

# **Effect of Coastal Reclamation on Metro Manila Weather: A Numerical Experiment**

*Elijah A. Joves*

*Institute of Environmental Science and Meteorology*

*University of the Philippines - Diliman*

*Quezon City*

## **Abstract**

Due to the increasing population and rapid urbanization in Metro Manila, there is a high demand for land resources, which has caused policymakers to consider land reclamation. Land reclamation is the process of creating new usable land from bodies of water such as seas and lakes. While land reclamation has been shown to influence local weather and climate in other regions, limited research in Metro Manila has examined its meteorological impacts. To address this gap, this study aims to (1) characterize coastal Metro Manila weather and (2) to analyze the effect of land reclamation on different meteorological variables including temperature and local wind circulations, using high-resolution simulations with the Weather Research and Forecasting (WRF) model. Simulations were conducted using nested domains, with the innermost domain (1 km resolution) focused on Manila Bay. A period with weak synoptic conditions is used as a case study for this thesis, to ensure that local wind circulation will dominate. We investigated different land reclamation extents: present, completed, and extended. The present case, which is treated as the control setup, is validated using observational data from surface stations. Several planetary boundary layer schemes are tested to select the most appropriate scheme to be used in this study, with the MYNN 2.5 scheme identified as the most suitable.

Simulations show that sea and land breezes are evident during days of weak synoptic conditions, with sea breezes having stronger magnitudes than land breezes. This asymmetric behaviour is linked to the urbanized area of Metro Manila, which strengthens the thermal pressure gradient in the morning, but weakens it at night.

The reclamation extent cases indicate that land reclamation leads to a localized, but significant, increase in 2-meter air temperature throughout the day, and a modification on the existing local

circulation. Moderate reclamation was shown to enhance sea breezes by increasing daytime temperatures along the coastline. Extreme reclamation results in reduced surface wind speeds over mainland Metro Manila, caused by the increased surface roughness introduced by the addition of more urban areas. Land breezes are weaker in both reclamation cases, as the introduction of reclaimed areas decreases the temperature difference between land and water, which results in less organized surface winds. Ultimately, this study provides insights on the effects of reclamation on coastal Metro Manila weather, which has implications for urban heat islands and air quality in this region.

Keywords: *WRF; Sea Breeze; Land Breeze; Reclamation*