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The Robustness and Vulnerability of Antarctic Land Ice within the Earth System

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Introduction

This case study analyses Antarctic land ice as an example of the robustness and vulnerability of the earth system to climate change on a time scale of the last century [1]. This research consists entirely of desk research and has been conducted to provide a clear overview of the possible role the Antarctic land ice plays within a world of Global (Climate) Change.

The research will look at several aspects related to climate change and the role that the Antarctic Ice Sheet (AIS) plays within the Earth system. The research will look at the influence of the AIS on the earth's climate in a natural context, the current observable and/or observed change in relation to the AIS, caused by human activity and the possible positive and/or negative feedback loops on such time scales [2].

Description

During this research, which consists entirely out of desk research, various, mainly scientific literary sources were consulted. The reliability of the source in question was examined to contribute to an accurate case study.

Two highly regarded Dutch literary sources within the field of Global Change were consulted. The book Hoezo Klimaatverandering and the work by, Klimaatverandering (translation Climate change), can be considered reliable and neutral [3].

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Some consulted sources come from the Royal Dutch Meteorological Institute (KNMI). This national meteorological institute provides reliable scientific research conducted by scholars working at the KNMI. The sources used are therefore neutral and easily accessible to the public [4].

Two chapters from the report 'The Ocean and Cryosphere in a Changing Climate', published by the Intergovernmental Panel on Climate Change (IPCC) were consulted. The used chapters were written by (Polar Regions) and Oppenheimer & Glavovic (Sea Level Rise) four scientists researching climate, oceans and Antarctica [5]. The IPCC is a leading panel working on climate research; its published scientific works do not contain any judgments and are therefore to be considered as neutral accurate.

Furthermore, the scientific journal ‘Nature’ has been extensively consulted. The articles in this journal are published by scientists working within their field of expertise. Articles published in Nature have a scientific background and therefore focused on the academic side; this makes the articles neutral and reliable to use. An article from the scientific news platform 'The Consumer' was consulted for this research. The article consulted was written by Phillips (Senior Research Fellow UT). consists of scientific facts and observations and is therefore a neutral and reliable source [6].

Solar radiation is largely responsible for the climate, but Spitz also concludes that surface-properties have an effect on incoming solar radiation. The AIS is, as it were, a large reflector; this causes little conversion of radiation into heat. Due to the increasing concentration of greenhouse gases, the AIS are heating up, resulting in the melting of the AIS. The higher the melt, the lower the volume of the AIS (WAIS & EAIS) these results in a higher degree of ablation. Through ablation, ice and/or snow is converted into melt water. This, in turn, leads to the freshening of the ACC, which causes the Antarctic continent to warm up even more. The Antarctic continent and with it the AIS – has entered a downward spiral. However, it will take until the next century before the melting of the AIS (mainly the EAIS) will have a major impact on our rising sea-levels [7].

Throughout this study, several aspects related to the robustness and vulnerability of the Antarctic Land Ice within the Earth System has been addressed. Within the analysis, light has been shed on to the positive and negative feedback loops that may occur at certain time scales.

Sea-level rise due to the melting of Antarctic land ice is currently unclear. One third of the sea level rise to date can be traced back to the melting of ice sheets in Antarctica and Greenland. Since the melt of the WAIS and EAIS is slow compared to the Greenland Ice Sheet (GIS), the current sea level rise is more difficult to relate to the southern continent. The Antarctic ice sheets contain the largest amount of stored freshwater; if this melts to a large extent it will lead to substantial sea-level rise.

Based on the findings found that floating ice shelves form a barricade that slows the flow of land ice towards the Southern Ocean. As temperatures at the edge/coast of the Antarctic continent increase, meltwater is released in larger quantities. The melt water can easily move through cracks on sea ice shelves, causing the sea ice to break up: hydrofracturing takes place; its

role as a doorstop is lost. In addition, increasing ocean temperatures will accelerate the melting of ASI. As soon as the ice cliffs on the Antarctic coast exceed 100 meters in height, they will collapse: they can no longer support their own weight (Ice-Cliff Failure), this will increase as temperatures rise and will also affect the EAIS, which was previously considered stable.

Conclusions

The Antarctic land ice can be regarded as both robust and vulnerable. The AIS is robust to climate change compared to other global events. For example, the AIS is melting at a slower rate than other ice sheets in the world. Due to its remote location and the protection provided by the ACC the AIS is somewhat self.

The melt that is currently taking place is mainly on the WAIS while the EAIS remains unchanged to a certain degree; this despite the fact that the EAIS amounts to ±85% of the land ice. Although there are no disastrous consequences to date, this could still happen. The atmospheric concentration of greenhouse gases is currently at such a level that the melting of the ice caps in relation to geological history is very likely. Because the AIS contains the largest amount of land ice that can and will be exposed to melting if current greenhouse gas emissions continue, it is also very vulnerable. Once the AIS begins to melt on a large scale, it will be unstoppable potentially resulting in a sea level rise of more than 10 meters.

REFERENCES

1. DeConto R, Pollard D. Contribution of Antarctica to past and future sea-level rise. Nature. 2016;531:591-610.
2. Gong D, Wang S. Antarctic oscillation: Concept and applications. Chin Sci Bulle.1998;43:734-738.
3. Huybrechts P, Oerlemans J. Response of the Antarctic ice sheet to future greenhouse warming. Climate Dynamics.1990;5:93-102.
4. Lee JR, Raymond B, Bracegirdle TJ, et al. Climate change drives expansion of Antarctic ice-free habitat. Nature 2017;547:1-19.
5. Rintoul SR, Hughes C, Olbers D. The antarctic circumpolar current system. Inter Geophy. 2001;77:271-302.
6. Seo M, Kimb HC, Huh M, et al. Long term variability of surface albedo and its correlation with climate variables over antarctica. Rem Sen. 2016;8(12):981.
7. Tollefson J. Trigger seen for Antarctic collapse. Nature. 2016;531:1-3.