases in both the Arctic and Antarctic. Reanalyses have also been validated in the Antarctic, e.g. 10.1002/jgrd.50336**

We appreciate the suggested reference by the reviewer. We changed the mentioned paragraph to read:

*"In the study of \citet{Tastula2013} ERA-Interim and NCEP data are compared to observational data of a drifting ice station in the Weddell Sea for three months in 1992. Their results indicate a warm bias of about 4K for NCEP and a warm bias of about 2K for ERA-Interim. With respect to wind speed, NCEP shows a positive bias (about 1ms^-1) while ERA-Interim features a negative bias (about -0.75ms^-1). Different atmospheric forcing can be one of the reasons for the increased POLA and IP in the years 2002 and 2003 for the Ronne polynya in the study of \citet{Haid2013}. As shown by \citet{Haid2015}, the atmospheric forcing may have an impact on ice production, not only with respect to bias but also with respect to regional distribution. In addition, the method for the computation of turbulent atmospheric fluxes is different between our method and \citet{Haid2013}, as it is suggested by much larger values particularly of the sensible heat flux for the sea-ice /ocean model."*