

Quantitative Evaluation of Tropical Ocean Waves from the Indian Ocean to the Pacific Ocean through the Indonesian Seas

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The Indonesian Seas, which connects the Pacific and Indian Oceans at low latitudes, is known to be affected by equatorial waves excited in both oceans. Many studies suggest that the equatorial Rossby wave signal incident from the Pacific Ocean reaches the eastern Indian Ocean through the Indonesian Seas. However, the wave transmission from the Indian Ocean has rarely been discussed, though waves from the Indian Ocean have been observed in the Indonesian Seas.

Here we identify the pathways and transmission rate of tropical wave energy from the Indian Ocean to the Pacific Ocean through the Indonesian Seas by using reduced gravity model with realistic coastline. The wave energy flux that can be applicable for all latitudes in a linear shallow water system is adopted from Aiki et al (2017). The energy flux diagnosed from the model output identify the major energy pathway entering the Indonesian Seas through the Lombok Strait and propagating northward through the Makassar Strait, which is consistent with the route suggested qualitatively from the mooring data and other model results. This wave energy pathway through the western part of the Indonesian Seas is prominent at all the wave period from the intraseasonal to interannual time scales.

In addition to the western pathway, a new pathway through the Banda Sea and Halmahera Sea to the Pacific Ocean appears only for the incoming waves with the intraseasonal time scale. The formation of this additional eastern pathway can be explained by the transmission characteristics of the Kelvin waves in the Makassar Strait. Since the width of the Makassar Strait is narrower than the deformation radius, complete adjustment is necessary for incoming wave energy to transmit through the strait. Therefore, when the wave period is shorter than adjustment time of the Makassar Strait, a part of the incoming wave energy is reflected and bypass eastward to the Banda Sea. This relationship between the time scale of the incoming wave and the wave energy pathways is in good agreement with the observation in both eastern and western part of the Indonesian Seas.

Keywords: Indonesian Seas, Energy flux