PACE SAT Meeting

1:00 -1:15 Project Update and Points of Information (Werdell, Dierssen)

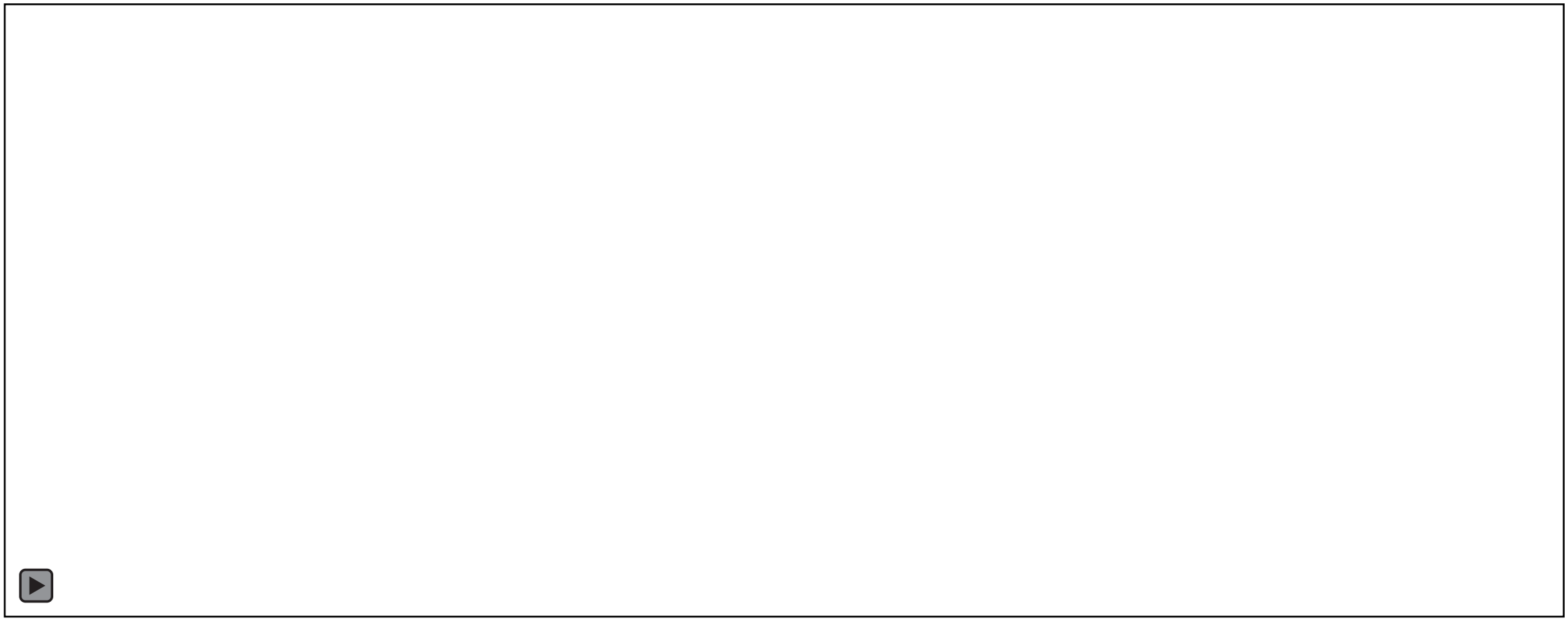
1:15-1:30 Questions and interactions

1:30-1:50 Dirk Aurin,

2:00-2:20 Liane Guild, C-HARRIER

1. Second Meeting Logistics

- Mystic CT and University of Connecticut
- Proposed HYBRID/IN PERSON & ONLINE
- **6-8 October 2021. Wed.-Fri.**



Invited

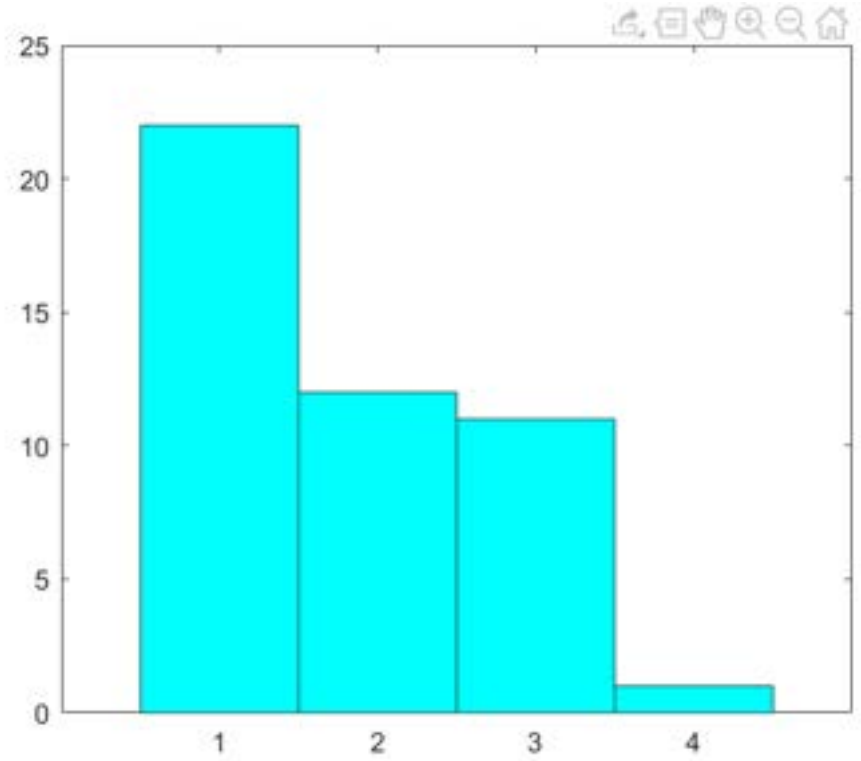
- Anyone from your team working on PACE is invited to attend
  - Postdocs, grad students, collaborators

- Each Team
  - Upload 15 min. prerecorded talks 2 weeks ahead of time
  - Each team will present a 1-slide overview during meeting

Survey

- 48 Responses – THANK YOU!

1. My institution allows me to travel for work and I plan to attend all/part of the meeting
2. My institution does not yet allow travel, but I hope to get permission and attend all/part of the meeting.
3. I cannot attend the meeting in person, but hope to have a real-time virtual presence
4. I cannot attend the meeting in person, but will watch a recording of the meeting



DRAFT Agenda for PACE Meeting

Day 1

Morning Session

9:00-9:30 am Welcome and Introductions and Logistics

9:30-10:30 am Science SAT intro 5 min talks each (9)

10:30-10:50 am Coffee Break

10:50-12:30 am Science SAT intro 5 min talks each (13)

12:30-1:45 pm LUNCH Branford House

Afternoon Session

1:45-2:15 pm Mission science & science team updates (Laura, Jeremy)

2:15-2:45 pm Mission progress & next steps updates (Andre' Dress, Gary Davis; 15 min each))

2:45-3:00 pm OCI update (Eric Gorman)

3:00-3:15 pm Coffee Break

3:15-3:45 pm Polarimeter updates (Vanderlei Martins, Otto Hasekamp; 15 min each)

3:45-4:30 pm Cal/Val Talks: MarONet (Ken Voss), HyperNAV (Andrew Barnard) (~20 min each)

4:30-5:15 pm Open Discussion Time

5:15-8:00 pm Happy Hour Mixer and Dinner at Branford House.

Day 2

Morning Session

9:00-9:45 am Applications Overview: Erin Urquhart Jephson
3 Case Studies to inspire from each discipline (recorded or in person)

9:45-10:30 am SEABASS Overview, SeaDAS Overview, etc…

10:30-10:45 am Coffee Break

10:45-11:30 am Subgroup Summaries -- 1: Uncertainties (Ibrahim & Sayer), 2: Polarimetry (Knobelspiesse)

11:30-12:30 am Breakout Group 1: Validation Disciplinary Working Groups. Campaigns, Data Archiving, Needs, Concerns, Instrumentation, etc..

12:30-1:45 pm LUNCH Branford House

Afternoon Session

1:45-3:00 pm Subgroup Summaries -- 3: Cloud (Cairnes), 4: Ultraviolet (Remer), 5: IOP Data (Stramski)

3:00-3:15 pm Coffee Break

3:15-4:30 pm Breakout Group 2: Gaps Analysis. Overview previously identified gap analysis, progress made, and new gaps

4:30-5:00 pm Discussion of Breakout Groups and Summaries.

7:00 pm *Catered Dinner in Mystic (Likely Mystic Seaport Latitude 41).*

Day 3

Morning Session

9:00-10:30 am PACE Data: Distribution SeaDAS (Franz), Level 1C Merged (Knobelspiesse), Aeronet (?), Other?

10:30-10:50 am Coffee Break

10:50-11:30 am Breakout Group 3: Public Relations (Brainstorm Ideas on How to get the word out about mission science, applications, and communication outside our science world)

11:30-12:30 am General Discussion and Summaries of Where we are and Where we are going

12:30 pm Meeting Adjourns – Gourmet Box Lunch Provided on Lawn or To Go.

More emails regarding logistics and registration coming up this month!

- Working with UCONN Conference Services
- Registration Fee will be charged
  - Cover Lunches and Dinners, Coffee breaks
  - Meeting space, audiovisual, etc…
- Lodging will be your own responsibility
  - We are negotiating group rate at a few select hotels.
  - Reserve early if possible.
  - Please get hotel in MYSTIC and not ~~GROTON~~ or ~~NEW LONDON~~
- We will setup transportation vans to/from Mystic to campus
  - Parking permits for those who want to drive together
- We will setup a carpool link for you to connect together

Special Sessions for AGU December in New Orleans, due SOON!!! August 4, 2021

- Session ID: 122207
  A003. Advanced remote sensing in preparation for NASA's PACE mission
  Section: Atmospheric Sciences
  Conveners: Lorraine Remer (UMBC) and Brian Cairns (NASA GISS)

- The NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission will extend key heritage ocean color, cloud, and aerosol data records and enable new insight into oceanographic and atmospheric responses to Earth's changing climate. PACE's primary instrument is a global-coverage spectrometer that spans the ultraviolet to near-infrared region. PACE's spectrometer will be complemented by two cubesat-sized multi-angle hyperspectral and hyper-angular polarimeters making measurements which will significantly improve aerosol and hydrosol characterizations, provide opportunities for novel ocean color atmospheric correction, and offer unique space-borne cloud observations. The goal of this session is to showcase new and improved remote sensing techniques that make use of the type of multi-angle, hyperspectral and polarimetric observations provided by PACE, together with applications that are facilitated by these enhanced remote sensing capabilities.

Some other AGU 2021 sessions as well…

- "B006: Advances in remote sensing for monitoring biodiversity change: Integrating data and models across scales and technologies."
  - Mostly terrestrial talks, but I'm giving keynote invited to highlight our work on biodiversity. So please send me any papers or updates from your research you want me highlight.
  - Led by Ved Chirayath, NASA Ames.

- GC012 - Advancing Global Imaging Spectroscopy and Thermal Infrared Measurements
  - Likely Jeremy will submit overview to this one led by David Thompson at JPL

Many Special Sessions proposed for Ocean Sciences Hawaii in February 2022

- Stay TUNED…

- Several PACE Related Sessions proposed.

- Proposed Hyperspectral Townhall linked to PACE, SBG, GLIMR

Next PACE SAT meeting **moved to 27 August**

- Unfortunately (or fortunately), I am going to be on vacation 20 August, 2021. Hoping to push the meeting 1 week to 27 August.

In documents on the PACE website

frontiers in Environmental Science

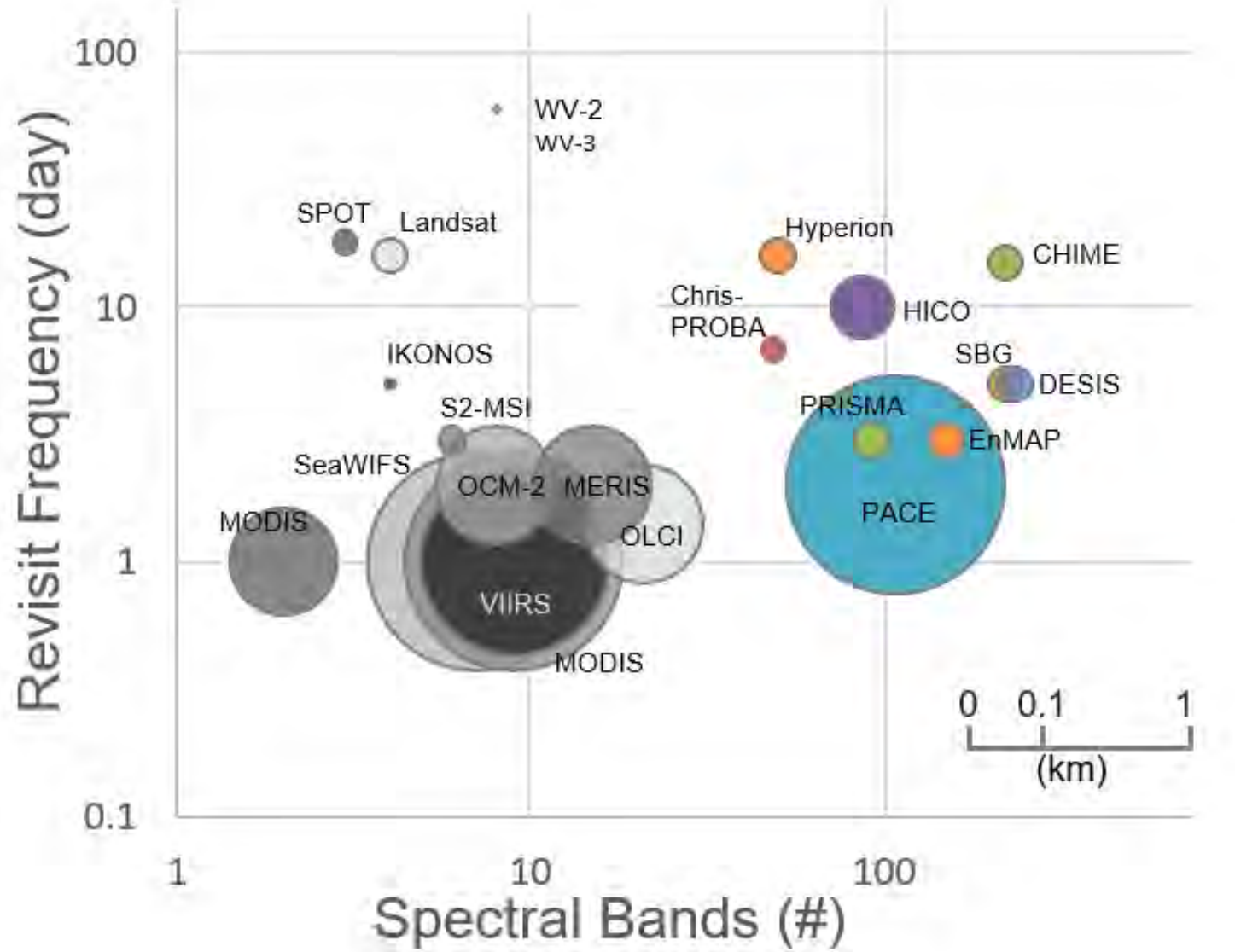
REVIEW
published: 07 June 2021
doi: 10.3389/fenvs.2021.649528

Check for updates

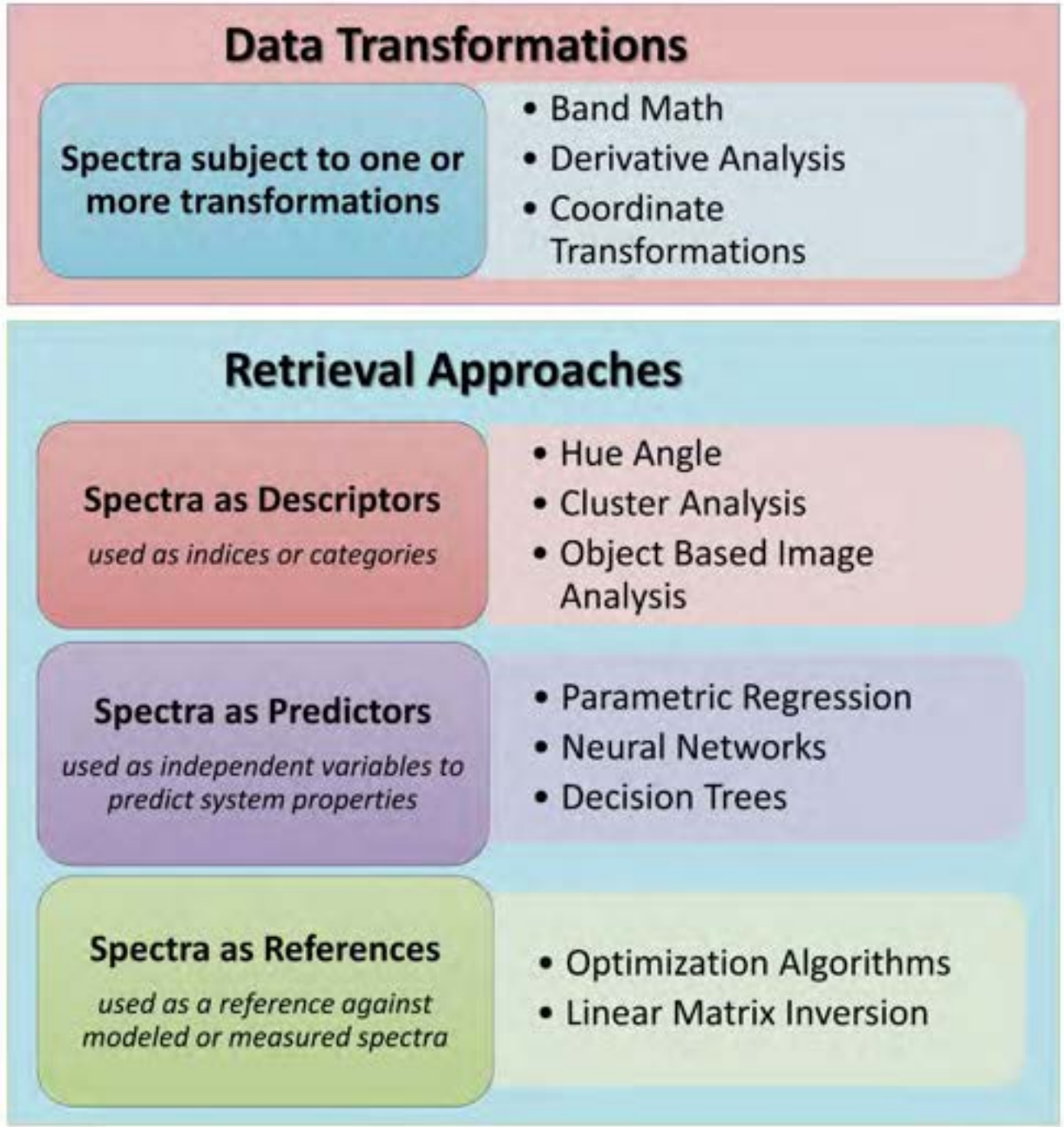
Living up to the Hype of Hyperspectral Aquatic Remote Sensing: Science, Resources and Outlook

Heidi M. Dierssen[1], Steven G. Ackleson[2], Karen E. Joyce[3], Erin L. Hestir[4], Alexandre Castagna[5], Samantha Lavender[6] and Margaret A. McManus[7]*

[1]Department of Marine Sciences, University of Connecticut, Groton, CT, United States, [2]Naval Research Laboratory, Washington, DC, United States, [3]College of Science and Engineering / TropWATER, James Cook University Nguma-bada Campus, Cairns, QLD, Australia, [4]Civil & Environmental Engineering, University of California Merced, Merced, CA, United States, [5]Protistology and Aquatic Ecology, Ghent University, Ghent, Belgium, [6]Pixalytics Ltd., Plymouth, United Kingdom, [7]Department of Oceanography, University of Hawai'i at Mānoa, Honolulu, HI, United States



Dierssen et al. 2021


Data Transformations
Spectra subject to one or more transformations
• Band Math
• Derivative Analysis
• Coordinate Transformations
Retrieval Approaches
Spectra as Descriptors
used as indices or categories
• Hue Angle
• Cluster Analysis
• Object Based Image Analysis
Spectra as Predictors
used as independent variables to predict system properties
• Parametric Regression
• Neural Networks
• Decision Trees
Spectra as References
used as a reference against modeled or measured spectra
• Optimization Algorithms
• Linear Matrix Inversion

Class	Essential Biodiversity Variable (EBV)	Wetlands	Benthic communities		Pelagic		
		Mangrove/ Salt marsh	Macro-phytes & Macroalgae	Coral	Phyto-plankton	Fish, Zoo-plankton	Apex Predator
Genetic Composition	Population genetic diversity						
Species Populations	Distribution						
	Abundance						
	Size/vertical distribution					**	
Species Traits	Pigments*					NA	NA
	Phenology						
Community Composition	Taxonomic diversity*						
Ecosystem Structure	Functional type*						
	Fragmentation/ heterogeneity						
Ecosystem Function	Net primary production					NA	NA
	Net ecosystem production					NA	NA

*Select types may be differentiated.

** using lidar techniques

Routine	Demon-strated	Unproven	Ecosystem Model

TABLE 1 | Recent reviews including hyperspectral aquatic remote sensing.

Primary author (# Coauthors)	Title	Publisher	Year	Subjects covered (relevant to hyperspectral)
Gege and Dekker (2020) (1)	Spectral and radiometric measurement requirements for inland, coastal and reef waters	Rem. Sens.	2020	Sensitivity study of measurement needs for inland and coastal waters
Kutser, et				
Dierssen				
Banks et				
Jezierska				
Wu et al.				

TABLE 2 | Software available for hyperspectral data processing.

Name	Website and Description	Interface	Publication
Free			
ASFit	https://github.com/darioomanovic/ASFit An all-inclusive tool for analysis of UV–Visible spectra of colored dissolved organic matter (CDOM)	Standalone (GUI)	Omanovic et al. (2019)
EnMAP-Bo			
Hytatis			
HyTools			
Hyperspec			
Toolbox (H			
Multi Endm			
Mixture An			
R package			
stars and			

TABLE 3 | Atmospheric correction approaches for aquatic applications.

Name	Website	Citations
ACOLITE	Standalone multi-spectral imagery but with prototype support for hyperspectral sensors https://github.com/acolite/acolite	Vanhellemont (2019)
ACORN		
ATREM		
CASIDAS		
COCHISE		
FLAASH		
HATCH		

TABLE 4 | Hyperspectral aquatic optical and biodiversity databases.

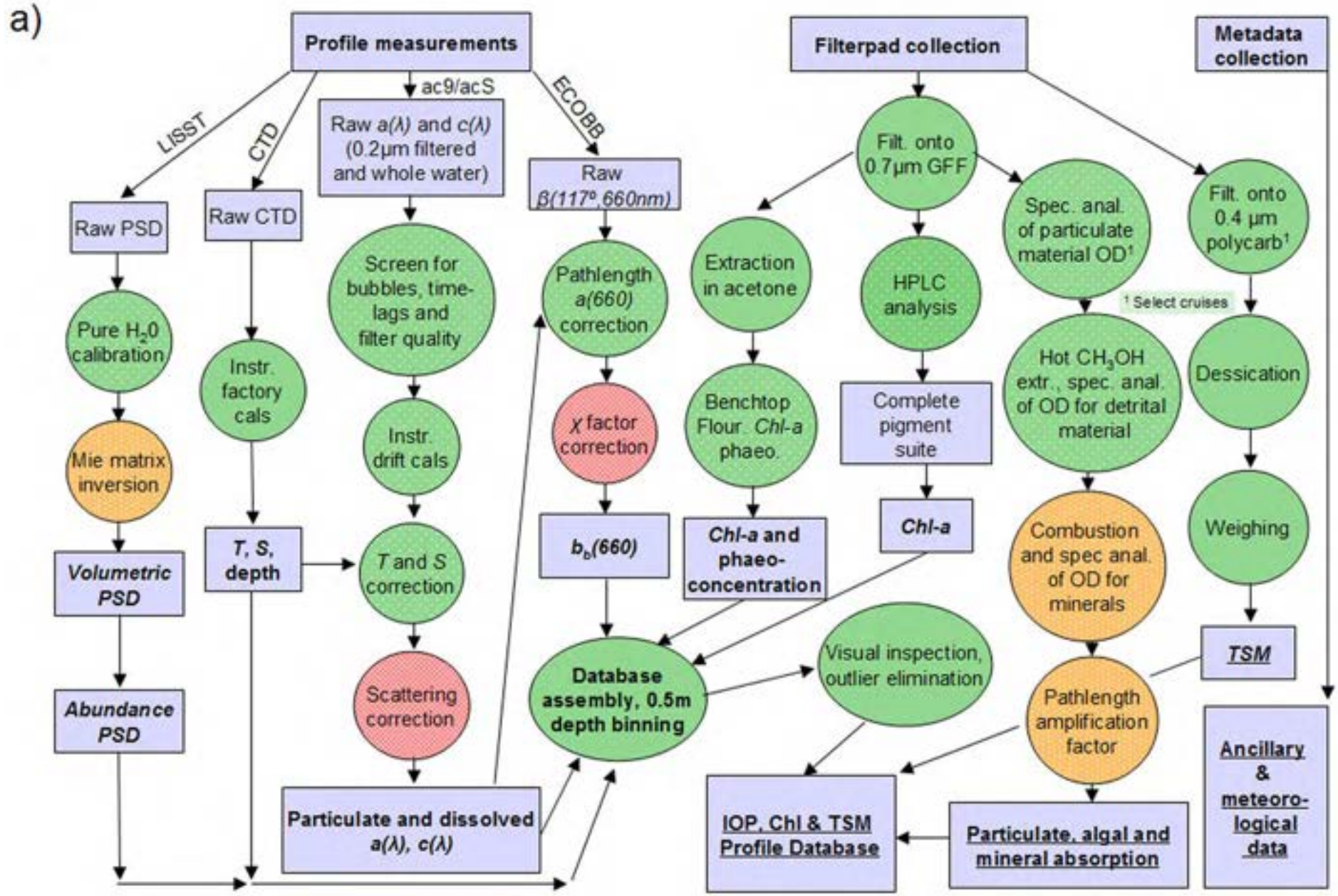
Dataset	Source	Description
Field and culture data		
Casey et al. (2020). Earth System Science Data, 12 (2), 1,123–1,139. https://doi.org/10.5194/essd-12-1123-2020. https://doi.pangaea.de/10.1594/PANGAEA.902230	Field, Global	A global compilation of *in situ* aquatic high spectral resolution inherent and apparent optical property data for remote sensing applications
LIMNADES https://limnades.st		
Carpenter, Diersse Airborne Laborato https://doi.org/10. https://airbornesci		
Knaeps et al. (201 https://doi.org/10.		

TABLE 5 | Relevant outreach programs.

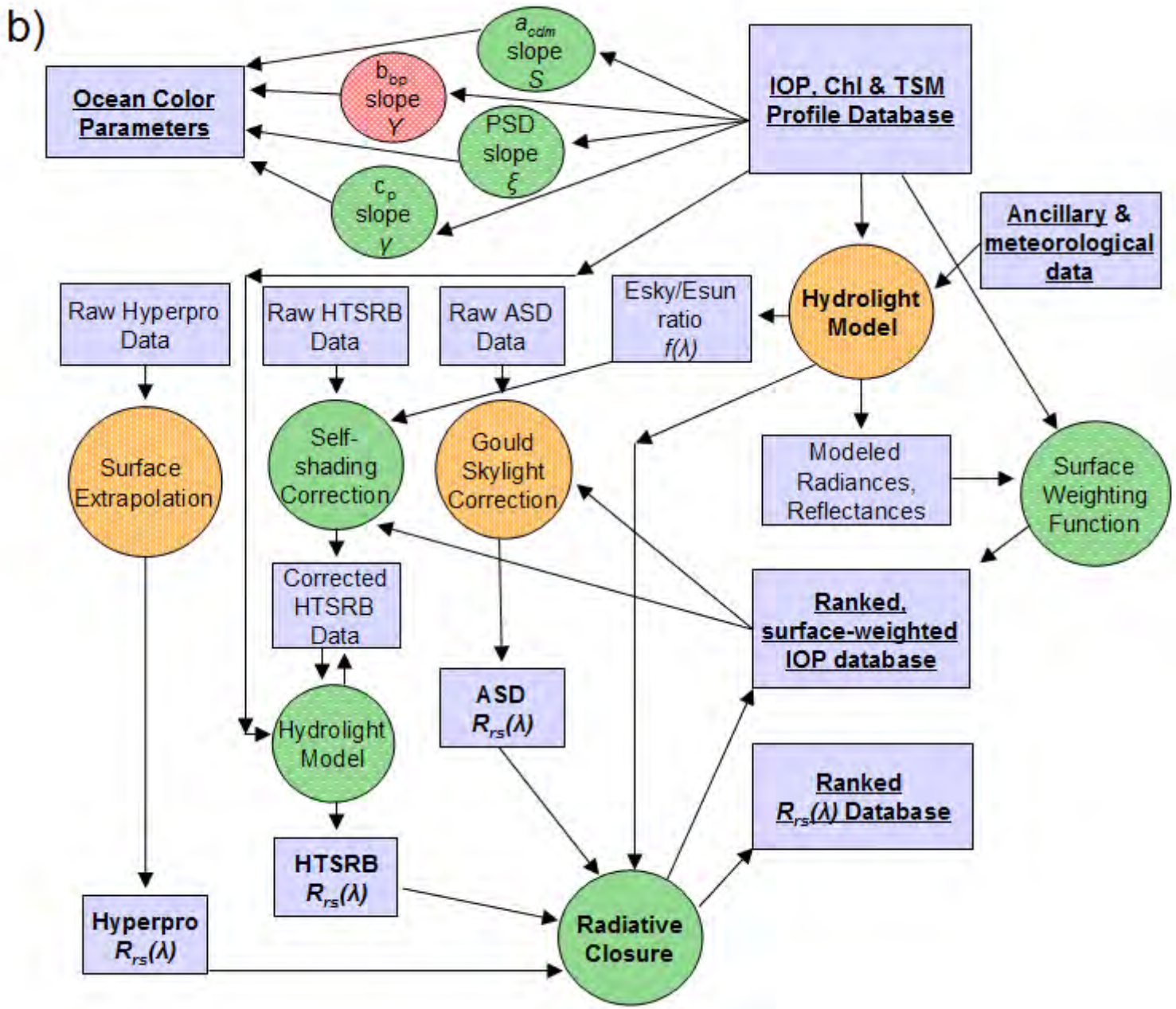
Name	Citation/Link	Description
Geo Aquawatch	https://www.geoaquawatch.org/	Develop and build the global capacity and utility of earth observation-derived water quality data, products and information to support water resources management and decision making
HYPERedu	https://www.enmap.org/events_education/hyperedu	An online learning platform for hyperspectral remote sensing as part of the education initiative within the EnMAP mission
IOCCG	https://ioccg.org/	Promotes the application of remotely sensed ocean color and inland water radiometry data across all aquatic environments, through coordination, training, advocacy and provision of expert advice
PACE Early Adopters	https://pace.oceansciences.org/app_adopters.htm	Promotes applied science and applications research designed to scale and integrate PACE data into policy, business, and management activities that benefit society and inform decision making
Remote Sensing Toolkit	https://www.rsrc.org.au/rstoolkit	Designed for managers to understand how images collected from different satellites and aircraft can be used to map and monitor changes over time

Fig. 7. A host of new applications will be available with better discrimination of pelagic and benthic biodiversity promised by hyperspectral imagery.

Dirk Aurin -- renegade



Aurin et al. 2010


b)
a_{cdm} slope S
b_{bp} slope Y
PSD slope ξ
c_p slope γ
Ocean Color Parameters
IOP, Chl & TSM Profile Database
Ancillary & meteorological data
Hydrolight Model
Esky/Esun ratio $f(\lambda)$
Raw Hyperpro Data
Raw HTSRB Data
Raw ASD Data
Surface Extrapolation
Self-shading Correction
Gould Skylight Correction
Modeled Radiances, Reflectances
Surface Weighting Function
Corrected HTSRB Data
Ranked, surface-weighted IOP database
ASD $R_{rs}(\lambda)$
Hydrolight Model
Ranked $R_{rs}(\lambda)$ Database
HTSRB $R_{rs}(\lambda)$
Hyperpro $R_{rs}(\lambda)$
Radiative Closure

Liane Guild
Research Scientist, NASA Ames Research Center

US Coral Reef Task Force (USCRTF) NASA Designee (since 2003). Member of the St Climate Change Working Group, Educatic Working Group, Watershed Partnership V

Kevin Turpie said, "Get some sun socks!"

NEXT PACE SAT Meeting 27 August, 2021