Summary of Conclusions

- We will make a two page report and circulate it for comment
  - Emphasize importance of currents & key gaps in observations and modeling
  - Key findings
  - Recommendations for Actions (assigned to people)

Importance of Currents

Ocean surface currents have a profound influence on human life in two major ways:

- They are critical in horizontal and vertical transport and dispersal of pollutants and physical, biological, and chemical properties;
- They are an important factor in air-sea exchange of properties like heat and energy; and
- They modify air/sea coupling in a manner that influences the eddy-richness of the oceans, and the strength and location of major currents, which in turn modifies weather over land, and are tied to seasonal to multi-dedacal variability that might be predicable.
- Surface currents can be assimilated to provide much better analyses of eddies locations and characteristics.
- Currents are believed to be a key constraint for constraining ocean/atmosphere coupled models, and can be used to improve coupling in long-term models

Key Gaps

- Observations of surface currents in the vast majority of the global oceans are too sparse to identify variability on a wide range of space and time scales, particularly the smaller scales that were key to the topics on the prior page.
- Ocean models are missing key physics because we don't have the observations to identify and properly model the processes associated with meso-scale wind/wave/current interaction, and the consequences of these processes on biogeochemistry and biology.
  - Waves are a key concern
- High resolution models of air-sea coupling also suffer from this same knowledge of key physical processes.

Key Recent Developments

- In the past few years, there have been great strides in observation systems that can address (1) physical processes, and (2) global observations of currents.

Recommended Definition of Surface Current

- Currents are more complicated that SST, so a GHRSST-like model of definitions as a function of depth is impractical
  - We do not yet have sufficient knowledge of physical processes (particularly when waves are breaking) to use a physically-based model to translate between observations at different depths
  - One group recommended that this group develop a clear statement of the depths corresponding to each component of the current observing system.
    - Fabrice Ardhuin has already done this – get info from him (Mark)
  - Other groups suggested that a more complicated model could be developed when a better knowledge of the relevant physics was available.

Key Findings (1)

- We can now measure near surface profiles of surface current (in non-rainy conditions), which will allow us to address the gaps of knowledge about wind/wave/current coupling
  - It was also noted that near-surface ocean stratification influences the current profile.
  - Ocean-temperature gradient might be important for the current profile, and will be important in a coupled atmospheric response to ocean surface currents
    - Atmospheric boundary-layer stratification also influences the coupled atmospheric response to ocean surface currents

Key Findings (1): Actions

- We recommend that a series of process studies take place to better understand and model the current profile as a function of the variables mentioned above. Such an experiment would have a spatial extent of roughly 10 km, and very high resolution within this distance, cover the diurnal cycle, and involve
  - a 'current copter'-like technology to measure waves, wave breaking, and the near surface current profile;
  - DopplerScatt (airborne mode) to observing larger scale winds and currents;
  - Ocean profiles and platforms to measure the near-surface to XX m depth vertical and horizontal currents, temperature and salinity in the study area;
  - Micro-scale turbulence measurements
- We recommend that these findings be used to improve ocean models and improve the effectiveness of the assimilation of ocean surface currents.
- We recommend the development of models for converting observed current to different depths
- We recommend efforts to better understand wave breaking and the influences of wave breaking on ocean currents

Key Findings (2)

- Satellite observations of near surface currents are needed to measure surface currents for large-scale applications
- These current observations should be coincident in space and time with observations of either winds (stress) or sea state.
- The efforts mentioned with Finding (1) will allow us to convert surface observations to current at depth, provide knowledge about the other key parameters.
- These observations should be assimilated in ocean models and used to
  - better understand two-way ocean/wave/atmosphere coupling,
  - Better model vertical and horizontal transport
  - Better understand the transport of micro plastics and debris
  - Improve search and rescue
  - Improve the knowledge of currents and sea state that impacts commercial transport
  - Produce gridded products that are favored by most users
  - Develop simplified models of coupling to use in climate models

Actionable Items

- Provide an update on capabilities and requirements to OOPC
  - Mark and Kyla will review with organizing committee+ and send to Meghan Cronin
  - Include sources of current data and guidance on use
- Develop improve parameterizations of wind/wave/current/flux algorithms
  - Work with modelers to make rapid use of these improvements
  - Develop better covariance matrices (or equivalent) for assimilation in coupled models
  - Improve parameterization of Langmuir circulation and related transport changes
- Work towards studies of how the ocean currents and waves influence the coupling of the atmospheric boundary-layer with the free atmosphere
- Produce a gridded current product for users. This should be a model product that assimilated currents, assuming this approach will result in better space and time resolution than a weighted average of observations.

Actionable Items

- Given a good forecast (or observation) capability, we could target interesting features with high resolution observations from
- Produce report to US CLIVAR (two page summary) (Kyla and Mark)
  - Get feedback from steering committee and attendees
- We need to reach out to the community to better communicate information about current products and example uses (not everyone reads OOPC specs sheets)
  - Develop other outreach activities and tools for using currents
  - Need to better quantify errors in currents and make this information available
  - Develop a help center for users of surface current data
- Assess the value of adding to the existing quantity of surface drifters