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A THERMODYNAMIC-HYDRODYNAMIC MODEL FOR THE INVESTIGATION OF THE IMPACT OF GLOBAL CHANGE ON LOW-ALTITUDE BLUE ICE IN ANTARCTICA

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Low-altitude blue-ice areas (LABIAS) are areas of exposed ice in Antarctica that lie below 1000m a.s.l and therefore can suffer melt-freeze processes. In some cases LABIAS contain a significant amount of subsurface liquid water. The formation of this meltwater is due to the large amount of solar radiation absorbed in the ice which cannot be disposed of because of the small heat conductivity of ice and which leads to a temperature increase in, and finally melting of, the ice. The research in this study concentrates on constructing a two dimensional (x-z) thermodynamic-hydrodynamic model of the ice-water mixture, using a two-stream approximation for the radiation, to study the formation, temporal evolution and spatial distribution of the water and the current velocities in the water. The redistribution of impurities in the ice is a consequence of the melt of water and the circulation of the water. The results show that the observed formation of liquid water inside the ice can be reproduced. A weak circulation of the water forms inside the subsurface lake, leading to a slow redistribution of contaminants. Global change was mimicked with a decadal scale increase in air temperature. As the temperature increased, the volume of liquid water inside the ice increased as well, for sufficiently high temperatures the sub-surface meltwater lake is likely to become a suprasurface lake. If this phenomenon were to occur on a larger scale it could lead to a more rapid disintegration of the Antarctic ice sheets.