

Energy balance in a warm world without the ocean conveyor belt and sea ice

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Abstract:

Under a strong global warming scenario, the global mean temperature could rise up to 10°C, causing the global ocean conveyor belt to collapse and the summer sea ice to disappear. This will lead to profound changes in our climate system and to impact drastically the living conditions of the globe. Here we study how the global heat redistribution and regional heat balance will respond to these changes using the National Center for Atmospheric Research Community Climate System Model version 4. Results show that the collapsed ocean conveyor belt reduces the oceanic northward meridional heat transport (MHT) by nearly 60% with a minor increase in the atmospheric MHT. The polar amplified warming is primarily caused by the increased absorption of longwave radiation due to the increased greenhouse gases and cloudiness, and by the increased absorption of shortwave radiation due to a lower albedo associated with the disappeared summer sea ice.