The cooling of sea surface temperature in the southern Indonesian Seas due to a combination of the Ekman transport and tidal mixing in narrow straits

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The Indonesian archipelago is characterized by the warmest sea surface temperatures (SSTs) in the world and is a key region of the world climate system. Kida and Wijffels (2012) reported that SST cooling around the Nusa Tenggara Islands (NTIs) located at the southern Indonesia plays a crucial role in the seasonal variation of SST over a large area in the Indonesian Seas. Although they suggested that both the monsoonal winds and tidal mixing might significantly impact such SST cooling, their numerical model settings were somewhat idealized.

In this study, to investigate the mechanisms of SST cooling around the NTIs, we carry out a numerical simulation using a regional ocean model where the realistic distribution of vertical diffusivity estimated from a high resolution baroclinic tide model is incorporated. The simulated results show that significant mixing in the narrow tidal straits between the NTIs creates well-mixed waters, which spread out northward (southward) during Austral summer (winter) and finally causes significant SST cooling over a large area of southern Indonesian Seas.

We therefore carry out numerical experiments where either of the monsoonal wind or localized tidal mixing in the narrow straits is switched off. These numerical experiments show that well-mixed waters in the narrow straits are continuously advected by the northward (southward) flow driven by the western (eastern) monsoonal wind during Austral summer (winter) until the Indonesian Throughflow spreads them out over a large area of southern Indonesian Seas, demonstrating the importance of the combined effect of the Ekman transport and tidal mixing.

Keywords: SST in the Indonesian Seas, Tidal mixing in narrow straits, Ekman transport

