High-resolution marine connectivity modelling in the Florida Coral Reef Tract

Charles Frys[1], Matthieu Le Henaff[2], Joana Figueiredo[3], Jonathan Lambrechts[1], Antoine Saint-Amand[1], Valentin Vallaeys[1] and Emmanuel Hanert[1,*]

High-resolution ocean circulation models are required to simulate the complex and multi-scale currents that drive physical connectivity between marine ecosystems. However, standard coastal ocean models rarely achieve a spatial resolution of less than 1km over the $>$100km spatial scale of dispersion processes. Here we use the high-resolution unstructured-mesh coastal ocean model SLIM that locally achieves a spatial resolution of $\sim$100m over the scale of the entire Florida Coral Reef Tract (FCRT). By coupling SLIM with a biophysical model of larval dispersal we can track the position of virtual larvae released into the simulated domain. Connectivity matrices are then generated from the positions of the particles at the start and at the end of the simulations. By using different connectivity measures and clustering methods, we can highlight the fine details of the connectivity patterns linking the different reefs of the FCRT. These indicators are then used to pinpoint the reefs that would need to be protected in priority and those that would be best suited to coral restoration projects. Our model is currently the first to simulate larval dispersal with such a high resolution between the thousand reefs composing the FCRT. By individually measuring each site's potential as a larval source or sink, we can provide new insights to reef restoration and protection strategies.

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[1] Université catholique de Louvain, Belgium
[2] University of Miami (CIMAS) and NOAA (AOML), USA
[3] Nova Southeastern University, USA
[*] emmanuel.hanert@uclouvain.be