3rd International Conference on Earth System Modelling
Vol. , 3ICESM-198, 2012
3rd International Conference on Earth System Modelling

The 20th century climatology and 21st century change in the North Pacific sea level pattern in CMIP3 and CMIP5 climate models

T. Yasuda and M. Sueyoshi
Meteorological Research Institute, Japan (tyasuda@mri-jma.go.jp)

Regional patterns of sea level in the North Pacific and the related atmospheric circulation in the 20th century simulation of CMIP3 and CMIP5 models are evaluated and their changes in the 21st century are examined. The 20th century climatology in CMIP5 models shows a better representation of sea level pattern in the North Pacific than CMIP3 models. Compared with the CMIP3 models, CMIP5 models have reduced negative biases in the subtropical and subpolar gyres and smaller positive biases in the Kuroshio Extension region. This improvement of sea level reproducibility makes us expect decreasing biases of the atmospheric circulation over the North Pacific. However, sea level pressure in CMIP5 has larger positive biases in the Subtropical High and negative biases in the Aleutian Low. These sea level pressure biases are associated with the stronger midlatitude westerlies result in the intensification of subtropical and subpolar gyres and the Kuroshio Extension in CMIP5. In evaluating the regional sea level pattern, therefore, it is important to examine the consistency of reproducibility between the sea level and above atmospheric circulation patterns. The 21st century changes in the wind stress due to those in sea level pressure results in the projected sea level changes in CMIP3 and CMIP5 models. In the midlatitude western North Pacific, the inter-model spread of the sea level change relative to the global mean is comparable to that based on the multi-model ensemble mean. While a positive sea level pressure change in the eastern North Pacific (40-50N, 170-150W) induces a large northward shift of the Kuroshio Extension, a negative sea level pressure change in this region induces a strong intensification of the Kuroshio Extension. Large inter-model variability of the sea level pressure projection in the eastern North Pacific causes a large uncertainty of the sea level projection in the western North Pacific. Models with a larger northward shift (intensification) of the Kuroshio Extension exhibit a poleward shift (an intensification) of the Aleutian Low larger than that for the multi-model ensemble mean. However, models that exhibit a larger intensification of the Aleutian Low do not necessarily show a larger intensification of the Kuroshio Extension. Our analysis suggests that the sea level pressure change that induces an intensification of the Kuroshio Extension is associated with a teleconnection from the equatorial Pacific, and that the sea level pressure change that induces a northward shift of the Kuroshio Extension is characterized by a zonal mean change.