

JPL Center for Climate Sciences Workshop, January 20-22, 2015:
Ocean Surface Mixed-Layer Processes & Air-Sea Interactions: A Critical Challenge for Climate Science

Day 1:

(8:00 AM) Check-in

(8:30 AM) Opening statements (Organizers' Welcome, CCS Welcome, JPL Welcome)

(8:45 AM) NASA HQ, Eric Lindstrom: Importance & NASA interest in the Ocean Surface Mixed-Layer

(9:00-10:00 PM) Air-sea interactions & connections to the ocean subsurface

(30 min) *The importance of the upper ocean mixed-layer to atmospheric PBL/climate* – Joao Teixeira (JPL)

(30 min) *Mixed-layer role in tropical cyclone heat potential, evolution & prediction* – Isaac Ginis (URI)

(10:00 – 10:15 AM) Coffee Break

(30 min) *MOC/Deep Ocean Connection* - Lynne Talley (UCSD-Scripps)

(15 min) *The ML relationship to ocean heat uptake and content*, Veronica Nieves & Josh Willis (JPL)

(11:00-12:15 PM) High Latitude Mixed Layer Processes

(30 min) *Quantifying upper ocean properties w/ in situ measurements, especially at high latitudes* – Robin Muench (ESR)

(30 min) *Mixed-layer role in sea ice-ocean interactions* – Laurence Padman (ESR)

(15 min) *Hydrographic preconditioning for seasonal sea ice anomalies in the Labrador Sea*, Ian Fenty (JPL)

(12:15-2:00 PM) Lunch

(2:00-3:00) The ML role in ocean BGC/Earth's carbon cycle

(30 min) *Mixed-layer role in ocean biogeochemistry/Earth's Carbon Cycle* – Amala Mahadevan (WHOI)

(15 min) *JPL Carbon Cycle modeling project* - Kevin Bowman (JPL)

(15 min) *Surface salinity effects on carbon dioxide fugacity/air-carbon flux* - Tim Liu or Xiaosu Xie (JPL)

(3:00 - 3:15 PM) Coffee Break

(3:15 - 3:30 PM) Organize into breakout groups & provide instructions

(3:30 - 5:30 PM) Break out groups--3 groups: (1) air-sea, (2) BGC, (2) ice-ocean (coffee concurrent)

✓ *Identify critical knowledge gaps in each field*

✓ *Identify key observations/developments needed to close those gaps*

✓ *Identify precision and spatiotemporal sampling requirements for proposed observations*

✓ *Discuss possible approaches to measurement & archiving*

✓ *Discuss complementary observations and modeling efforts that would leverage these datasets*

(6:30 PM) Banquet - Mijares in Old Town Pasadena

Day 2:

(9:00-10:30 AM) Modeling of upper ocean processes

(30 min) *Theory & modeling of mixing processes* – Leif Thomas (Stanford)

(15 min) *Large Eddy Simulation (LES) and the upper ocean ML* - Georgios Matheou (JPL)

(15 min) *Simulation of upper ocean mixing/eddies in ECCO* - Dimitris Menemenlis (JPL)

(15 min) *Salinity in modeling upper ocean processes* - Tony Song (JPL)

(15 min) *Tidal & Freshwater effects on upper ocean mixing in ROMS* - Adam Wang (JPL-JIFRESSE)

(10:30 - 10:45 AM) Coffee Break

(30 min) *The role of the mixed-layer in global surface current estimation* – Kathleen Dohan (ESR)

(15 min) *Using ECCO to understand ML processes* - Daria Halkides (JPL/ESR)

(11:30 – 12:15 PM) Measuring upper ocean processes

(15 min) *Aquarius/SST obs. link to surface density/mixing* - Bin Guan (JPL)

(15 min) *SPURS-I/II* - Zhijin Li (JPL)

(15 min) *The OSMOSIS experiment* - Andrew Thompson (Caltech)

(12:15 – 2:00 PM) Lunch

(30 min) *Breaking waves, turbulence, and bubbles*, Johannes Gemmerich (Univ. of Victoria)

(30 min) *Upper ocean optics, mixed-layer inference & ocean biology* – Dave Siegel (UCSB)

(30 min) *LiDAR technology for mixed-layer measurement* – Gary Spiers (JPL) and Darek Bogucki (TAMU-CC)

(3:30 - 3:45 PM) Coffee Break

(3:45-5:30 PM) Break out groups discussion

✓ *The need for a real-time global dataset of ML properties & critical parameters*

✓ *The way forward in developing a global ML observation system (esp. Remote Sensing)*

✓ *The role of models/model-data synthesis in developing ML products*

✓ *Potential collaborations across disciplines/institutions*

✓ *Future missions*

(6:30 PM) Dinner with remaining external visitors

Day 3:

(9:00-9:45 AM) 3 groups present conclusions from breakout discussions to larger group for open discussion

- o (15 min) Group 1
- o (15 min) Group 2
- o (15 min) Group 3

(9:45-12:00 PM) Open Discussion

- o Where does JPL fit in?
- o JPL's strengths/weaknesses in ongoing ML-related research
- o JPL instrument (ML2) development effort
- **Organize White Paper**

Workshop Goals:

- Evaluate need and identify requirements for a real-time, global ML property dataset (properties of most immediate need; approaches to be taken toward measurement, simulation and archiving of ML products.)
- Identify the role of model-data synthesis in the above
- Identify missing links across disciplines
- Chart a path forward in developing a real-time, global ML observation system
- Identify potential future missions, complementary observation/modeling efforts
- Forge beneficial collaborations
- Fortify JPL instrument (ML2) development effort (silent goal)
- Energize NASA HQ about ML science, esp. Advanced Component Technology Program Managers (silent goal)
- Publish meeting summary