Ocean plastic circulation model including macro- and microplastics over the world's ocean

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A numerical model regarding the ocean plastic circulation over the world's ocean was developed. The ocean plastics were categorized into four particles such as drifting marine plastic debris (macroplastics), macroplastics littered on beaches, pelagic microplastics fragmentized from macroplastics, and microplastics littered on beaches. The model represents the generation of macroplastics, transport of macro/microplastics, and removal of microplastics from the upper ocean. The generation of microplastics were given to the river mouth in line with the estimate of Lebreton et al. (2017). The transport of plastic particles was due to the ocean currents, windage, and Stokes drift given to the model. The transition between drifting macroplastics and those on beaches occurs on a timescale experimentally given to Kataoka et al. (2013). The transition between pelagic microplastics and those on beaches occurs on a timescale experimentally given to Hinata et al. (2017). The removal of microplastics occurs on the timescale of 3 years in line with Isobe et al. (2019). The transition from macroplastics to microplastics occurs by degradation/fragmentation on a timescale of one year. Based on the computation from 1960 to 2017, the plastic budget over the world’ s ocean was evaluated.

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