Drifting buoys

- at 0m and 0.8m depth
Röhrs et al. 2012: Observation-based evaluation of surface wave effects on currents and trajectory forecasts Ocean Dynam., 62.
drifters vs. HF radar current
Difference between HF radar current and drifter speed vs. Stokes drift

Röhrs et al. 2015. Comparison of HF radar measurements with Eulerian and Lagrangian surface currents Ocean Dynam. 65.
more data, more comprehensive
drifter speed vs. wind speed

Significant correlation, but very low. Trajectories cannot be predicted from wind speed only.
rotary spectra of drifter velocity
Coherence indicates if the signals have a well-defined phase difference.

Admittance measures how strong one signal forces the other.

Phase difference may be due to temporal or directional offset.
# Surface drift deflection angle

<table>
<thead>
<tr>
<th></th>
<th>surface (iSphere)</th>
<th>1m (CODE)</th>
<th>15m (SVP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>our study</td>
<td>60°</td>
<td>80°</td>
<td></td>
</tr>
<tr>
<td>Niiler and Paduan 1995</td>
<td>60° (regression model)</td>
<td></td>
<td>70°</td>
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<tr>
<td>Rio and Hernandez 2003</td>
<td></td>
<td></td>
<td>20°-60°</td>
</tr>
<tr>
<td>Poulain et al 2009</td>
<td>17-20° (undrogued SVP)</td>
<td>28°</td>
<td>27°-42°</td>
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<tr>
<td>Gonella 1972</td>
<td>45-90° (analytical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weber 1984</td>
<td>10-40° (analytical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ekman 1905</td>
<td>45° (analytical)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Drift

- Ekman solution for wind-driven transport
- Stokes drift
- underlying current
- water drag
- wind drag
- CODE drifter
- iSphere
Velocity shear in the Ekman layer

Ekman solution for wind-driven transport

Ekman solution for constant eddy viscosity
Velocity shear in the Ekman layer

Vertical mixing and stratification is very important for the direction of surface transport.

For constant stress (very strong mixing), the deflection angle at the surface is 90°. For weak mixing near the surface, the deflection angle is 45°. For strong mixing, the base of the Ekman layer is at 0°.

Ekman solution for constant eddy viscosity.

for constant stress (very strong mixing) = Ekman transport (vertically integrated)
possible implication of the drift deflection angle
deflection angle in ROMS (k-omega mixing)
Adjoint sensitivity studies on surface currents?

- Wind forcing
- How important is stratification and mixing to determine the direction?

Define an index $J$ that describes surface currents, or Lagrangian surface transport

- total speed
- mesoscale eddy kinetic energy
- shoreward velocity
- deflection angle to wind?
- can we use Lagrangian quantities?
Cod egg transport through passages
Residence time of cod eggs in Vestfjorden

Fraction of eggs that manage to escape