Supplementary Material: Numerical Simulation Code

The following Python script was implemented within the OpenOil framework to calculate movement direction, trajectory lengths, and speed metrics for the simulated oil particles.

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#%%

# Assuming o.get_lonlats() returns lon and lat

lon, lat = o.get_lonlats()

# Calculate longitude and latitude differences between consecutive time steps

lon_diff = np.diff(lon)

lat_diff = np.diff(lat)

# Calculate the angle (direction) of each movement in radians

movement_angles = np.arctan2(lat_diff, lon_diff)

# Convert angles from radians to degrees

movement_directions_deg = np.degrees(movement_angles)

# Calculate the mean direction (dominant direction)

mean_direction_deg = np.mean(movement_directions_deg)

# Function to convert degrees to compass direction

def degrees_to_compass(degree):

    directions = ['N', 'NE', 'E', 'SE', 'S', 'SW', 'W', 'NW']

    ix = int((degree + 22.5) // 45) % 8

    return directions[ix]

# Get dominant compass direction

compass_direction = degrees_to_compass(mean_direction_deg)

# Convert the mean direction to the range [0, 360) degrees

mean_direction_deg = (mean_direction_deg + 360) % 360

# Assuming o.get_trajectory_lengths() returns a tuple with total distance, distances during each
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time step, and speed

total_distance, distances, speeds = o.get_trajectory_lengths()

# Save total distance to a file

np.savetxt('/home/vaspapa/opendrift/Agia_Zoni_II/total_distance.txt', total_distance, header = 'total_distance', delimiter=' ')

# Save distances to a file

np.savetxt('/home/vaspapa/opendrift/Agia_Zoni_II/distances.txt', distances, header='distances', delimiter=' ')

# Save speeds to a file

np.savetxt('/home/vaspapa/opendrift/Agia_Zoni_II/speeds.txt', speeds, header='speeds', delimiter=' ')

# Calculate mean speed excluding zero values

non_zero_speeds = speeds[speeds != 0]

mean_speed = np.mean(non_zero_speeds)

# Calculate mean distance

mean_distance = np.mean(total_distance)

# Combine lat, lon, and total distance into a single array

data = np.column_stack((lat, lon, total_distance))

# Save the data to an ASCII file

np.savetxt('/home/vaspapa/opendrift/Agia_Zoni_II/particle_data.txt', data, header='lat lon length', delimiter=' ')

# Print mean speed, distance and the mean direction

print(f"Mean Direction: {mean_direction_deg} degrees")

print(f"Dominant Compass Direction: {compass_direction}")

print(f"Mean Speed (excluding zeros): {mean_speed}")

print(f"Mean Distance: {mean_distance}")
```

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#%%
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