**INTRODUCTION**

An accurate model of local wind-driven currents is crucial for operational oceanography, for example to predict the drift of floating objects or marine pollution. Lagrangian drift velocities near surface are mostly controlled by wind, waves and turbulent mixing. A Lagrangian mean drift is associated to waves (the Stokes drift). In the 1990’s, measurements revealed enhanced near-surface turbulence in the presence of breaking waves. In the recent years, wave-current models were developed. They separate the wind driven currents into the wave Stokes drift and a quasi-Eulerian mean currents:

$$U = U_{QE} + U_s$$

In addition, waves induced vertical mixing applied to the quasi-Eulerian current has been added to the model. The implementation depends on the model and the vertical mixing scheme. Nevertheless how the near-surface turbulence evolves with waves is still a debated problem.

- What are the consequences of the stokes drift and vertical mixing for the surface drift?
- Different current models and wave-current coupled models are used. How do they compare?
- How important are the differences between those models for applications?

**REALISTIC NUMERICAL SIMULATION**

Surface elevations and currents

**CROCO**

- 20 minutes
- Hs, T0M1, dir, Uss, TUs

**WW3**

- Wind-wave interactions
- Nonlinear wave-wave interactions
- Forcing: CFSR
- 3rd-order upstream biased advection scheme for the current velocity
- Depth-induced breaking
- Dissipation & reflection
- off the shoreline

The coupled model used the vortex force formalism (Uchiyama,2010) and take into account the Stokes-Coriolis force.

Stokes drift is calculated with the Breivik implementation (Breivik,2016).

**RESULTS OBTAINED FOR THE GULF OF MEXICO**

Cospectra analysis between wind and 1st layer currents:

- **Growing sea**
  - U10~10 m/s
  - Hs~1.4
  - Cp/U10 <1.2

- **Fully developed waves**
  - U10~10 m/s
  - Hs~2.6
  - Cp/U10~1.2

Current vertical profile for:

<table>
<thead>
<tr>
<th>Wave enhanced mixing parameterization</th>
<th>WW3</th>
<th>Stokes drift</th>
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<th>WW3</th>
<th>Stokes drift</th>
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<tbody>
<tr>
<td>Increased viscosity</td>
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<td>Depend on u*</td>
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Average over all frequencies where the cross spectrum coherence is significant

- Admittance (% 10m wind speed)
  - KPP: 1.5
  - KPP_CO (u): 1.5
  - KPP_CO (u+us): 2.2
  - GLS: 2.5
  - GLS_CO (u): 1.3
  - GLS_CO (u+us): 2.1
  - Stokes drift: 0.85

- Phase (degree)
  - KPP: -44
  - KPP_CO (u): -48
  - KPP_CO (u+us): -32
  - GLS: -30
  - GLS_CO (u): -54
  - GLS_CO (u+us): -34
  - Stokes drift: 6

Large consequences are predicted in terms of surface drift trajectories, as illustrated for one case in the Gulf of Mexico: