COMSOL CONFERENCE
2015 KUALA LUMPUR

The Visualization of Ocean Movement in Southern Ocean

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Abstract

Ocean is the cornerstone in Earth's system because the surface of the Earth is covered by ocean about 71%. Ocean also holds approximate 97% of the Earth's water. Ocean is always moving and continuous. This study is focusing on the ocean movement in Southern Ocean which is located in the southernmost of the Earth. It can be called as Antarctica Ocean because it consists of the waters extending until the line of latitude at 60 degrees south from the coast of Antarctica. Southern ocean has been studied to understand how the ocean circulation can affected the climate change of our earth. Eventhough the ocean's climate is changing relatively slow and vary from year to millenia but it can contribute to climate change. Certainly that the ocean is an important regulator of the climate due to the capability on carrying the huge amounts of fresh water, nutrient and heat.

In this study, COMSOL Multiphysics 4.4 is used as the platform to visualize the ocean movement in Southern Ocean. The parameters that involved are temperature, velocity, density and salinity. The visualization will be in 2-dimensional with the simple geometry to represent as the Southern Ocean. Then, the models for this problem is built by using the physics mode. The selection physics mode are turbulent flows in the single phase flow and also the heat transfer in fluids. This problem is the time dependent study and the water is choosen as the material for the geometry. The solution from the COMSOL is shown in the figure 1 and figure 2.

In the figure 1, the result shows that near the Antarctica region, the temperature of the ocean is cold. The blue colour represents the cold region while the red colour represents the hot region. The ocean circulates from the high region to the cold region based on the heat transfer as shown in figure 2.

As a conclusion, it can be seen that COMSOL Multiphysics is a good platform to visualize and simulate the movement of the Southern Ocean related to the temperature behaviour. The mathematical modelling in COMSOL Mutliphysics will able to implement the mathematical modelling for ocean movement in Southern Ocean with some parameter those are important in understanding the works of ocean."

Reference

Charette, M. and Smith, Walter H. F., The volume of Earth's ocean. Oceanography, 23 (2): 112–114 (2010).

retrived from http://www.comsol.com/multiphysics/

Figures used in the abstract

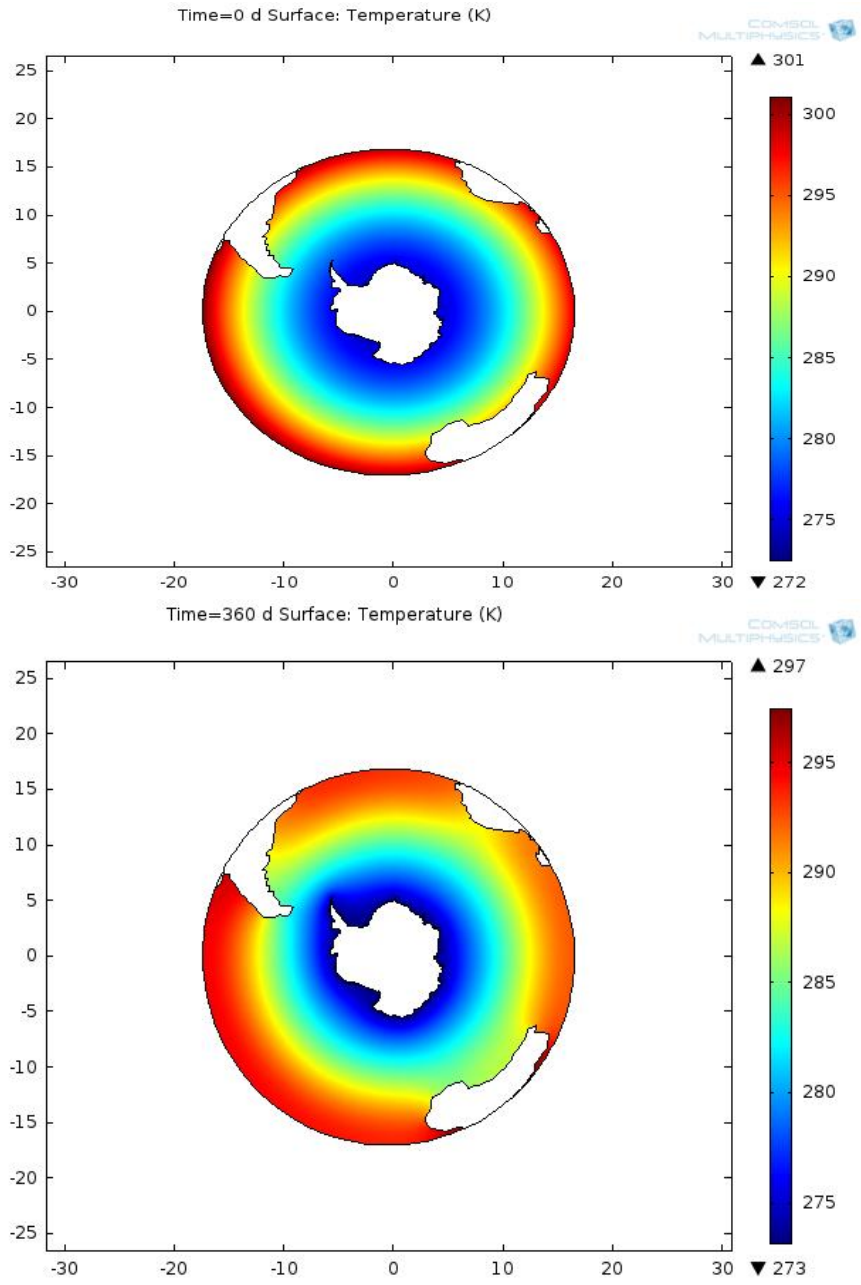

Figure 1: The Temperature (in Kelvin) in Surface of the Southern Ocean Movement in the Beginning of Days (up) and at 360 days (down).

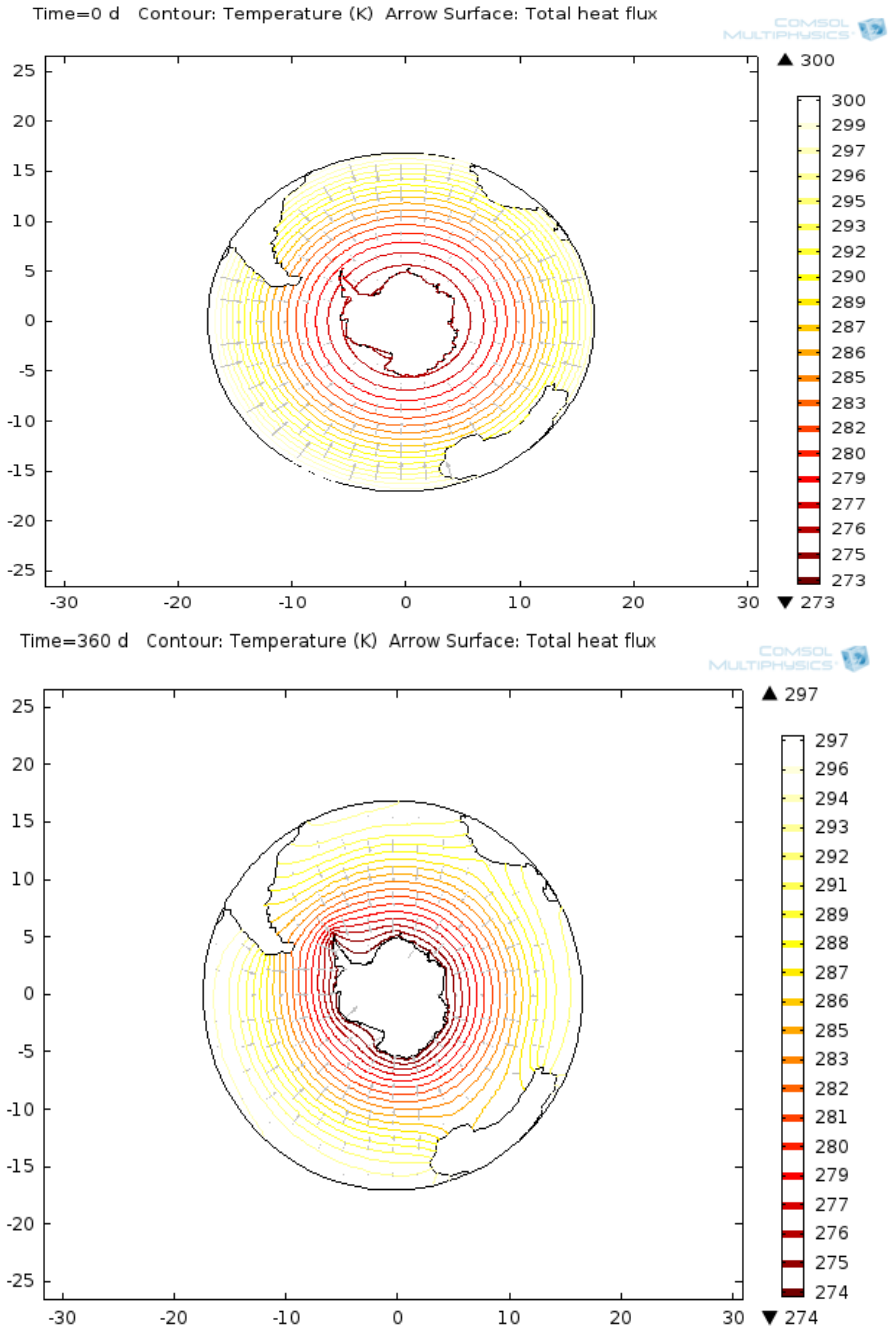

Figure 2: The Temperature (in Kelvin) in Contour of the Southern Ocean Movement with the Total Heat Flux at the Beginning of Days (up) and at 360 days (down).