Study Group on Air-Sea Transition Zone to Advance ESP

- Background
  - Fast Track Action Committee on Earth System Predictability Research and Development (FTAC) recommendation for a one-year study on advancing air-sea interaction observations approved
  - Agency sponsors confirmed: NASA, NOAA, NSF, ONR
  - US CLIVAR Program Specialist position advertised and filled: **Sam Coakley (Rutgers U.) started February 22**

- Goal of the Study: To develop a well-defined strategy to advance observing and modeling capabilities and understanding of air-sea interaction at all required scales for harnessing ESP
  - Anchored on observing the air-sea transition zone (the upper ocean boundary layer, air-sea interface, and atmospheric marine boundary layer as a single identity, instead of a sum of the three components) to benefit improved understanding, coupled data assimilation, and air-sea modeling

Study Group Charge

- Identify current capabilities, key gaps, lessons learned from the past, and best practices in data, technologies, understanding, and modeling requirements
- Assess the relative importance to ESP to resolve various space and time scales, interactions among different scale processes, and addressing model biases
- Build upon recent and potential future advances in sensor/platform technology to inform new satellite and in situ observing systems to resolve processes of ocean-atmosphere interaction, including estimates of turbulent air-sea fluxes of heat and moisture over the global oceans and their transport into the rest of the atmosphere through the marine boundary layer
- Explore possibilities of using modern statistical and modeling tools and co-designing air-sea observing and data assimilation (DA) systems to optimally use available data, fill observational blind spots, and minimize cost while harnessing predictability and providing broader societal benefits
- Liaise and coordinate with other relevant US and international activities (e.g., SCOR OASIS WG, US CLIVAR Air-Sea WG)
- Produce strategy document providing system recommendations to be shared with the Interagency Council for Advancing Meteorological Services (ICAMS)

Observations to Advance ESP

Enable the global observing system

- Treat the coupled boundary layers as a single identity
- Collect simultaneous and collocated oceanic and atmospheric measurements

Capitalize on recent advances in sensors and platform technologies

- Further new remote sensing capabilities
- Enhance in situ autonomous sensor technologies

Co-design observing networks with modeling & data assimilation community

- Improve hierarchy of model representation
- Actions to be taken over the next decade

US CLIVAR
Climate Variability & Predictability

Roadmap

Phase 1 – Inter-Agency coordination (year 1-2)

- Identify current and near-future observing capabilities and assess their relative importance for ESP
- Determine well-defined strategy and observing system requirements to advance observing and modeling of air-sea interaction at all scales for harnessing ESP
- Leverage inter-agency coordination (US CLIVAR, ICAMS) to support a study to produce system recommendations

Phase 2 – Field work & Testing (year 2-5)

- Build on recommendations from Phase 1, produce observational data to test system requirements and predictability. Leverage upcoming field campaigns e.g., S-MODE, CLIVAR AdAC, SWOT cal/val
- Improve high-resolution coupled simulations for the air-sea transition zone. E.g., use hierarchical and advanced DA approaches (inverse, adjoint, ML), encourage MIP-like multi-modeling center participation.

Phase 3 – Implementation (year 5-10)

- Integration with existing global observing capabilities (e.g., relevant US and international missions and networks) Go global!

US CLIVAR
Climate Variability & Predictability

Timeline for Study Group

- November: SSC develops initial member list and co-chair slate; IAG selects and invites co-chairs
- December: Confirm co-chairs
- February: Develop initial work plan; determine member slate with SSC approval
- **March**: Invite and confirm members; hold first meeting to review charge and the initial workplan
- March-November: Review state of science and infrastructure; organize briefings and discussions to inform strategy

  Bi-weekly meetings, with roughly this schedule

  March-June: Full study group meetings, selected visitors (e.g. Meghan Cronin, OASIS)

  July-October: Combination of full group meetings and subgroup meetings, initial writing

  November-December: Full study group meetings, finalizing recommendations
- December: Complete draft; present at Fall AGU Town Hall
- January 2023: Publish and promote; present at AMS Town Hall; brief IAG and ICAMS

Current membership

Carol Anne Clayson (co-chair)	Woods Hole Oceanographic Institution
Simon de Szoeke (co-chair)	Oregon State University
Charlotte DeMott	Colorado State University
Kyla Drushka	University of Washington/APL
Greg Foltz	NOAA/AOML
Raghavendra (Raghu) Krishnamurthy	DOE/PNNL
Tony Lee	NASA/JPL
Andrea Molod	NASA/GMAO
David Ortiz-Suslow	Naval Postgraduate School
Julie Pullen	Jupiter
David Richter	University of Notre Dame
Hyodae Seo	Woods Hole Oceanographic Institution

Patrick Taylor	NASA/Langley
Elizabeth Thompson	NOAA/PSL
Chris Zappa	Columbia University
Paquita Zuidema	University of Miami

3 positions awaiting responses that will offer additional expertise in:

- Coupled data assimilation & modeling
- Instrumentation

US CLIVAR
Climate Variability & Predictability

Current membership

Carol Anne Clayson (co-chair)	Woods Hole Oceanographic Institution
Simon de Szoeke (co-chair)	Oregon State University
Charlotte DeMott	Colorado State University
Kyla Drushka	University of Washington/APL
Greg Foltz	NOAA/AOML
Raghavendra (Raghu) Krishnamurthy	DOE/PNNL
Tony Lee	NASA/JPL
Andrea Molod	NASA/GMAO
Julie Pullen	Jupiter
David Ortiz-Suslow	Naval Postgraduate School
David Richter	University of Notre Dame
Hyodae Seo	Woods Hole Oceanographic Institution

Patrick Taylor	NASA/Langley
Elizabeth Thompson	NOAA/PSL
Chris Zappa	Columbia University
Paquita Zuidema	University of Miami

Representation in other programs:

- OASIS
- US CLIVAR Air-Sea Interactions Working Group
- TPOS
- PIRATA
- ATOMIC
- S-MODE
- SOCCOM
- SPURS
- DYNAMO
- WFIP-3

US CLIVAR
Climate Variability & Predictability

DRAFT STRAWMAN OUTLINE

Chapter 1: Executive Summary

Chapter 2: Intro; State of the Science

- Committee charge, scope of report
- Aspirations for prediction (especially precipitation) for the next decade
- Current capabilities and limitations
- Lessons learned from the past

Chapter 3: Requirements of the observing system for the next decade

- Known requirements
- Unknown requirements
    - Process studies and field work needed to narrow requirements
    - Modeling/OSSEs needed to narrow requirements
- Localized and global observations

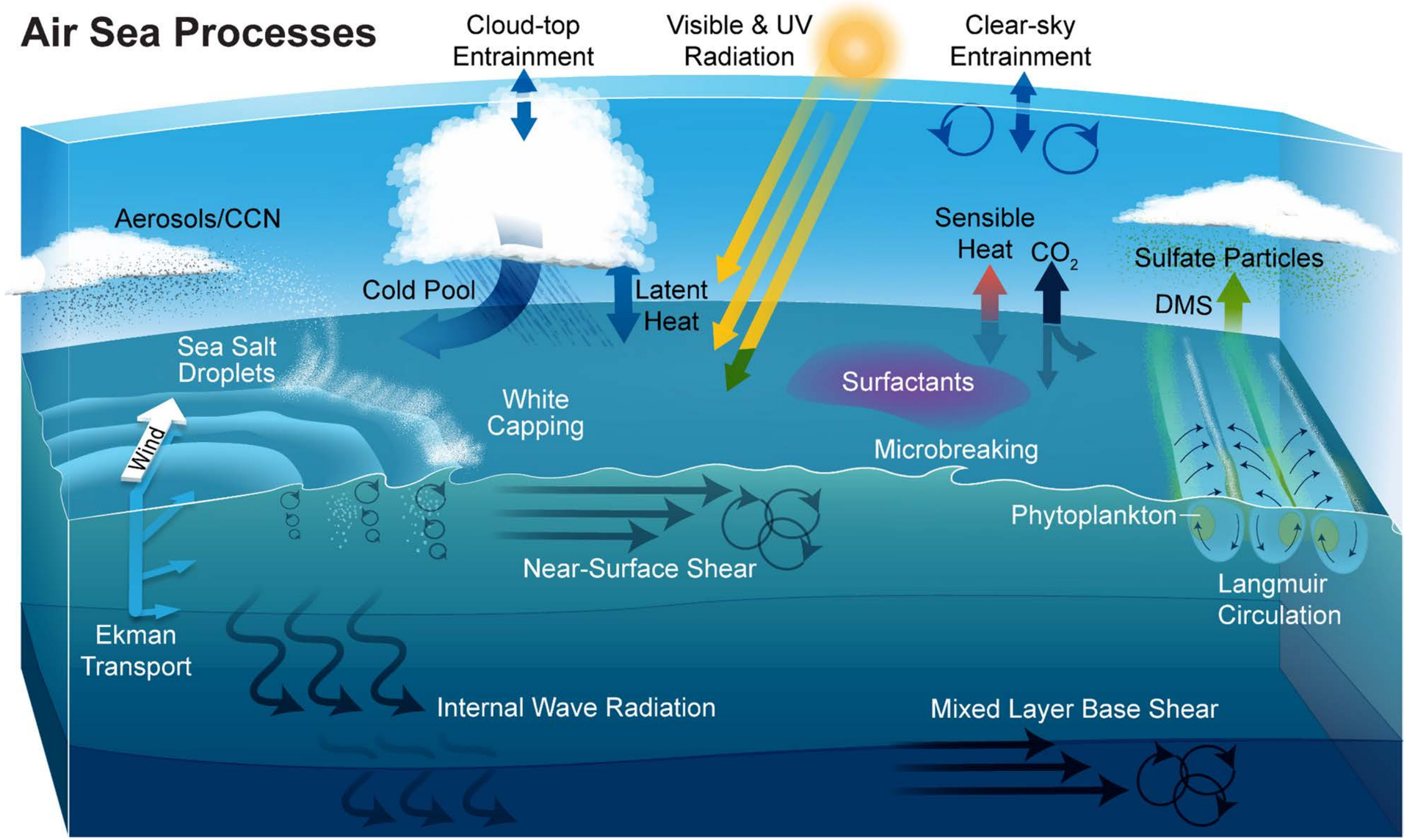
Chapter 4: Available and needed capabilities and technologies

- Observations
- Modeling

Chapter 5: Roadmap

- Key findings
- Actions to be taken over the next decade

US CLIVAR
Climate Variability & Predictability



US CLIVAR
Climate Variability & Predictability