**2021
2030** United Nations Decade
of Ocean Science
for Sustainable Development

Workshop Report

**Observing Air-Sea Interactions Strategy (OASIS) for a Predicted Ocean
a satellite event for the UN Decade of Ocean Science for Sustainable Development -
Predicted Ocean Laboratory
September 16, 2021**

**SCOR Working Group #162 for developing an Observing Air-Sea Interactions Strategy
(OASIS)**

Authors:

Meghan F. Cronin (NOAA PMEL, USA), WG co-chair, organizer, Best Practice Moderator
Christa Marandino (GEOMAR, USA), WG co-chair, organizer, Plenary Moderator
Sheri Schwartz (COL, USA), ECOP event organizer and Gather.Town Architect
Maggie Chory (COL, USA), ECOP event organizer
Phil Browne (ECMWF, UK), WG member, ECOP organizer, Network Design & Model
Aneesh Subramanian (UCB, USA), organizer, Network Design & Model Improvement Moderator
Improvement Moderator
Warren Joubert (SAWS, SA), WG member, ECOP organizer, Capacity & Partnership Building
Moderator
Brian Arbic (UM, USA), organizer, Capacity & Partnership Building Moderator
Mark Bourassa (FSU, USA), organizer, Ocean Shot Moderator
Marcel du Plessis (UG, Sweden), ECOP organizer, Ocean Shot Moderator
Sebastiaan Swart (UG, Sweden), WG co-chair, Ocean Shot Moderator
Ute Schuster (UE, UK), organizer, WG member, Best Practices Moderator
Chelle Gentemann (FI, USA), organizer, FAIR data & OASIS products
Riu Sun (SIO USA) ECOP Notetaker
Jack Reeves Eyre (UW CICOES USA), ECOP Notetaker
Verena Hormann (SIO USA) Notetaker
Oscar Alves (BOM, Australia), WG member, Plenary Moderator
Faith February (UCT, SA), ECOP invited talk
Precious Mongwe (CSIR, SA) ECOP invited talk
Seth Zippel (WHOI, USA), ECOP invited talk

Viviane Menezes (WHOI, USA) ECOP invited talk
Daneisha Blair (FSU USA), ECOP invited talk
Anna-Lena Deppenmeier (NCAR, USA) ECOP Keynote
Paige Martin (LDEO, USA / ANU, Australia) ECOP Keynote
Jaime Palter (URI, USA) Keynote
R. Venkatesen (NIOT, India), WG member, Keynote
Alison Gray (UW USA), Keynote
Carol Anne Clayson (WHOI USA), Keynote
Jamie D. Shutler (UE, UK), Moderator of data & OASIS products session

Citation: Cronin, M. F., C. Marandino, S. Schwartz, M. Chory, P. Browne, A. Subramanian, W. Joubert, B. Arbic, M. Bourassa, M. du Plessis, S. Swart, U. Schuster, C. Gentemann, R. Sun, J. Reeves Eyre, V. Hormann, O. Alves, F. February, P. Mongwe, S. Zippel, V. Menezes, D. Blair, A.-L. Deppenmeier, P. Martin, J. Palter, R. Venkatesen, A. Gray, C. A. Clayson, J. D. Shutler (2021). Workshop Report for the Observing Air-Sea Interactions Strategy (OASIS) for a Predicted Ocean, a satellite event for the UN Decade of Ocean Science for Sustainable Development - Predicted Ocean Laboratory, held virtually on September 16-17, 2021. doi: [10.3289/SCOR_WG_162_2021](https://doi.org/10.3289/SCOR_WG_162_2021)

Overview

The “OASIS for a Predicted Ocean” satellite event to the UN Decade Predicted Ocean Laboratory took place twice to account for different time zones, on Sep 16, 2021 at 1600 CET and on Sep 17, 2021 at 0100 CET. The fun event used the interactive gather.town platform (Figures 1-2), and had poster viewing (Figure 3) and socializing before and after the events. Overall, the event was fun and went smoothly due to the careful planning by the organizers, the Consortium for Ocean Leadership (COL) support team, and the gather.town architect, Sheri Schwartz. Roughly half of the team of organizers, moderators, keynote and invited speakers, and note takers were Early Career Ocean Professionals (ECOP), representing the stake they have in the future.

The opening plenary began with a 4-minute welcome video by Meghan Cronin, followed by five short videos from invited ECOP speakers in each of the themes. Participants then went to one of five Theme Team rooms, where they viewed the keynote talk, and brainstormed. Notetakers prepared presentations on the fly and the moderators provided short 3-minute summaries of the discussion in the final plenary. All talks are available for viewing on the OASIS youtube channel: <https://www.youtube.com/channel/UCikmU5CIK-w0lc0hNnI89vw/videos>

Opening Plenary talks (Welcome talk and ECOP presentations) can be found at: <https://www.youtube.com/watch?v=xBHW9lxNqHw&list=PL7IEVqN7cilwAuovNPnzvvhY23mcckD0m&index=1>

Keynote talks can be found at: https://www.youtube.com/watch?v=fEglb-PN3_w&list=PL7IEVqN7cilzc3zv_0h77J04QNmqPbrPJ

See Appendix 1 for transcripts or short summaries of each talk. Appendix 2 lists the posters. Appendix 3 shows logistical information about using Gather.Town shared with participants prior to the event. Appendix 4 describes Consortium for Ocean Leadership’s Participant Code of Conduct & Anti-Harassment Policy, which has been adopted by OASIS.

Figure 1. Map of OASIS Gather.Town.

Figure 2. Details about the breakout room color coding.

Figure 3. Map of the Poster Room layout.

Breakout Summaries for 1400 UTC and 2300 UTC

The breakout reports were prepared primarily by the moderators and notetakers for each Theme Team. We also list the ECOP invited speaker and Keynote speakers as these pre-recorded presentations helped shape the discussions.

Breakout Discussion Reports for Observing Network Design & Model Development Theme Team

Moderators: Phil Browne (ECMWF, UK), Aneesh Subramanian (UCB, USA)

Notetakers: Riu Sun (SIO USA)

Invited ECOP Speaker: Faith February (UCT, SA)

Keynote Speaker: Anna-Lena Deppenmeier (NCAR, USA)

This theme team had around 15 participants in the room during the first session. The keynote speaker for this theme was Dr. Anna Lena Deppenmeier from the National Center for Atmospheric Research, Boulder, Colorado. We had a short and lively discussion about

processes that need better observations and modeling capabilities. Some of the processes highlighted were surface flux exchanges, ocean surface waves, ocean heat uptake and mixing, biogeochemical and aerosol exchanges from the ocean surface to the atmosphere and also in the interior of the ocean. The group recommended that we need better parameterizations for surface fluxes and ocean heat uptake in current weather and climate models. The observations collected should be compatible and consistent between ocean and atmosphere boundary layers. The design of observing networks should consider both space and time scales of variability and how to observe multiscale processes. We need more process understanding on how much surface waves matter for air-sea interaction. We also need better observations and process understanding of how turbulent processes in the upper ocean modulate surface fluxes. We need to design observing networks for Isotopes in the ocean and atmosphere with their differences noted. The team recommended that we should build capability to have global arrays for wave buoys. This will help calibrate and validate future satellite missions as well. Currently it is difficult to couple wave and ocean models without understanding the interactions between the two better. Hence better process understanding and translation to model improvement will help improve our modeling and prediction capability from weather to climate timescales. We need better engagement between academic and private industry to incorporate new and novel observations for surface ocean and atmosphere observations into our network. This would also entail a community discussion on the issue of data commercialization and how to address this for academic research use and industry use adequately.

For the second session there were a handful of participants present and covered many of the points discussed in the first session. Notably, discussions focused more on biogeochemical applications and how the OASIS remit might extend slightly further as interactions can have longer range effects. For cost effective deployment of observation networks for carbon fluxes at the air-sea interface we should consider retrofitting existing networks (e.g., TAO/TRITON) with additional sensors, as well as expanding to sparsely observed regions (e.g., southern ocean, western boundary currents).

Breakout Discussion Reports for Capacity Building & Partnerships Theme Team

Moderators: Warren Joubert (SAWS, SA) and Brian Arbic (UM, USA)

Invited ECOP Speaker: Precious Mongwe (CSIR, SA)

Keynote Speaker: Paige Martin (LDEO, USA / ANU, Australia)

In the first session, there were 6 people in attendance, including representation from the SOLAS IPO. During the second (2300 UTC) breakout session, we had about five people in this theme room. The main question to be answered was: *How can OASIS become truly global through capacity building and sharing?* Both sessions' participants put their names into a Google Doc and briefly discussed some capacity development priorities, including summer schools, mentoring programs, computing workshops, developing toolboxes/curricula, easy-to-operate and low-cost instrumentation, FAIR data, and peer-to-peer mentoring.

Breakout Discussion Reports for Ocean Shots Theme Team

Moderators: Marcel du Plessis (UG, Sweden) and Mark Bourassa (FSU, USA)

Invited ECOP Speaker: Seth Zippel (WHOI, USA)

Keynote Speaker: Jaime Palter (URI, USA)

The attendees (>20 each session) agreed that we need multiple improvements to observations and the ability to use observations:

- 1) Increased spatial sampling of high temporal resolution bulk observations from in situ observations. A much greater spatial density of observations is highly desired;
- 2) Increased observations of surface and boundary-layer variables from satellite missions. Wide swaths of high spatial resolution observations are needed to provide the desired spatial resolution over the global ocean (and large lakes); and
- 3) Focused field studies to better understand variations in surface fluxes, and how these fluxes and bulk variables are linked to atmospheric and oceanographic boundary-layers.
- 4) Need to increase collection of long-term continuous bulk flux observations and incorporate more eddy covariance measurements in observing systems to test bulk parameterisation in different environments.

Posters invited for this session addressed several approaches to address these topics, and the value of several of these ideas were emphasized in each of the Ocean Shots sessions. Another key point is that the value of these observations would be greatly improved if they could be integrated into a coupled ocean/atmosphere (and likely wave) boundary-layer model. This suggestion meshes extremely well with the third objective, and would cause the data to have much greater value for ocean and atmospheric modeling, as well as for climate models that require a coupled ocean and atmosphere. It was noted that this coupling was much stronger on small (<20 km) spatial scales, and that dynamics as well as thermodynamics were important in this coupling. Therefore it was recommended that satellite observations have sufficient resolution to capture these scales and that mobile uncrewed in situ observations have sufficient temporal resolution to capture these small spatial scales. It was strongly recommended that the community works towards organization of a boundary-layer working group.

Breakout Discussion Reports for Best Practices and Interoperability Theme Team

Moderators: Ute Schuster (UE, UK) and Meghan Cronin (NOAA PMEL, USA)

Notetakers: Jack Reeves Eyre (UW CICOES USA) and Verena Hormann (SIO USA)

Invited ECOP Speaker: Viviane Menezes (WHOI, USA)

Keynote Speaker: R. Venkatesen (NIOT, India)

In the first (1400 UTC) session, discussions centered around the following ideas:

- 1) The need to pass lessons learned during development of existing observing platforms (e.g., uncrewed vehicles) on to development of the next generation of observing platforms. This would help both those *developing* the observing systems, and those *using* data from multiple platforms.
- 2) The opportunities and challenges of observing across “boundaries”: lessons for ocean obs. people from terrestrial observing communities; challenges in the coastal ocean due to different data requirements from the open ocean.
- 3) The need to make observation data more palatable for model developers and analysts: this could mean integrating different datasets together and/or simpler formatting efforts to make obs. and models more interoperable.

A couple of ongoing efforts were highlighted as examples of best practices in development:

- a) Surface Radiation sessions at the Ocean Best Practice Workshop (September 21-23).
- b) The ocean carbon community has put together an unofficial “community” best practice document; this is awaiting endorsement.

The second session (2300 UTC) had a total of about five participants. Recommendations were made for the implementation of FAIR data principles and the development of air-sea interaction

training material/workshops with due regard to best practices. Like in the first session (1400 UTC), the surface radiation ocean best practice workshop was announced and discussed.

Breakout Discussion Reports for FAIR data, model and OASIS products Theme Team

Moderators: Jamie Shutler (UE UK) and Chelle Gentemann (FI USA)

Invited ECOP Speaker: Daneisha Blair (FSU USA)

Keynote Speaker: Carol Anne Clayson (WHOI USA) and Alison Gray (UW USA)

What we do not want to do. Credit:
<https://xkcd.com/927/>

We had few attendees at this session, but post-meeting there was a very active twitter thread on the topic of air-sea flux toolboxes ([here](#)). There were several topics discussed where more work is needed:

- 1) Develop community consensus software libraries on github for heat/momentum/gas fluxes.

Currently, the community standard air-sea flux model, including latent and sensible heat flux, net heat flux, and other associated fluxes including evaporation, evaporation minus precipitation, sensible heat flux due to rain, buoyancy flux, and wind stresses is COARE3.0-3.6. This model has been made available in Fortran (v3.0), Matlab (v3.6), and Python (v3.5) and a Gas flux model (v3.6) ([here](#)). A significant issue with deploying this code from an FTP site is that it doesn't allow for software tracking, community development, discussions, and community building that happens on an open site like GitHub. A more modern gas flux model framework are, i) FluxEngine (v4.0) python library, enables calculations of single point, along cruise track, regional or global gas and momentum fluxes, is available on GitHub and Pypi, is well documented and contains tutorials, is maintained by users, its outputs are traceable to a reference dataset and COARE has previously been plugged into this framework, ii) a gridded-data-optimized version of COARE, Xcoare, which is distributed via GitHub and iii) there is a French group distributing [Cerform](#). In summary, there is a lot out there, some of which is not well maintained, lacks continuous

integrations, tests, and other standard open software project basics. This is not to criticize these codes, it is great to have all these open software, but now we need a community effort to focus community efforts, so the community can focus on the science and potential advances rather than proliferating toolboxes.

- 2) Community standard FAIR data format, metadata standards to make it easier to share results in a common repository (perhaps cloud data lake).

A multitude of air-sea flux in situ and spatially resolved datasets exist, but many lack complete and robust metadata, some are very difficult to use and some are impossible to trace their heritage. It would be helpful to have a community standard around air-sea flux data terminology and agreement on minimum metadata to include and begin sharing data more openly with clear metadata information and provenance. This would help to advance air-sea flux modeling. As an example, the FluxEngine toolbox (mentioned above) outputs are in standard formats (e.g., CF standard NetCDF, or csv), contain full metadata and provenance information, but the metadata format is not standardised.

- 3) Accessibility: The community efforts appear spread across multiple languages and frameworks which can create difficulty with sharing and building together.

The community is in some way siloed into Matlab, Fortran and Python users. As seen above, these models can be inconsistent - and one solution would be to create a basic underlying library and then use Matlab and/or Python wrappers to create consistent versioning for science use. But this could create a large management overhead for a community of volunteers to support and would require starting from scratch. Alternatively, exploiting similarities in languages would allow the community to relatively painlessly focus on one language which would again allow the community to accelerate development. (e.g., Matlab and Python syntax can be very similar, whereas Fortran is quite different).

There is a lot of work to be done in this area, but the data and software are critical to advance all the science questions we have and this work should ideally be prioritized.

Poster session and Gather.Town event Summary

After the 1-hour event concluded, participants had the opportunity to view posters, wander through Gather.Town, and socialize with friends and colleagues. The list of posters can be found in the Appendix 2.

Participants were asked to register in advance of the event, which led to 138 registered participants. There were numerous back-to-back (and sometimes overlapping) satellite events during the Predicted Ocean Laboratory. Our best estimate was that the actual number attending were 60 participants during the first event and 40 participants during the second for a total of 100 participants attending the event as a whole.

Appendix 1: Pre-recorded presentations transcripts or summaries

All pre-recorded videos can be found on the OASIS youtube channel at:
<https://www.youtube.com/channel/UCikmU5CIK-w0lc0hNnl89vw/videos>

Introduction by Meghan Cronin (NOAA PMEL, USA), SCOR WG #162 co-chair, Organizer (transcript)

SLIDE 1

Welcome to the Predicted Ocean Laboratory satellite event -- "OASIS for a Predicted Ocean". I am Meghan Cronin, co-chair of the SCOR Working Group #162 for developing the Observing Air-Sea Interactions Strategy (OASIS), which is now endorsed as a UN Ocean Decade Programme.

This is the famous photo of Earth taken by the Apollo 17 astronauts enroute to the Moon in 1972. This photo changed our perspective of our place in the Universe. Almost 50-years later, Global warming is undeniable. Our role in the Universe needs to change.

I hope that through OASIS we can work together to track the carbon dioxide emissions as they are absorbed into the ocean, and observe, understand and predict the air-sea interactions that influence weather and climate, and ultimately the ocean environment, ecosystem, and biosphere.

Through OASIS, I hope that the world gains a better understanding of the delicate balances that govern weather, climate, and the ocean environment and a better understanding of our role in the Universe.

SLIDE 2

OASIS is built around 5 themes. After hearing short talks from Early Career scientists on each of these themes, you are invited to quickly move through the lobby and into the breakout room of your choice.

The left-most room (color coded Blue) is the Observing Network Design & Model Development Theme Team. They will be defining the OASIS strategy and the "Ocean Shots" – like "moon shots" that are needed.

The second left-most room is the "Capacity and Partnership Building" Theme Team. How can OASIS become truly global through capacity building and sharing?

The middle room (color coded Magenta) is the "Ocean Shots" Theme Team. How can OASIS implement these "Ocean Shots" needed to make a Predictable Ocean?

The room second from the right (color coded Orange) is the "Best Practices & Interoperability" Theme Team. What Best Practices should OASIS develop?

The right-most room (color coded Red) is the "Findable-Accessible-Interoperable-and Reusable (FAIR) Data, Models & OASIS Products". What OASIS products need to be developed to create a Predicted Ocean?

In the breakout rooms, you should go to the "TV" and play the 3-4 minute keynote speaker. You should then join an approximate 15 minute breakout discussion in the white-board by clicking "x".

When that is done, you will quickly make your way back to this room for the short summaries from each Theme moderator.

After the 1-hour event is done, please wander around gather.town. Explore the poster room, meet up with old friends and colleagues.

Gather.Town will be open all day.

SLIDES 3-7

Before we get started with the Early Career talks, I would like to thank the OASIS Architects of Gather.Town: Sheri Schwartz & Maggie Chory.

And thank all the co-organizers and moderators...

... and early career & keynote speakers and the notetakers.

Finally, I'd like to highlight more than half this OASIS event team are Early Career Scientists.

They are our life blood.

Thank you everyone. Please enjoy the event.

Faith February (UCT, SA), ECOP invited talk for Observing Network Design & Model Development Theme Team

Faith February made the case that the OASIS should include in-situ observations in the southern hemisphere to improve understanding of sea spray aerosols and their role in air-sea exchanges. The improved understanding can lead to more accurate inputs for prediction models of climate change, biogeochemistry cycles, air-sea fluxes and ecological processes.

Precious Mongwe (CSIR, SA) ECOP invited talk for Capacity Building & Partnerships Theme Team

Precious Mongwe discussed how basic phenomena such as the sign of the seasonal cycle in the southern ocean are still unknown.

Seth Zippel (WHOI, USA), ECOP invited talk for Ocean Shots (transcript)

Seth described the Smart Ocean conference that he organized that led to the NSF funded Convergence Accelerator. This source of funding could lead to new technological solutions for OASIS Ocean Shots.

(Slide transcript)

SLIDE 1

My name is Seth Zippel, and I'm an assistant scientist at Woods Hole Oceanographic Institution.

I'm here to talk about my experiences with NSF's C-accel program, and how this program might align with future OASIS-themed opportunities. This talk is intended as part of the "Ocean Shots" theme

SLIDE 2

For those of you not familiar, the NSF Convergence Accelerator is a unique R&D program within NSF's OIA directorate. The program focuses on funding: *Research driven by a specific and compelling problem that requires deep integration across disciplines. Integrated teams including industry, academics, not-for-profits, government entities, and others.* Use-inspired fixed-term projects with a strong focus on deliverables

SLIDE 3

The Convergence Accelerator Process starts with Ideation, where researchers respond to a Dear Colleague Letter to generate ideas, some of which are encouraged to submit workshop proposals. Roughly 12 workshops are funded each cycle to jumpstart team building, showcase the seeds for convergent research projects, and to generate excitement about the workshop topic. Workshop final reports are used by the Convergence Accelerator program managers to guide research track selection. Out of the 12 workshop final reports, two track topics are created, and Solicited for Phase-1 proposals. Up to 30 Phase-1 proposals are funded for up to \$750k / 9 mos., where teams expand their projects, attend the C-accel curriculum, and compete in a pitch-a-thon. Only teams that have received Phase-1 funding may apply for Phase-2, where teams are given to 5 million over 24 months for the solution development phase. Societal Impact: After Phase-2 Funding, the goal is to achieve national-scale impact, and for projects to become sustainable beyond NSF support, be it as industry, or through government, private, or charitable support.

SLIDE 4

I was involved in the convergence accelerator program as one of the Organizers of the SmartOceans2020 workshops which led to Track-E: the Networked Blue Economy. Phase-1 proposals for Track-E were due in June of this year, so anyone wishing to get involved at this point must join an already formed and funded team for their Phase-2 proposal. Workshops for the next cohort took place in Spring and Summer of 2021. Some of these workshops touched on themes you may be interested in, including Climate Change, resiliency, and geospatial observation. So be on the lookout for Solicitations for Phase-1 proposals for future tracks which may be of interest to the OASIS community. Lastly, folks can start a new ideation process by responding to a Dear Colleague Letter, and working towards a new workshop proposal for your OASIS or Ocean Shot topics. I would suggest contacting the Convergence Accelerator Program Managers Early in this process. While the program managers are still restricted in the feedback they can give you, my experience was that the C-accel program managers were interested in being more hands on than program managers from other directorates. They are looking for topics that can generate excitement, including buzz outside of the academic community, and for topics that are ripe for acceleration, with the promise of deliverables that lead to societal impact over a short duration. Thank you for listening, and I'd be happy to answer any questions folks have at the gather town session, or by email.

Viviane Menezes (WHOI, USA) ECOP invited talk for Best Practices

Viviane told how she used a Best Practice paper to decide how to use her startup funding for purchasing air-sea interaction observing equipment.

Daneisha Blair (FSU USA), ECOP invited talk for FAIR data, model and OASIS products

Daneisha described a new air-sea flux toolbox that she is helping to develop in M. Bourassa's group.

Anna-Lena Deppenmeier (NCAR, USA) ECOP Keynote for Observing Network Design & Model Development Theme Team

Anna-Lena used the example of the tropical Pacific cold tongue, a region of strong air-sea interaction where large heat fluxes enter the ocean, to describe how climate model development would benefit from concurrent observations of surface and subsurface (turbulent) fluxes.

Paige Martin (LDEO, USA / ANU, Australia) ECOP Keynote for Capacity Building & Partnerships Theme Team

Paige described the python workshops that she leads in the Coastal Ocean Environment Summer School in Ghana. She described how these workshops have facilitated research in under-resourced areas. For instance, one Nigerian participant was able to collect observations for his PhD research in atmospheric science after learning how to run his instruments at lower cost with a raspberry pi driven by python.

Jaime Palter (URI, USA) Keynote for Ocean Shots Theme Team

Jaime described what would be gained if we had a new global network of Uncrewed Surface Vehicles, and enhanced observations from existing air-sea interaction observing nodes including OceanSITES, Volunteer Observing Ship (VOS). Jaime, with the SCOR Working Group #162, has submitted this Ocean Shot titled “**A Global Network of Surface Platforms for the Observing Air-Sea Interactions Strategy (OASIS)**” to the US National Academy of Sciences, Engineering and Medicine.

R. Venkatesen (NIOT, India), Keynote for Best Practices and Interoperability Theme Team

Venkat described the relation of the air-sea flux estimates to the Global Ocean Observing System (GOOS) Essential Ocean Variables. He argued that best practices is a methodology that has repeatedly produced superior results relative to other methodologies with the same objective. High quality GOOS air-sea flux observations depend upon best practices. Please participate in the Ocean Best Practice System’s workshops for Surface Radiation. SOLAS, with OASIS, is also organizing a Best Practice workshop for Direct Covariance Fluxes.

Alison Gray (UW USA), Keynote for FAIR data, model and OASIS products Theme Team

Alison described “Air-sea carbon flux data and data products for a Predicted Ocean”. In particular, she described the value of the Surface Ocean CO₂ Atlas (SOCAT) that has embraced the Findable-Accessible-Interoperable-Reusable data principles. Recent advances include combining coastal and open ocean pCO₂ and standardizing fluxes from different pCO₂ products. She argued for the need to extend and sustain these high-quality surface ocean carbon observing network. Saildrones and other USV can provide autonomous high-frequency measurements of CO₂ in both seawater and air. Data from BGC Argo floats equipped with pH sensors can also be used to calculate ocean pCO₂, albeit with greater uncertainty than direct measurements.

Carol Anne Clayson (WHOI USA), Keynote for FAIR data, model and OASIS products Theme Team

Carol Anne described four different Heat fluxes from global ocean satellite products, including some of the different methodologies and differences in the trends. She argued that to have well-calibrated satellites designed to measure all needed bulk flux parameters, we need many more mid-latitude and polar in situ flux measurements, and in particular direct flux measurements. In situ flux data sets, particularly direct flux measurements, need to be organized better. We need an Ocean heat flux toolbox site that is visible and known by the flux community, and it should include only refereed and well-documented codes (parameterizations).

Appendix 2: List of Posters

Most of the posters shown were created for OceanObs19. The list of posters below are grouped by their locations in the Gather.Town Poster Room (Figure 3).

**Left Side - Row 1 (from the bottom of the room up)
Posters listed left to right**

Steinhoff et al. - Constraining the oceanic uptake and fluxes of greenhouse gases by building an ocean network of certified stations: the ocean component of the Integrated Carbon Observation System, ICOS-Oceans

Wanninkhof et al. - A surface ocean CO₂ reference network, SOCONET and associated marine boundary layer CO₂ measurements

Palter - A Global Network of Surface Platforms for OASIS"

Left Side - Row 2

Posters listed left to right

Cronin et al. - Air-Sea Fluxes with a focus on Heat and Momentum

Centurioni et al. - Sustained, Open Access, In-Situ, Global Wave Observations for Science and Society

Gentemann et al. - Butterfly: revealing the oceans' influence on our weather and climate

Left Side - Row 3

Posters listed left to right

Wineteer et al. - Ocean Shot: Satellite measurements of winds and currents through Ka-Band doppler scatterometry

Lowder et al. - A Case Study for Delivering Capacity Development: The Ocean Foundation's Approach to Building Global Ocean Acidification Monitoring Programs Through Equipment, Training, and Support

Andres et al. - Transforming Ocean Science: Fostering a Network for Cooperative Science Research on Commercial Ships (Science RoCS)

Right Side - Row 1 (from the bottom of the room up)

Posters listed left to right

Clayson et al. - Super Sites for advancing understanding of the oceanic and atmospheric boundary layers

Muller-Karger et al. - Marine Life 2030: Forecasting Changes to Ocean Biodiversity to Inform Decision-Making: A Critical Role for the Marine Biodiversity Observation Network (MBON) in OASIS

Russell et al. - Southern Ocean Storms - Zephyr

Right Side - Row 2

Posters listed left to right

Subramanian et al. - Impact of ocean observation systems on ocean analyses and subseasonal forecasts

Anderson et al. - Scaling up from Regional Case Studies to a Global Harmful Algal Bloom Observing System

Vinogradova-Shiffer &McCurdy - Advancing Ocean Science through Open Science and Software on the Cloud

Right Side - Row
Posters listed left to right

Arbic - An Ocean Corps for Ocean Science

O'Carroll et al. - Observational Needs of Sea Surface Temperature

Layoyaux et al. - CERA-20C: a 20th century record of consistent ocean-atmosphere states

Right Side - Row 4
Posters listed left to right

Meinig - Our Public Private Partnership rapidly developed and deployed drones to meet scientific regional observing needs. Global next....

Kent et al. Ocean Surface Climate: Observing requirements for long-term records at the ocean surface

Vinogradova-Shiffer &McCurdy - Improved Value of the Observing System through Integrated Satellite and in situ design

Center Top

Gommenginger et al. - SEASTAR: Observing Ocean Submesoscale Dynamics and Small-Scale Atmosphere-Ocean Processes in Coastal, Shelf and Polar Seas

Appendix 3: Pre-meeting instruction for the OASIS Gather.Town provided to registered participants

The link and password to OASIS Gather.Town are not included below.

Gather.Town 101 – Tips & Tricks for the event:

Navigation:

- To navigate your character throughout the different event spaces, use your arrow keys.
- Hold the “G” key on your keyboard to move through people and silence nearby conversations/video chats.

Private Spaces:

- There are private spaces throughout the different rooms, typically indicated by a different floor color. Upon entering one, you will also see a message on your screen that reads, “You have entered a private space.”
- All conversations outside this space cannot be heard by those within the space. Conversations within this space cannot be heard outside of it.

Interactive Objects:

- See Figure 2 for a comprehensive list of the objects you can find throughout the event.
- To interact with an object, press the “X” key on your keyboard.

Chat:

- Please keep an eye on the chat, as announcements will be made here.
- When in a private space or Theme Room, use the “Nearby” option (or direct message an individual).
- Using the “Everyone” option sends a chat to all participants, even those in a different room.

Help Desk:

- If you are having any trouble, visit our Help Desk (green desk) in the Main Room. We will be ready to answer your questions!

Interactive Objects

In each room, you will find different objects to interact with by pressing the “X” key on your keyboard. Here’s a comprehensive list of the for each area:

Main Room:

- Signs outside each room.
- Help document on the Help Desk (green desk at front).
- This presentation on the Help Desk.

Plenary Room:

- None.

Poster Room:

- Posters and, if applicable, a table next to each poster with a printable flyer.
- Bulletin boards (in the back) that link to the Comments and Questions document.

Theme Rooms:

- Whiteboard for brainstorming and discussion.
- TV (in a private space) linked to the keynote speaker’s video on YouTube.
- Google doc (on the conference table) for additional notetaking and brainstorming space.
- Google doc (on a table in the corner) for participants to list their names, emails, and interest areas.

Lounge:

- Whiteboard for casual discussion and brainstorming.
- Various games are on some of the tables. Feel free to have some fun!

OASIS for a Predicted Ocean Program for Thursday 16 Sep 2021

The event is repeated at 1400 UTC and 2300 UTC to account for time zones

: -60 Poster viewing and socializing
: 0 Pre-recorded Introduction + videos by ECOPs for each theme (6x4 min = 24 min)
: 24 Go to Theme rooms
: 25 Theme Room pre-recorded video by keynote speaker
: 29 Theme Room Breakout session
: 45 Plenary. Moderators report back from each theme room with 3 min. summaries x 5
: 60 Posters and socializing (close at :120)

Gather.Town is open all day 16 September 2021. Please pop in at your convenience to view posters and meet colleagues and friends.

Code of Conduct

By entering our Gather.town space, you agree to our Virtual Event Code of Conduct.
[Click here to read the Code of Conduct](#)

Appendix 4. Participant Code of Conduct & Anti-Harassment Policy

The Consortium for Ocean Leadership [for Virtual Events] policy is publicly available through the OASIS website at: https://airseaobs.org/wp-content/uploads/2021/09/COL-Code-of-Conduct-Anti-Harassment_Virtual_OASIS.pdf

Guiding Principles and Code of Conduct

As a community organization, the Consortium for Ocean Leadership (COL) regularly organizes and hosts events, including meetings, workshops, conferences, trainings, and educational events, with members from multiple sectors within the ocean science, technology, education, and related communities and stakeholders. The core values of COL form the foundation on which we perform work and conduct ourselves and define how we interact with each other.

Our core values are:

Respect for each other, and for all cultures and backgrounds:

We embrace each other's differences so that we may enrich the well-being of everyone. We value different experiences, backgrounds, and perspectives that bring forward creative and innovative solutions. We value a safe environment in which to offer multiple, and at times conflicting, opinions that drive toward common goals. We particularly value the diversity across the organization, and the contributions each person and organizational component makes to the success of us all. We are a growing and evolving organization; we value change.

Honesty, integrity, and candor:

We seek the truth and speak it directly.

Credibility:

We strive to be a trusted source of unbiased and science-based advice and information: science and technology are the ground upon which we stand.

Professionalism:

Demonstration of exemplary qualities in all aspects of personal presentation and conduct; we establish and adhere to high standards.

We believe we can accomplish the most by working together.

The participants of this meeting were chosen for the experience and perspectives they bring to the discussion; therefore, every voice is important to reaching our goal of building an Observing Air-Sea Interactions Strategy (OASIS) for a Predicted Ocean.

To those ends, in this meeting, we invite all staff and participants to abide the following code of conduct:

- **Respect for each other, and for all cultures and backgrounds:**
 - Value a diversity of views and opinions and seek out perspectives other than those already represented.
 - Seek to understand, learn, and build rather than to be right.
 - Assume that you have relative privileges and both explicit and implicit biases. Know that others may or may not have had similar opportunities, experiences, and background as you. Recognize that their contributions are equally valuable. For those from dominant identity groups, refrain from contributions that prioritize dominant experiences over those who have been marginalized.
- **Honesty, integrity, and candor/ Credibility**
 - Speak to your knowledge and experience when it is not represented in the group discussion. ○ Avoid sharing sensitive personal information about yourself or another individual, whether or not an attendee of this event.
 - Honor confidentiality. do not share the specifics of others experiences or information without permission.
 - Speak only for yourself. Avoid contributing to assumptions or generalizations about groups, and do not ask individuals to speak for their (perceived) group.
- **Professionalism**
 - Leave space for others to engage and express comments and ideas if you have spoken recently, by speaking if you have not, and by letting people finish their thoughts before adding new ones.
 - Affirm the person, critique the ideas. Provide feedback constructively and with the intent for mutual growth, and welcome feedback and constructive dissent.
 - Be solution- and goal-oriented
 - Contribute what has not yet been said, rather than repeating or re-affirming what has.
 - Though we will be discussing topics that may involve high personal meaning and impact, refrain sharing potentially triggering information in the group and instead utilize the support resources offered.

Etiquette for virtual communication

- If you would not say something to someone's face, refrain from writing/saying it virtually.
- Know that use of strong language, capital letters, and exclamation marks can be easily misinterpreted online as unwelcome yelling or aggressive behavior.
- Remember that tone does not carry via text. People might not realize you are joking or being sarcastic.

Supporting one another

If you notice someone in distress, privately ask if they would like support or assistance. If yes, offer support, direct them to the workshop's support resources, and/or ask if they would like you to contact a COL staff member.

Reporting incidents

Notification of an issue or concern should be done by contacting a COL staff person by phone, email, or private chat message in Gather.town.

COL staff members responsible for this meeting:

Sheri Schwartz, Program Associate

Email: sschwartz@oceanleadership.org

Phone: Number Not Shown Here (not a mobile phone)

Maggie Chory, Program Associate
Email: mchory@oceanleadership.org
Phone: Number Not Shown Here

Other COL reporting points of contact:
Jasmine Hill, Meetings and Travel Specialist
Email: jhill@oceanleadership.org
Phone: Number Not Shown Here (not a mobile phone)

Anti-Harassment Policy **Policy on Harassment**

COL is dedicated to providing a harassment-free and inclusive event experience for everyone regardless of gender identity and expression, sexual orientation, disabilities, physical appearance, race, nationality, age, religion, or any other protected category. COL will not tolerate unlawful harassment or behavior that creates an intimidating, hostile, or offensive environment at any of the events it organizes or co-organizes in any location throughout the world. All event participants are required to abide by this Code of Conduct, which is adapted from the American Geophysical Union and complies with the new directive from the National Science Foundation.

Sexual harassment is a specific kind of unlawful harassment and includes sexual advances, requests for sexual favors, unwelcome or offensive touching, and other verbal, visual or physical conduct of a sexual nature that has the purpose or effect of creating a hostile work environment. Harassment can include, but is not limited to, comments, cartoons, "jokes," e-mail messages, computer images, physical conduct (including gestures), horseplay, stereotyping, and unwelcome touching.

Unacceptable Behavior includes, but is not limited to:

- Harassment, intimidation, or discrimination in any form.
- Physical or verbal abuse by anyone to anyone, including but not limited to a participant, speaker, guest, staff member, volunteer, sponsor, etc.
- Sexual attention or advances.
- Personal attacks directed at other participants, speakers, guests, members, staff, etc.
- Alarming, intimidating, threatening, or hostile comments or conduct.
- Nudity and/or displaying sexual images.
- Threatening or stalking anyone, including a participant.
- Other conduct which could reasonably be considered inappropriate in a professional setting.

Anyone requested to stop unacceptable behavior is expected to comply by ceasing the behavior immediately, regardless of

o Whether they agree the behavior is a policy violation

o Whether the request comes from the target of the behavior, a bystander/witness, a member of the COL staff, or another person in charge of the meeting.

Consequences for policy violations may include but are not limited to:

- COL staff (or their designee) or security may take any action deemed necessary and appropriate, including immediate removal from the event without warning or, when applicable, refund (to include travel reimbursement).
- COL reserves the right to prohibit attendance at any future event.
- Notification of an infraction to the offender's home institution

Acknowledgement

We acknowledge funding provided by national committees of the Scientific Committee on Oceanic Research (SCOR) and from a grant to SCOR from the U.S. National Science Foundation (OCE-1840868) to support this activity of SCOR Working Group #162 (OASIS). We also thank the Consortium for Ocean Leadership for their support with coordinating this event. This is PMEL contribution number **5313**.