# Evaluation of Delft3D Microplastic Model of the Mid-Atlantic New Jersey Coast Using Field Measurements

New Jersey

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Introduction

<u>Goal:</u> Combine field data with a numerical model to better understand the hydrodynamic processes that transport and deposit microplastics on sandy coasts
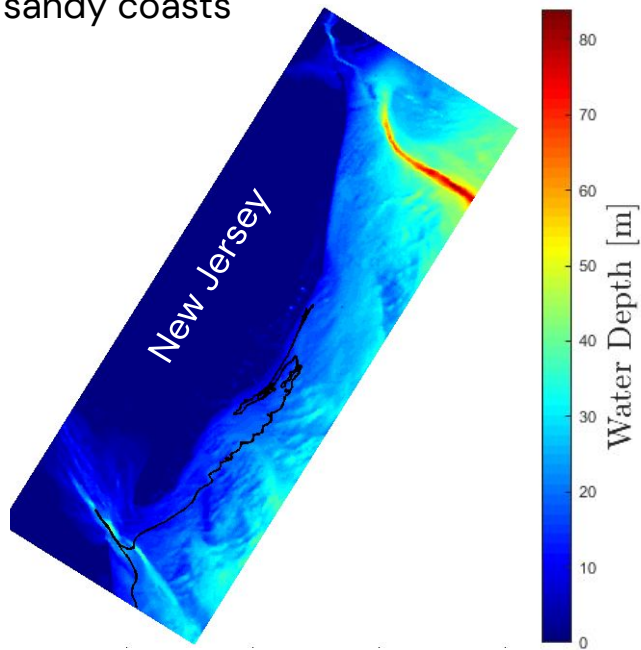
Field Data

- 27 beaches in NJ, USA
- Two replicates
  - Winter 2020/21
  - Summer 2021

- Microplastics
  - 6 measurements along each transect

- 3 transects
  - Dune line
  - High tide line
  - Low tide line

square
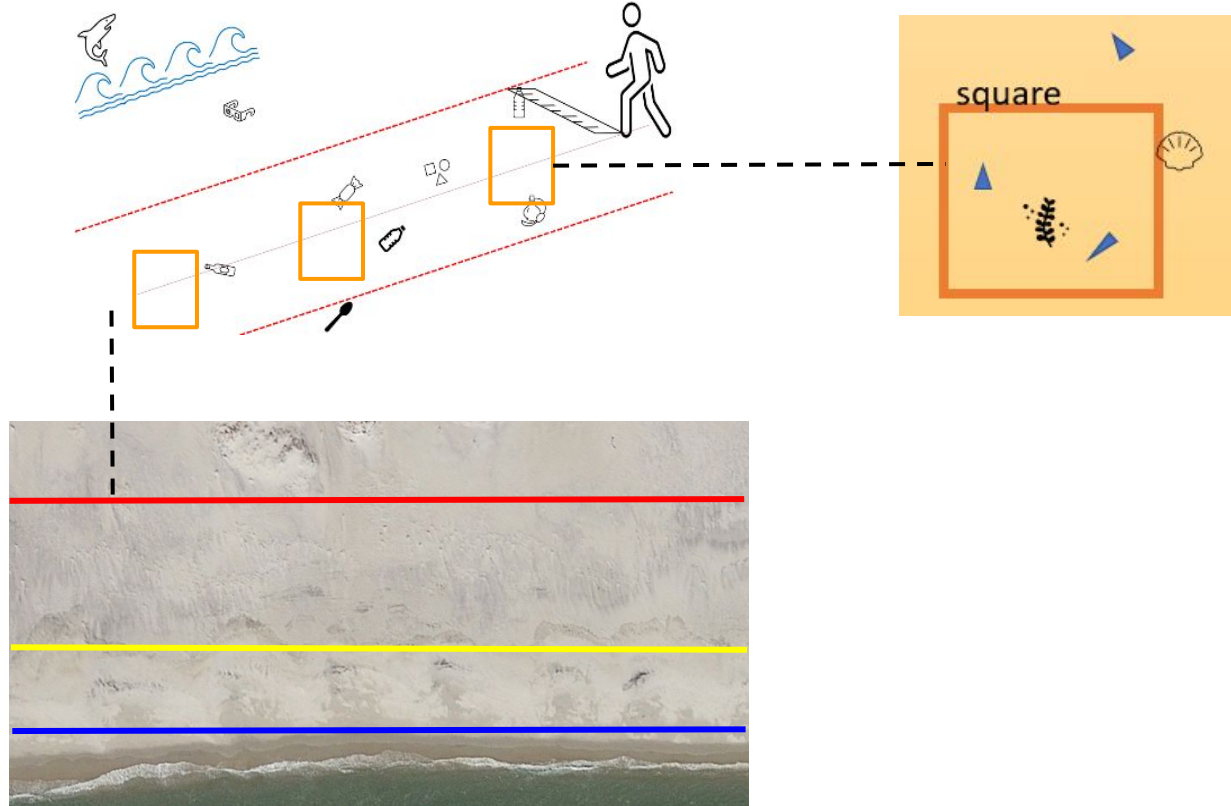
Model

- Characteristic hydrodynamic model of New Jersey coast
- Reynolds Averaged Navier Stokes (RANS) equations
- Delft3D
  - FLOW– Hydrodynamics
  - WAVE– Hydrostatic wave field
  - PART– Particle tracker
- Oct 05, 2015 – Oct 05, 2016
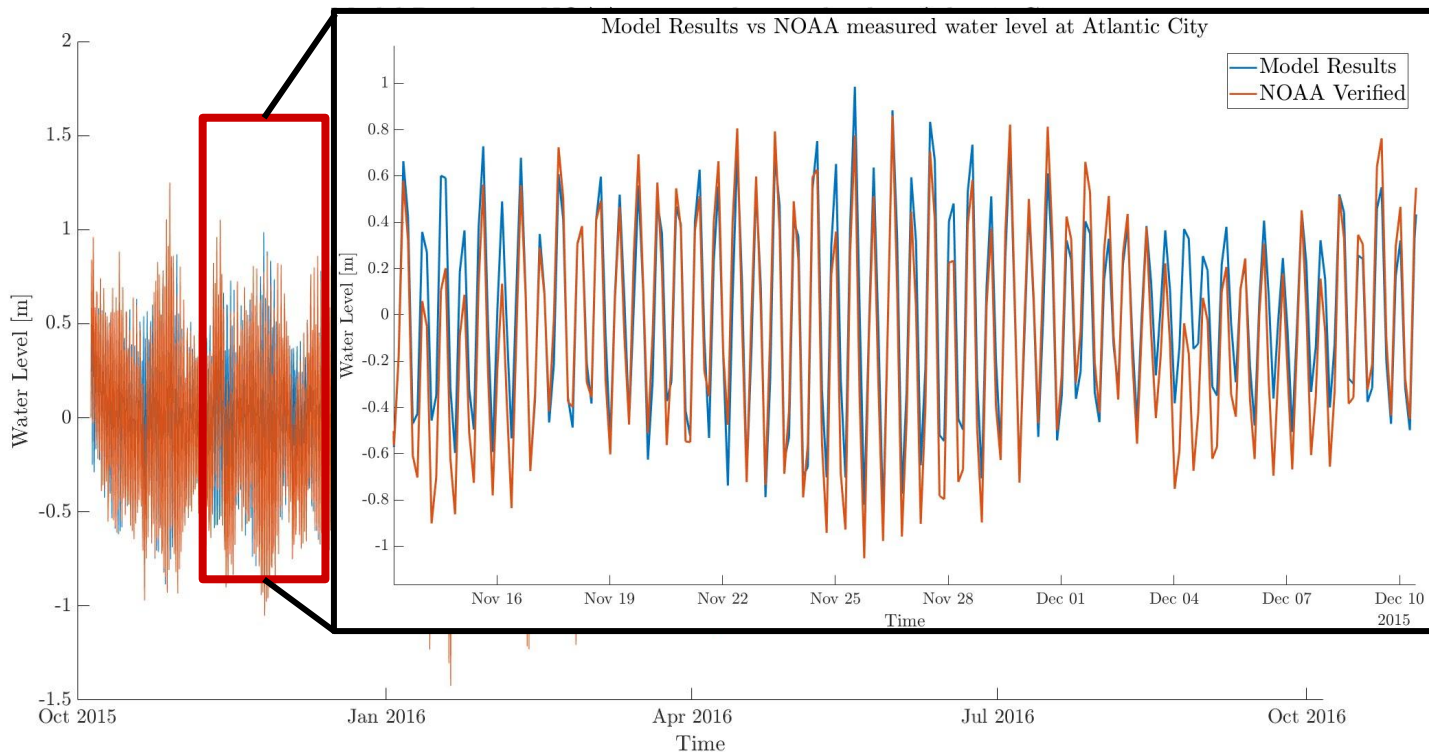
Model– Hydrodynamic Validation

Model Results vs NOAA measured water level at Atlantic City
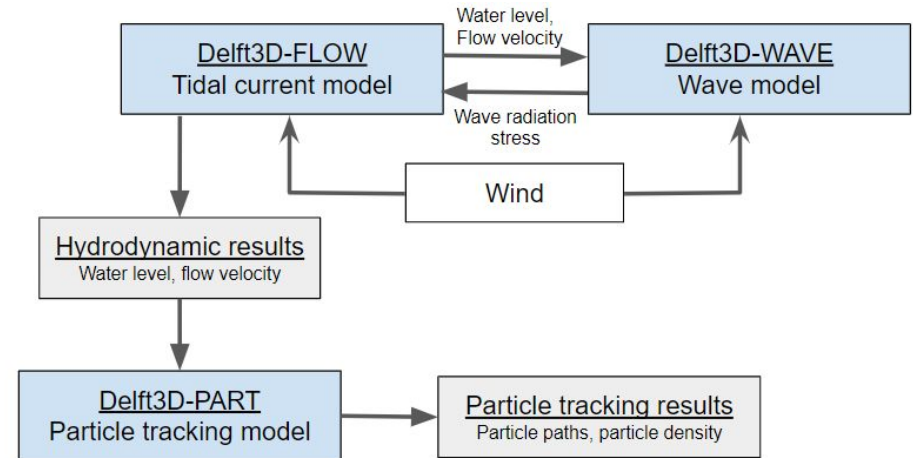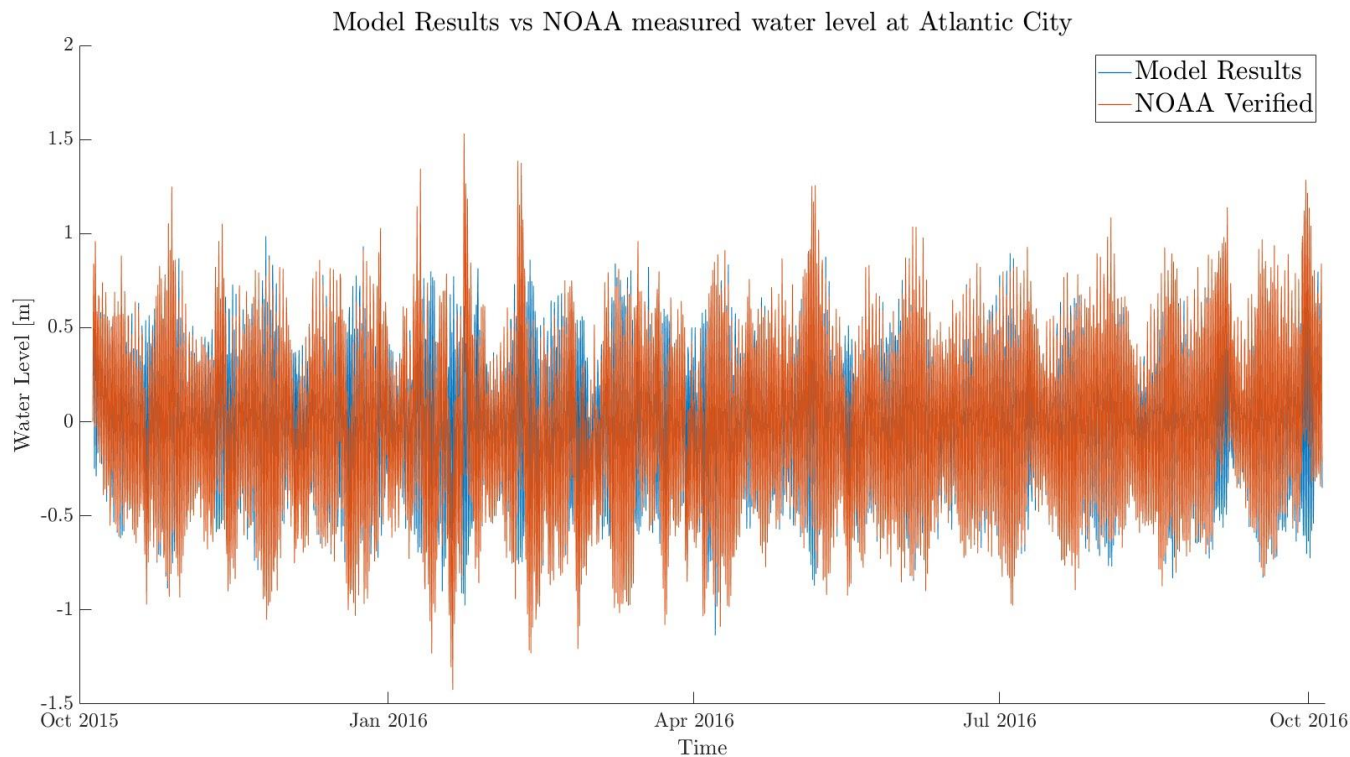
Model– Hydrodynamic Validation

RMSE: 0.2m

nRMSE: 0.09m

Correlation

Coefficient: 0.92

Model Results vs NOAA measured water level at Atlantic City
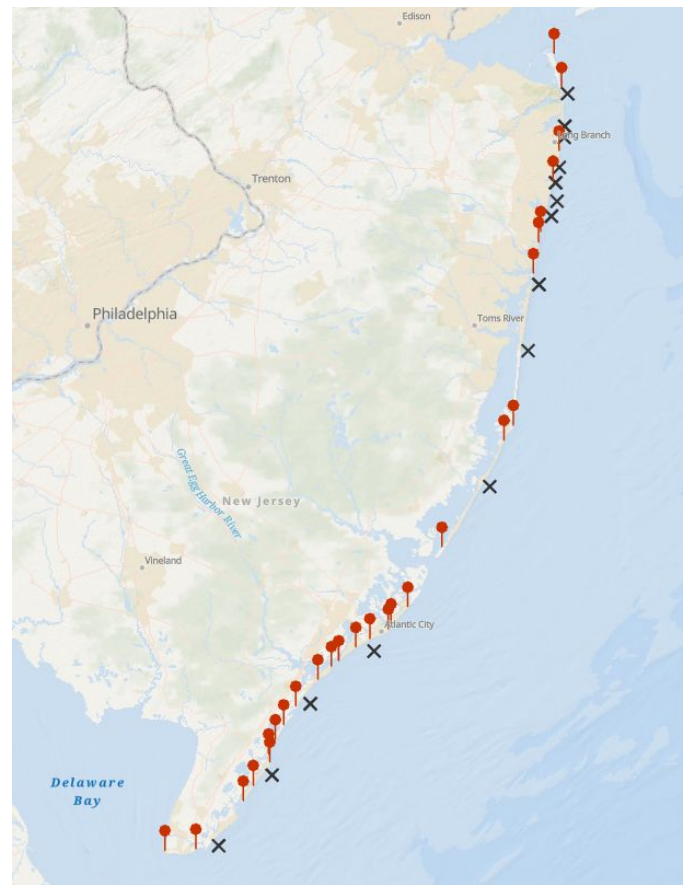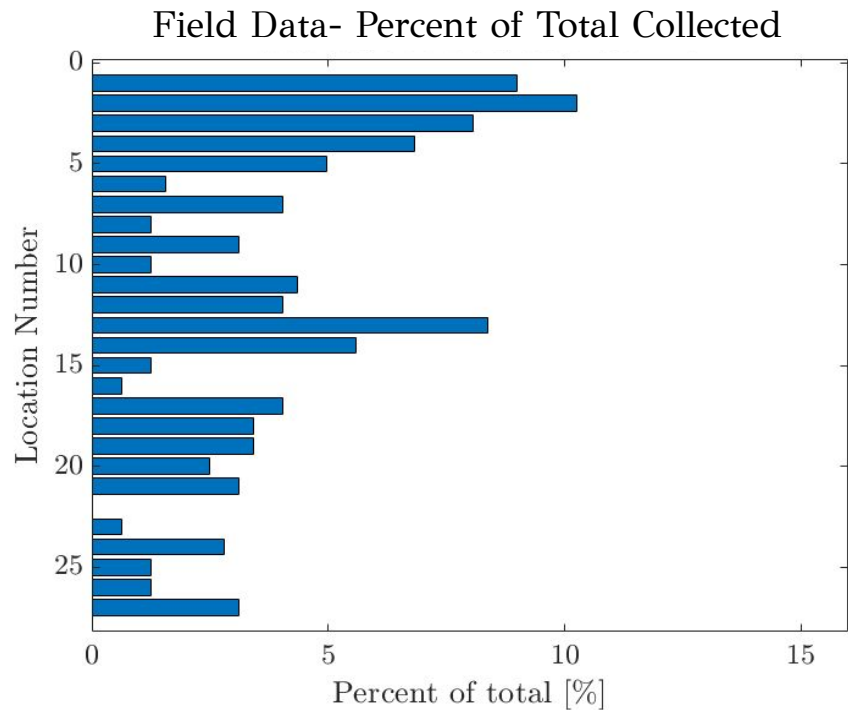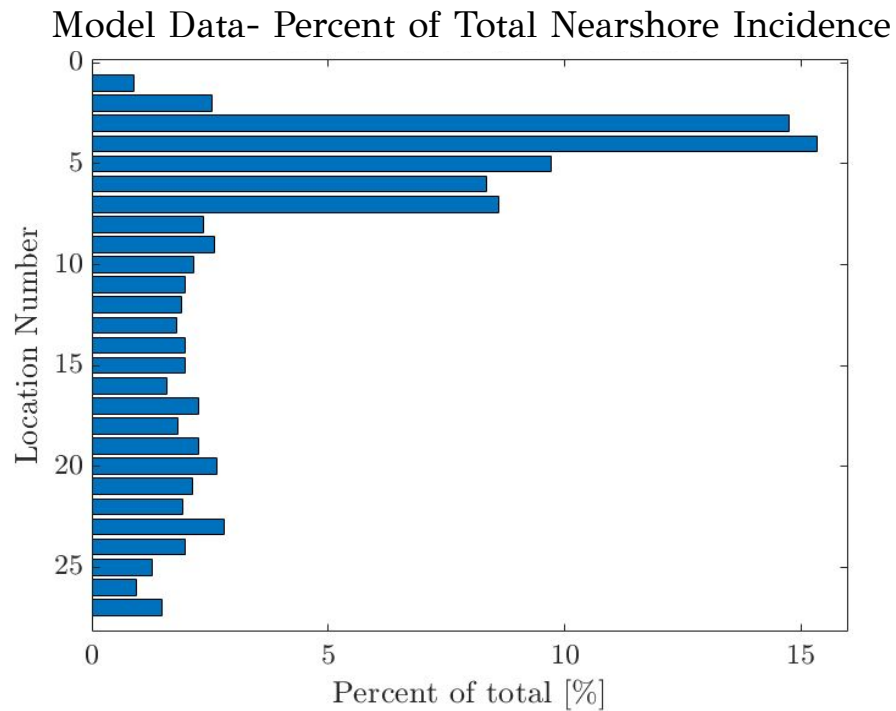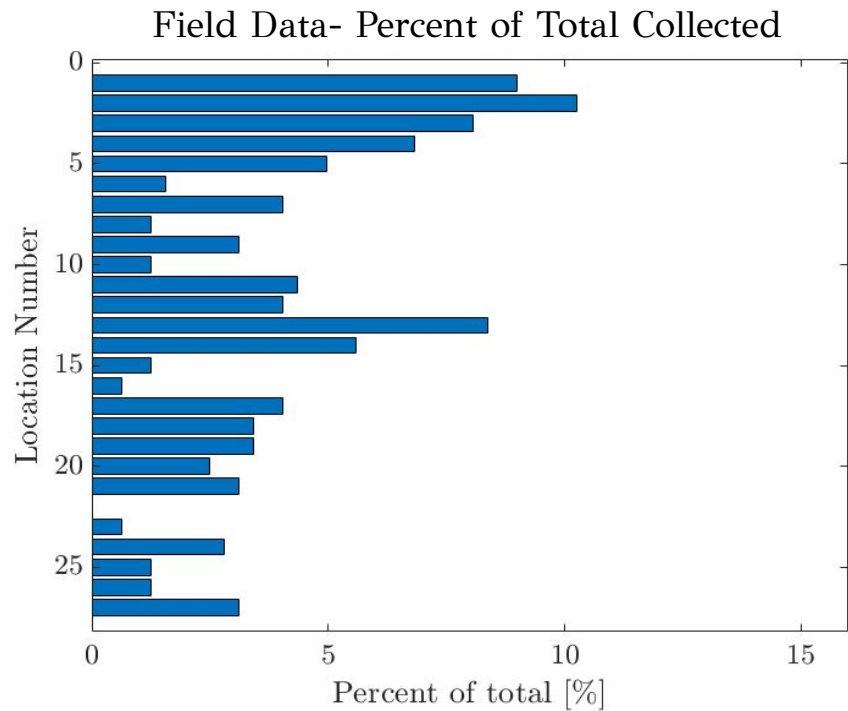
Model– Particle Tracking

- 14 WWTP ocean outflows → 14 release points (black X)
    - Continuous
    - Uniform outflow concentration

- 27 beaches sampled → 27 observation points (red pin)
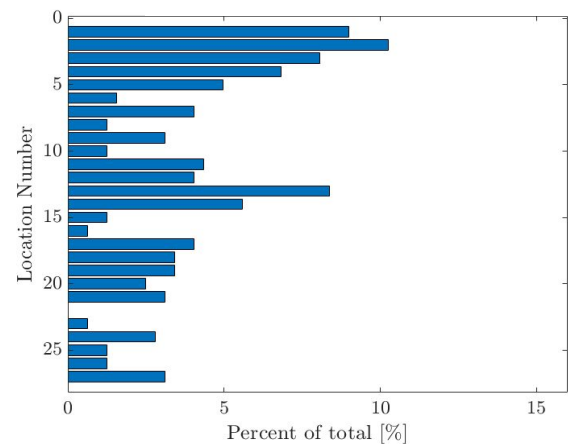
Model– Field Comparison

Field Data- Percent of Total Collected

Model– Field Comparison

Field Data- Percent of Total Collected

Model Data- Percent of Total Nearshore Incidence

Model– Field Comparison

Field Data- Percent of Total Collected

Field Data- Winter and Summer Combined Count

Model Data- Floating Particle Density

28 Aug, 2016
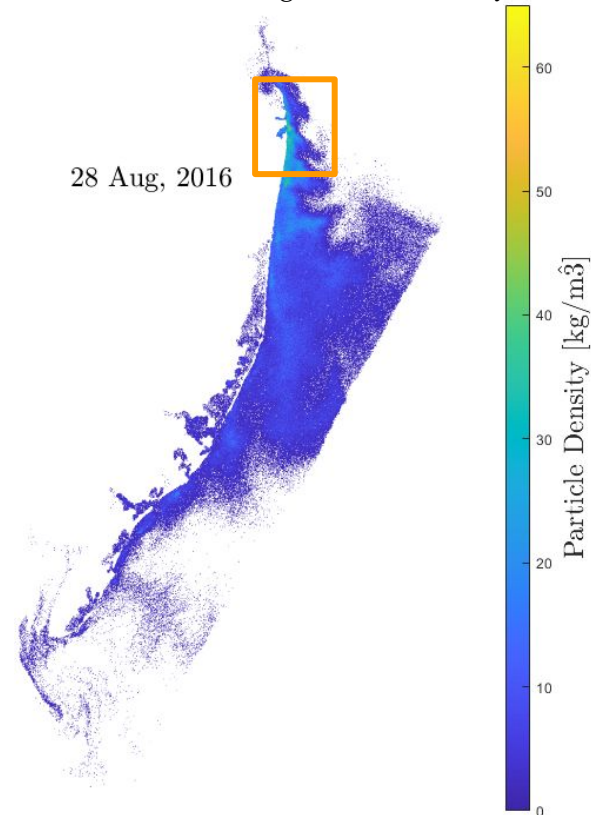
Residual Current

Average Current Velocity over Model Duration (1 year)

- Northern convergence zone

- Residual northerly current

- Large velocities at Delaware Bay inlet
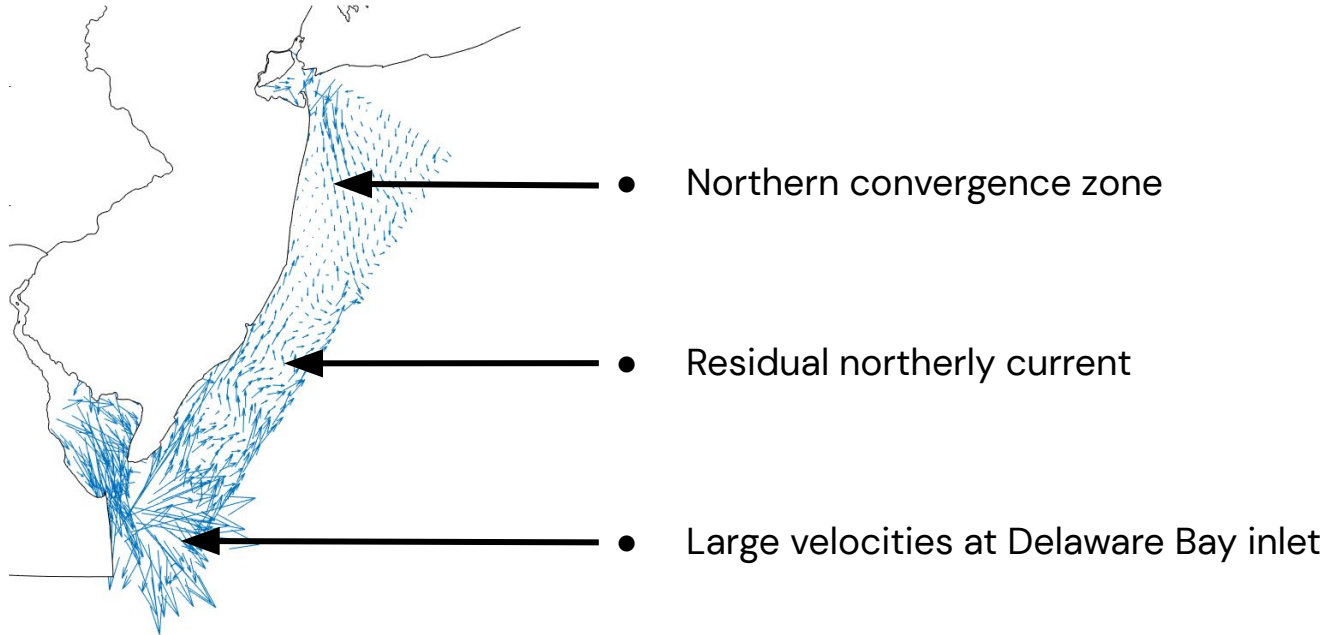
Conclusions

- Persistent current along the mid-atlantic coast that transports microplastics north

- Microplastic movement is more responsive to annually recurring currents (tidal and wave generated) than to wave transport alone

- Future ocean plastic models focused primarily on offshore transport may not need to resolve nearshore processes (e.g. wave-breaking)

Thank you!

Questions?

Extra Slides- Model Details

Hydrodynamic model:

- 200m regular cartesian grid
- 24 second time step

Particle Tracking model:

- Particle density: 890kg/m^3
- Beaching probability: 0.5