Today's Agenda

- **Points of Information (Bontempi and Werdell)**
- **New Business (Dierssen and Remer)**

  -June Team meeting and presentations

  -Early Adopters paired

  -Subgroups

  -First Light

  -Performance metric survey

- **Bryan Franz: PACE Science Data Segment update**

- **Next Telecon: 2-3 June 2020 (First Team Meeting)**

Werdell update

PACE mission update for the SAT – 1 May 2020

Mission

- GSFC closed, telework only
- Major instrument & S/C work halted
- Focusing on docs & remote analyses
- Limited, prioritized re-entry upon reopening
- Many suppliers also impacted

Project Science, SDS, HQ

- CANs, not contracts
- SAT engagement underway – conversations, presentations, groups
- Docs, algs, implementation, validation – preparing for SAT insight & contributions
- Web updates to SAT page, *data product list*
- Early Adopters + Applications workshop

OCI

- On site activities on hold; no procurement
- Evaluation of engineering unit testing (Jan-Mar 2020) ongoing. Formal data review to be held in July. *Recommend Gerhard provide an overview to SAT in July/Aug.*

HARP2

- UMBC campus closed
- Remote work (incl. with vendors) on design, firmware, modeling, docs, dev of ops & cal

SPEXone

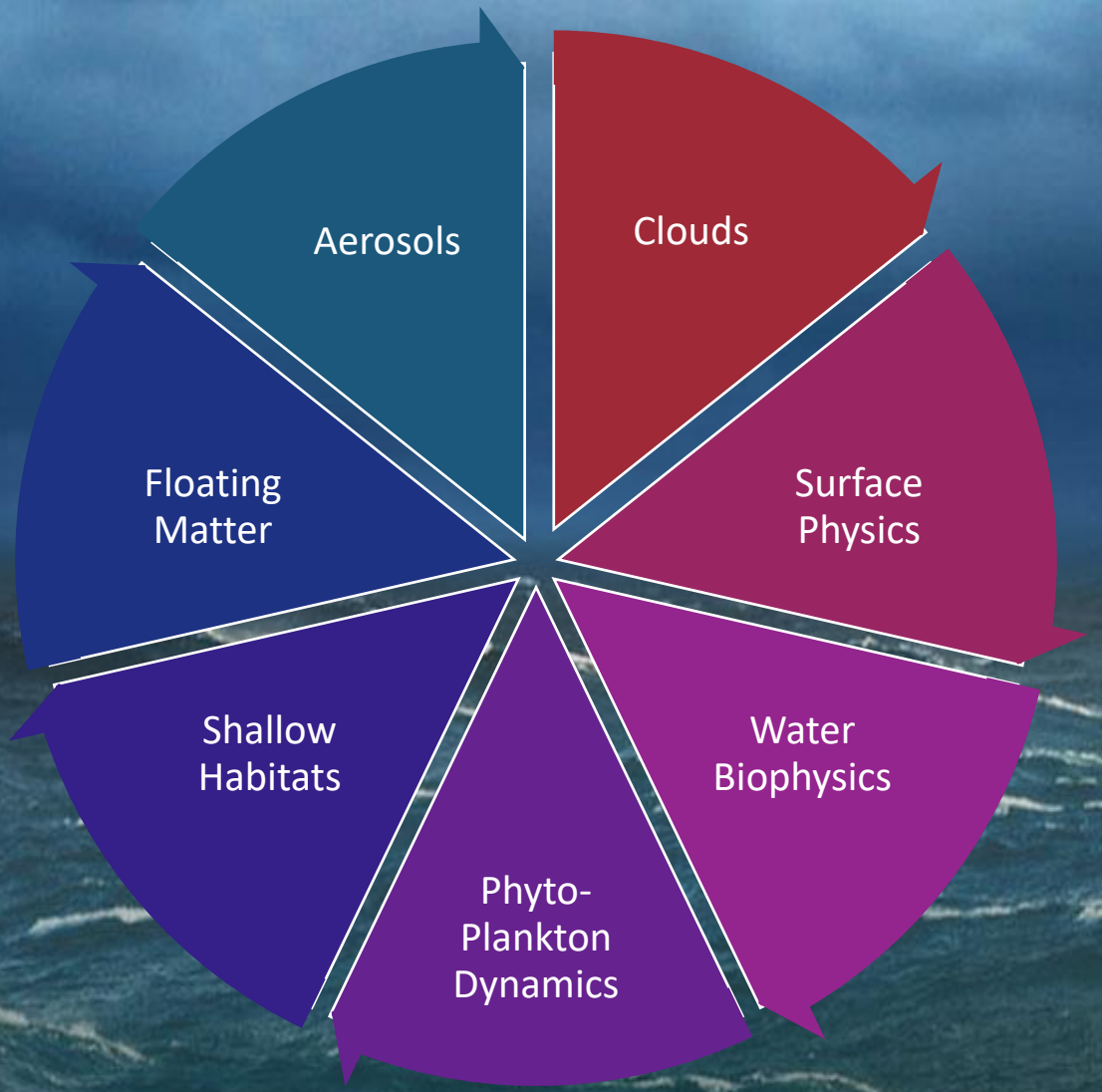
- Resumed limited hardware work on site under new rules/constraints
- Remote work on flight software, docs, data flow, test & cal procedures

SAT Shout-outs to New Yorkers stranded abroad

- Matteo Ottaviani – Italy
  - Teleworking until he can get back to NYC

- Jacek Chowdhary – Poland
  - Teleworking from Poland
  - Would like to have us record webex, if that is ok with everybody
  - (Email me if you have a problem with recording and I will not distribute)

PACE SCIENCE TEAM BY TOPIC



Terrestrial ecosystems

- New science team member:

K. Fred Huemmrich
Joint Center for Earth System Technology
University of Maryland Baltimore County

Biospheric Sciences Laboratory
Code 618
NASA Goddard Space Flight Center
Greenbelt, MD 20771
Cell: 301-395-7782
Email: kfhuemm@gmail.com

Lone Shark Award!

Dr. Huemmrich research focuses on the use of remote sensing to describe biophysical characteristics of terrestrial ecosystems and to utilize that information to improve understanding and modeling of ecosystem processes. He is interested in developing approaches that lead to global observations from satellite based sensors.

Early Adopters have been paired: THANK YOU!

PACE EARLY ADOPTERS

Early Adopter	Applied Sciences Category	SAT Partner(s)	Region(s)	EA Project Title	End-user(s)	Application	ARL (current; anticipated)
Anastasia Romanou (GISS-Colombia)	Water Resources & Climate	Peter Gaube	Global	Shifts in biodiversity and linkages to ecosystem health and food security	World Wildlife Fund (POC: Ryan Bartlett); UN Disaster Risk Reduction Office (POC: Marc Gordon); UN Development Program (UNDP; POC: Pradeep Kurukulasuriya); Wildlife conservation society (POC: Hedley Grantham)	Improving global climate model predictions	TBD
Chuanmin Hu (USF)	Water Resources/ Quality	Chuanmin Hu	Eastern Gulf of Mexico, Florida Straits, South Atlantic Bight	Fingerprinting floating algae type through PACE measurements	Florida Fish and Wildlife Conservation Commission (POC: TBD); US EPA (POC: Blake Schaeffer)	HAB detection & identification	ARL 3; TBD
	Disasters	Matteo Ottaviani	United States	Detecting and differentiating oil slicks through PACE measurements	Oil companies (POC: David Palandro); Oil management agencies (BOEM, BSEE) (POC: Jay Cho); NOAA NRDA (POC: Lisa Dipinto); NOAA CoastWatch (POC: Veronica Lance); US Environmental Protection Agency (POC: Robyn Conmy)	Detection and mapping of oil slicks/spills in the Gulf of Mexico	ARL 2; TBD
Clarissa Anderson (Scripps) Raphael Kudela (UCSC) Richard Stumpf (NOAA) Paul DiGiacommo (NOAA)	Water Resources/ Quality	Nima Pahlevan	California Coast	Applying PACE products to the California Harmful Algae Risk Mapping (C-HARM) System	NOAA CoastWatch (POC: TBD); NESDIS-STAR (POC: Dale Robinson, dale.robinson@noaa.gov)	HAB mapping	ARL 9; 7/8
Jason Jolliff (NRL) Sherwin Ladner (NRL) David Lewis (NRL)	Water Resources/ Quality	Michael Twardowski	Gulf of Mexico, CONUS	Ocean Colorimetry with PACE	NRL-Ocean Modeling and Prediction Branch (POC: Hans Ngodock, Hans.ngodock@nrlssc.navy.mil)	Turbid waters monitoring and prediction; Sediment plume tracking	ARL 2; 7
Liz Ferguson (Ocean Science Analytics) Craig Risien (OSU)	Water Resources/ Quality	Toby Westberry	Oregon	Coastal and Offshore Oregon Marine Mammal Ecological Study	Commercial & Recreational Fishing Industry (POC: TBD); Online training community (POC: TBD)	Marine mammal tracking; GIS software; Online training sessions	ARL 2; 6
Marina Marrari (FECOP)	Water Resources/ Quality	Brian Barnes	Costa Rica, Central America	Pezca: Near real time satellite data distribution platform for	Recreational anglers, commercial fishermen, tourism agents, NGOs,	Mobile app. for fishing & recreation	ARL 3; 9

PACE Early Adopter Table—Updated 04/29/2020

Early Adopter	Applied Sciences Category	SAT Partner(s)	Region(s)	EA Project Title	End-user(s)	Application	ARL (current; anticipated)
				Central America: Monitoring and fisheries applications.	government officials and the academic sector (POCs: TBD)		
Damian Brady (U. Maine) Andrew Thomas (U. Maine) Carter Newell (Pemaquid Oyster and Mussel) Chris Davis (ME Aquaculture Innovation Center)	Water Resources/ Quality & Modeling	Emmanuel Boss	Gulf of Maine	Aquaculture Site Prospecting: Applying PACE products to sustainable aquaculture site selection	Limited Purpose Aquaculture License holders (POC: TBD)	Aquaculture site selection	ARL 6/7; 7/8
Mariusz Pagowski (NOAA CERES/ CU Bolder) Arlindo da Silva (NASA/ GMAO) Daryl Kleist (NOAA/ NWS/ EMC)	Air Quality & Climate	Snorre Stames; Jacek Chowdhary; Lorraine Remer	Global	Assessing Potential of PACE Aerosol Products for Data Assimilation	NOAA/Climate Prediction Office/The Modeling, Analysis, Predictions, and Projections Program (POC: TBD); NOAA/Office of Weather and Air Quality (POC: TBD)	Prediction of global aerosols to study impact on weather and climate	ARL 4/5; 7
Heather Holmes (U. Utah)	Air Quality	Alexei Lyapustin	Western United States	Modeling spatial and temporal exposure to air pollution in the western U.S.	Washoe County Air Quality Management Division (POC: TBD)	Wildfire/smoke forecasting	ARL 2; 5/6
Rick Stumpf (NOAA) Shelly Tomlinson (NOAA)	Water Resources/ Quality	Robert Shuchman	United States	Discriminating algal blooms in turbid coastal, estuarine and large lake environments	State managers in Florida, Maryland, Virginia, Ohio, California (POCs: TBD); NCCOS	Inland/estuarine CyanoHAB mapping	ARL 3; 6
Daniel Tong (GMU)	Air Quality	Pengwang Zhai; Jacek Chowdhard	United States	Satellite based marine emissions of trace gases and organic aerosols	National Weather Service (NWS; POC: TBD)	Trace gas & aerosol emission modeling/ tracking	ARL 4/5; 7/8
Dustin Carroll (Moss Landing-SJSU) Dimitris Menemenlis (JPL)	Water Resources/ Quality & Climate	Cecile Rousseaux	Global	The Data-assimilative, Global-ocean ECCO-Darwin Biogeochemistry Model	ECCO Consortium; Columbia University (POC: Galen McKinley); California Institute of Technology (POC: Jess Adkins)	Global-ocean biogeochemistry model	ARL 6; 7
Jessica Turner (VIMS) Marjorie Friedrichs (VIMS) Carl Friedrichs (VIMS)	Water Resources/ Quality	Robert Frouin; Emmanuel Boss	Chesapeake Bay	Water clarity and particle size from hyperspectral remote sensing reflectance	Chesapeake Bay Program Modeling Work Group; Chesapeake Bay Program Scientific, Technical Assessment and Reporting Work Group;	Water clarity & particle size indicator and tracking tool	ARL 4; 7
					Virginia Shellfish Aquaculture Industry Advisory Committee		
Hunter Erickson (Hyphae) Jeff Lloyd (Hyphae)	Water Resources/Quality	Nima Pahlevan;	Not Specified	Planetary Management for Everyone- Hyphae Internet of Nature AI	TBD	Info. dissemination mobile app. for ocean health	ARL 4; 8
Michael Ondrusek (NOAA) Charles Kovach (NOAA)	Water Quality	Mike Sayers	Chesapeake Bay	Development and assessment of hyperspectral ocean color products for PACE	Maryland DNR; NOAA CoastWatch; NASA OBPG	TSM concentration & quantification in inland/coastal waters	ARL 3; 6

Science Team meeting is OFFICIALLY postponed

- June wi t be a good time for
  - Pra
- But we are not cancelled yet
  - there are no fe cellation
- If so, w aybe until Fall/Winter
  - I like e Thanksgiving. ts, hotels, etc…

15-20 min Recorded Presentation on Research

- **Due by May 19 (two weeks before meeting)**
- Introduction of team (pictures good)
- Project objectives
- Deliverables
- Methods: fieldwork, synthetic and ancillary datasets
- Performance metrics (See Following)
- Validation plan and/or needs
  - Needs that can and cannot be met presently
- **Anything you want to share in terms of collaborations, assistance, field requests, etc…**

This will NOT go public to PACE website. This is meant for us to work together.

UPLOAD TO: https://pacesat.marinesciences.uconn.edu/presentations/

(currently in draft, but will be live hopefully in a week or so).

Will send email update when it is finished.

- Recorded presentation Instructions: https://www.dummies.com/software/microsoft-office/powerpoint/how-to-record-narration-for-a-powerpoint-presentation/
- Or other formats possible too.

Performance Metrics (please mention in talk)

- Which performance metrics do you plan to use to evaluate your algorithms?
- What is the acceptable range of value expected for your product and what is this based on (e.g., theory, measurements, literature)?
- What is the spatial domain of applicability (e.g., global, regional)?
- How do you plan to assess your spatial domain (with a predefined mask, with a thresholding technique based on another parameter, etc…)?
- What conditions do you anticipate will have the highest uncertainty in retrievals for your algorithm? (spatial, temporal, environmental conditions, etc…)?

e.g., Seegers et al. (2018)

Table 2. Statistical output comparing algorithm performance of the SeaWIFS-to-*in situ* *Chl* validation data set. The highlights indicate which algorithm best performed for each statistical comparison. If results were within 0.02 of best performing they were highlighted simply to emphasize similarly performing algorithms. It is possible to compare suggested approach on the left in addition to r^2 and regression slop on the right.

		Suggested Metrics				Other	
Water Type Algorithm	**n**	**bias**	**MAE** Accuracy	**Overall Wins (%)**	**CV**	**r^2**	**slope**
Across All							
GSM	2037	0.79	1.76	41.4	0.59	0.78	0.99
OC3	2161	1.03	1.63	49.5	0.55	0.84	0.90
OCI	2161	1.03	1.61	53.8	0.45	0.85	0.90

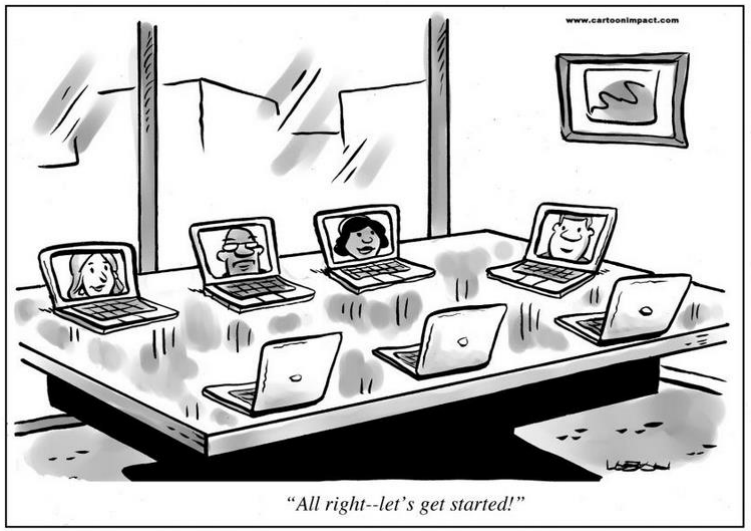
e.g., Performance metrics (Morley et al. 2018)

Table 1
A Summary of Key Metrics

Metric	Definition	Symmetry	Scale/Order dependent	Comments
		Error metrics		
ϵ	$y - x$	Y	Scale	Forecast error
Q	y/x	N	Order	Ratio; complement of forecast relative error
		Accuracy metrics		
MSE	$\left(\frac{1}{n}\sum_{i=1}^{n}\epsilon_i^2\right)$	Y	Scale	Different units/scale; quadratic penalty
RMSE	$\sqrt{\left(\frac{1}{n}\sum_{i=1}^{n}\epsilon_i^2\right)}$	Y	Scale	Same units as x, y; quadratic penalty
MAE	$\frac{1}{n}\sum_{i=1}^{n}\lvert\epsilon_i\rvert$	Y	Scale	Same units as x, y; linear penalty
MdAE	$M\lvert\epsilon_i\rvert$	Y	Scale	Same units as x, y; linear penalty; robust and resistant
MAPE	$\frac{100}{n}\sum_{i=1}^{n}\left\lvert\frac{\epsilon_i}{x_i}\right\rvert$	N	Order	Percentage; penalizes overprediction more heavily
sMAPE	$100\,\frac{1}{n}\sum_{i=1}^{n}\left\lvert\frac{y_i - x_i}{(x_i+y_i)/2}\right\rvert$	Y	Order	Percentage; unintuitive normalization; handles $x = 0$
ζ	$100\left(e^{(M(\lvert\log_e(Q_i)\rvert))} - 1\right)$	Y	Order	Percentage; robust and resistant
		Bias metrics		
ME	$\frac{1}{n}\sum_{i=1}^{n}\epsilon_i$	Y	Scale	Same units as x, y
MPE	$\frac{100}{n}\sum_{i=1}^{n}\frac{\epsilon_i}{x_i}$	N	Order	Percentage; penalizes overprediction more heavily
MdLQ	$M\log_e(Q_i)$	Y	Order	Different scale
SSPB	$100\ \mathrm{sgn}(\mathrm{MdLQ})\ (e^{(\lvert\mathrm{MdLQ}\rvert)} - 1)$	Y	Order	Percentage; robust and resistant

Note. The columns give, in order, the abbreviation or symbol of the metric (as used in the text), the definition, whether the penalty is symmetric, whether the metric is scale or order dependent, and selected attributes.

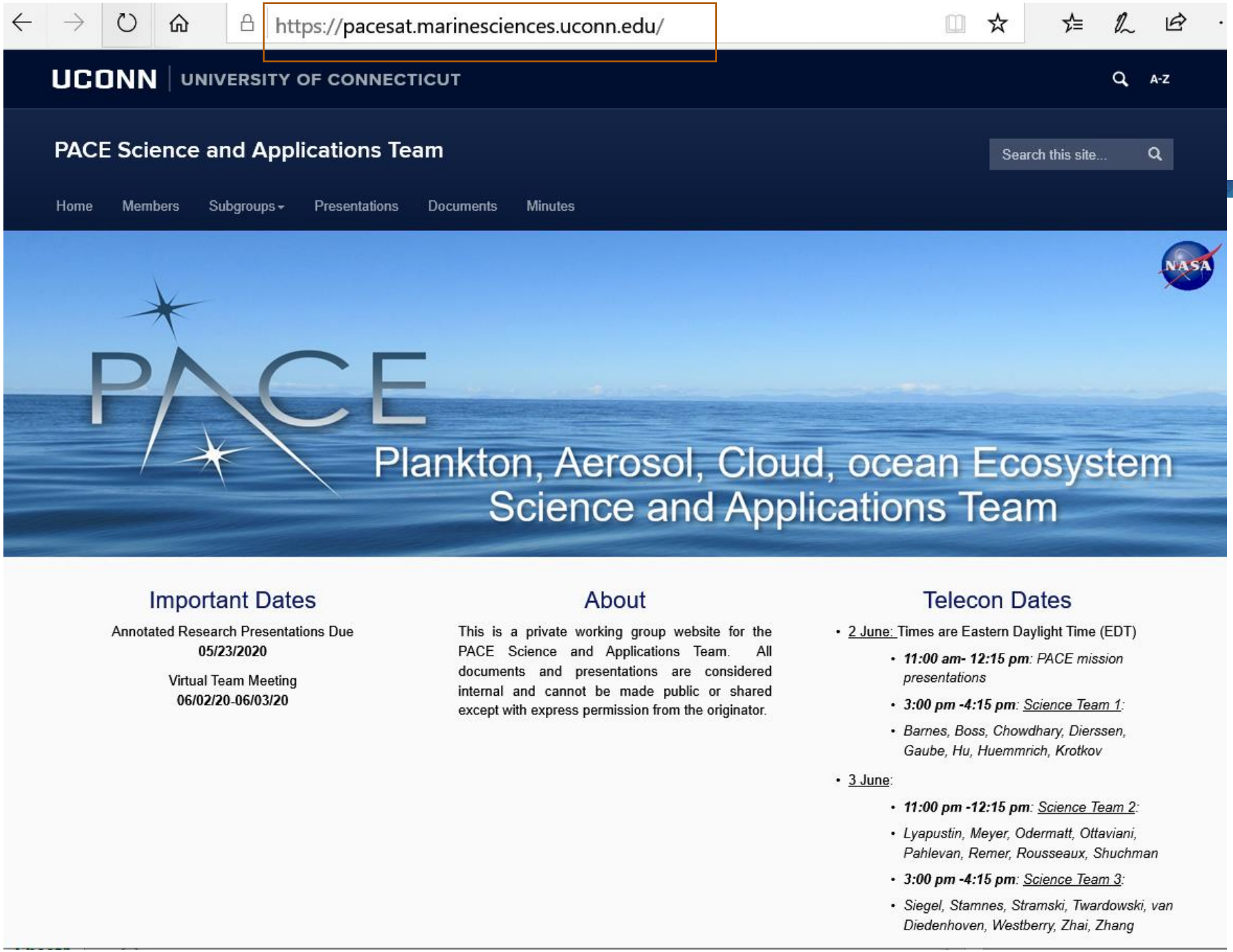
Virtual Meeting in June 2020



- 19 May -2 June: View talks of your fellow team members to prepare
- 31 May: *Send me your **1 page slide** to collate or I will make one for you!*
- 2 June:
  - *11:00 am- 12:15 pm: PACE mission presentations (NASA GSFC, section leads, TBD)*
  - *3:00 pm -4:15 pm: Science Team 1: 5 min. introductory slides from each Team*
    - *Barnes, Boss, Chowdhary, Dierssen, Gaube, Hu, Huemmrich, Krotkov*
- 3 June:
  - *11:00 pm -12:15 pm: Science Team 2: 5 min. introductory slides from each Team*
    - *Lyapustin, Meyer, Odermatt, Ottaviani, Pahlevan, Remer, Rousseaux, Shuchman*
  - *3:00 pm -4:15 pm: Science Team 3: 5 min. introductory slides from each Team*
    - *Siegel, Stamnes, Stramski, Twardowski, van Diedenhoven, Westberry, Zhai, Zhang*

Please let me know if you have a scheduling or other conflict!

The compilation of 1 page slides will go public to PACE website



- Website is almost ready

First Light: HARP Cubesat Data

- On the International Space Station, link on the PACE website. Tech demonstration mission.
- This may be useful for the TEAM as synthetic data for PACE
- Update in a future telecon by Vanderlei

Subgroups

Dividing by Topics for Collaboration

And Consensus Building

1. Whole Group Input
   - Uncertainties/Metrics
     - LEADS: Amir Ibrahim & Andy Sayer
   - Validation Needs and Approaches
     - LEAD: Heidi Dierssen
   - Nomenclature
     - LEAD: Aquatic (Frouin IOCCG)
       - Atmospheric (TBD)

2. Subgroups
   - Polarimetry
   - Ultraviolet
   - Phytoplankton Characterization
   - Synthetic Datasets
   - Bright Target Differentiation
   - Inverse Modelig

Uncertainties Working Group

- LEADS: Amir Ibrahim: amir.ibrahim@nasa.gov
- Andy Sayer: andrew.sayer@nasa.gov
  - PACE is committed to pixel estimates of uncertainties for all geophysical products
  - System-level indicates end-to-end (full system) uncertainties
  - Keep uncertainties in mind when proceeding with your algorithm/method development
  - More interaction from leads and guidance will be forthcoming
  - Proposing a strawman report be produced for your feedback.

  - **Will have some invited presentations on this topic on telecon after June meeting.**

Polarimetry Working Group

- LEAD: Kirk Knobespiesse kirk.d.knobelspiesse@nasa.gov
- First monthly meeting:
  - Tuesday, May 5, 2020 9:30 AM – 10:30 AM, EDT
- Please let him know if you want to be added to the mailing list.

1. SPEXone instrument team
2. HARP2 instrument team
3. SAT PI Chowdhary
4. SAT PI Stamnes
5. SAT PI van Diedenhoven
6. SAT PI Ottaviani
7. SAT PI Twardowski
8. SAT PI Zhai
9. project science MAPOL algorithm (Gao)

Ultraviolet Working Group

- Lead: Lorraine Remer
- Potential Members:
  - Chowdhary
  - Krotkov
  - Stamnes
  - Stramski
  - Twardowski
  - Zhai
  - Zhang

- laremer@hotmail.com

Phytoplankton Characterization

- Lead: Cecile Rousseaux
  - cecile.s.rousseaux@nasa.gov

Pontential Members:

- Allison Chase
- Peter Gaube
- Nima Pahlevan
- Dave Siegel
- Mike Sayer
- Bob Shuchman
- Toby Westberry

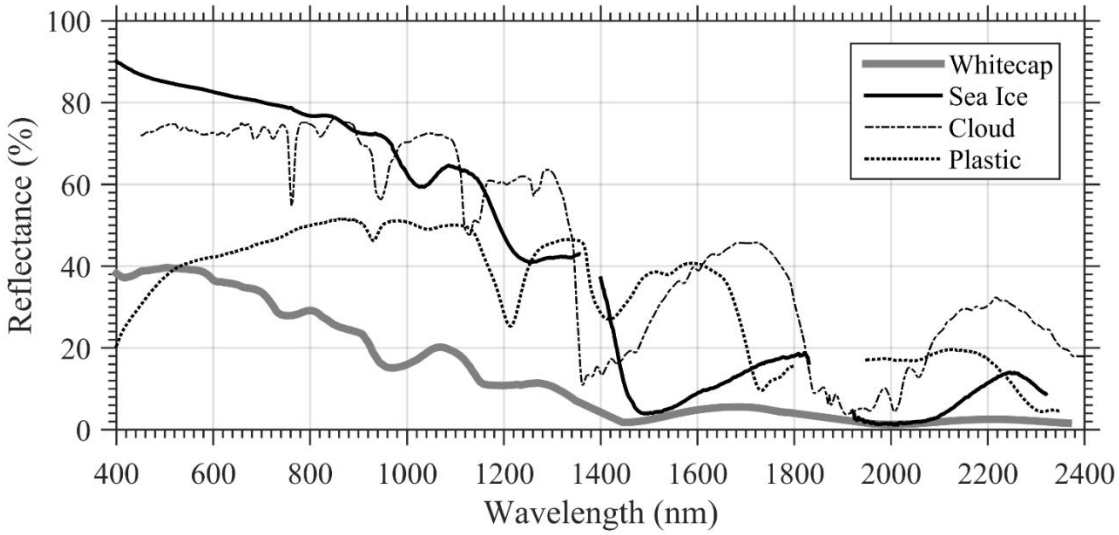
Synthetic Datasets

Lead	Jacek	Chowdharry	jacek.chowdhary@nasa.gov
	Pengwang	Zhai	PACE similuator TOA reflectance
Members		Gaube	MLD from data assimilating models and tracer advection from models/observations
		Hu	To be developed by the PACE SAT
		Ottaviani	HARP2 (and SPEXone) simulated radiances for PACE, possibly merged; aerosol retrievals from HARP2 and SPEXone for the same pixels
		Siegel	Maybe; Not sure – depends what's available
		Stamnes	IOCCG 2006/PACE 2019 in situ+synthetic dataset
		Stramski	Radiative transfer datasets developed at LOG (see Loisel et al. 2018); other sources of synthetic datasets will be explored
		Twardowski	Twardowski and Tonizzo (2018)
		van Diedenhoven	We will generate simulated data of HARP-2 and SPEXone measurements based on LES cloud fileds using 1-D and 3-D radiative transfer
		Westberry	radiative transfer simulations from HydroLight

Bright Pixel: Flag and Atmospheric Correction

Lead Heidi Dierssen
Heidi.Dierssen@uconn.edu

Cloud	Meyer
	Stamnes
	van Diedenhoven
Seafloor	Barnes
Floating Vegetation	Hu
Algal Scum	Shuchman
	Pahlevan
Land	Lyapustin
	Huemmrich
Whitecap	Dierssen
Sea Ice	Dierssen



Inverse Modeling

- **LEAD:** Dariusz Stramski and Rick Reynolds
- dstramski@ucsd.edu

- Members: Please let Dariusz know if this is of interest to you.

- Inverse models whose goal is to estimate the total and constituent IOPs from reflectance (and, perhaps, in the future also using the polarization properties of water-leaving light).
- Other types of inverse models?

To Do

- Construct and upload your Research Presentation
  - Due 19 May 2020
  - May eventually become public but you can modify
  - pacesat.marinesciences.uconn.edu/presentations
  - This will be **private** to SAT team.
- Send in your 1-slide to Heidi Dierssen by 31 May 2020
  - This will go **public**