Variability in reef connectivity in the Coral Triangle

The Coral Triangle (CT) is the global center of marine biodiversity and is considered the most threatened of all reef regions. Reproductive connectivity between reefs plays a critical role in a reef’s capacity to recover after disturbances. Thus, oceanographic modeling efforts to understand patterns of reef connectivity are essential to the effective design of a network of Marine Protected Areas (MPAs) to conserve marine ecosystems in the Coral Triangle. In this talk I will summarize my recent work here at NCAR, coupling a Regional Ocean Modeling System developed for the Coral Triangle (CT-ROMS) with a Lagrangian particle tracking tool (TRACMASS) to investigate the probability of coral larval transport between reefs. Potential connectivity between reefs was highly variable and stochastic from year to year within the 47-year hindcast simulation (1960-2006), emphasizing the importance of decadal or longer simulations in identifying connectivity patterns, key source and sink regions, and thus marine management targets for MPAs. Nonetheless, the potential connectivity results I present here suggest that although reefs in this region are primarily self-seeded, rare long-distance dispersal may promote recovery and genetic exchange between reefs in the region. The spatial pattern of “subpopulations” based solely on the physical drivers of connectivity between reefs closely match regional patterns of biodiversity, suggesting that physical barriers to larval dispersal may be a key driver of reef biodiversity. Finally, 21st Century simulations driven by the Community Earth System Model (CESM) suggest that these major barriers to larval dispersal persist into the future under 8.5 W/m² of climate forcing, despite some regional changes in connectivity between reefs.