Geophysical Research Abstracts
Vol. 21, EGU2019-10086-2, 2019
EGU General Assembly 2019

The contribution of temp-spatial thickness diffusivity coefficients to the response of enhanced Southern Hemisphere westerlies in a CORE-II model

Yiwen Li (1,2), Hailong Liu (1,2), Pengfei Lin (1,2)

(1) State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China, (2) College of Earth Sciences, University of Chinese Academy of Sciences, Beijing 100049, China

The ability of the thickness diffusivity coefficient to simulate the response of enhanced Southern Hemisphere westerlies in a coarse resolution model followed the Coordinated Ocean-ice Reference Experiment Phase II (CORE-II) is evaluated by implementing different thickness diffusivity coefficients in the model. It shows that the experiment with a temp-spatial thickness diffusivity coefficient formulated in terms of the stratification has an eddy compensation of 0.47 Sv during 1998-2007 taking up to 8.4% of the residual circulation during 1960-1969, which is closer to the 9.9% from the high resolution ocean model. The constant and spatial various thickness diffusivity experiments all show smaller values of the eddy compensation. It is found that the eddy compensation in the stratification-dependent experiment is attributed to the vertical variation of the thickness diffusivity coefficient after decomposing the parameterized eddy-induced velocity, while the spatial structure part dampens the eddy compensation. In terms of the response of the eddy compensation, responses of both the thickness diffusivity and the indirectly changed density slope make similar contributions to the enhancement of the eddy compensation, while the response of spatial structure part is primarily due to the variation of the density slope rather than the thickness diffusivity. Besides, the thickness diffusivity coefficient also influences response of residual circulation through the Euler-mean circulation. The increased meridional gradient of the thickness diffusivity during 1998-2007 over 1960-1969 in the stratification-dependent case decreases the meridional gradient of the density slope, which dampens the corresponding meridional sea surface height gradient and leads to weaker Euler-mean circulation and stronger residual compensation. In summary, the temp-spatial stratification dependent thickness diffusivity can enhance the response of the eddy compensation through its vertical variation part due to both the direct change of the thickness diffusivity and the indirect change of the density slope, and the indirect change of the density slope also influence the Euler-mean circulation, which affects the response of residual circulation to the intensified Southern Hemisphere westerlies as well.