

Coalescences of the Southern Gyre with the Great Whirl in the western Arabian Sea in a regional ocean model

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Strong alongshore southwesterly winds over the western Arabian Sea (AS) associated with the Indian summer monsoon locally excite coastal upwelling, the northward Somali Current, and two anticyclonic oceanic gyres. These two gyres, the Southern Gyre and the Great Whirl, develop around 4°N and 10°N, respectively, in boreal spring and early summer. The Southern Gyre moves northward, and coalesces with the Great Whirl in some years, but it remains near 4°N in other years. Previous studies suggest that a coherent structure associated with a pair of cyclonic and anticyclonic eddies appears in association with the northward movement of the Southern Gyre. However, favorable conditions for the northward movement of the Southern Gyre and the coalescence of the two gyres as well as a role of eddies in generating these conditions have not been investigated. In this study, therefore, we explore the conditions and possible mechanisms for the coalescences by analyzing 55-year outputs, from 1960 to 2014, of a model based on the Regional Ocean Modeling System (ROMS).

Of the 55 years, the coalescence occurs in 31 years, i.e. the occurrence ratio of 0.56. It turns out that there are two types of the coalescence scenario. In the first type, the Southern Gyre develops locally and generates by itself the coherent structure responsible for the northward movement. In the second type, a remotely forced anticyclonic disturbance in the equatorial region propagates from the east and enters the Somali coast during the early summer. This disturbance helps the development of the anticyclonic eddy of the coherent structure. Detailed processes appear in the two scenarios will be discussed at the presentation.

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