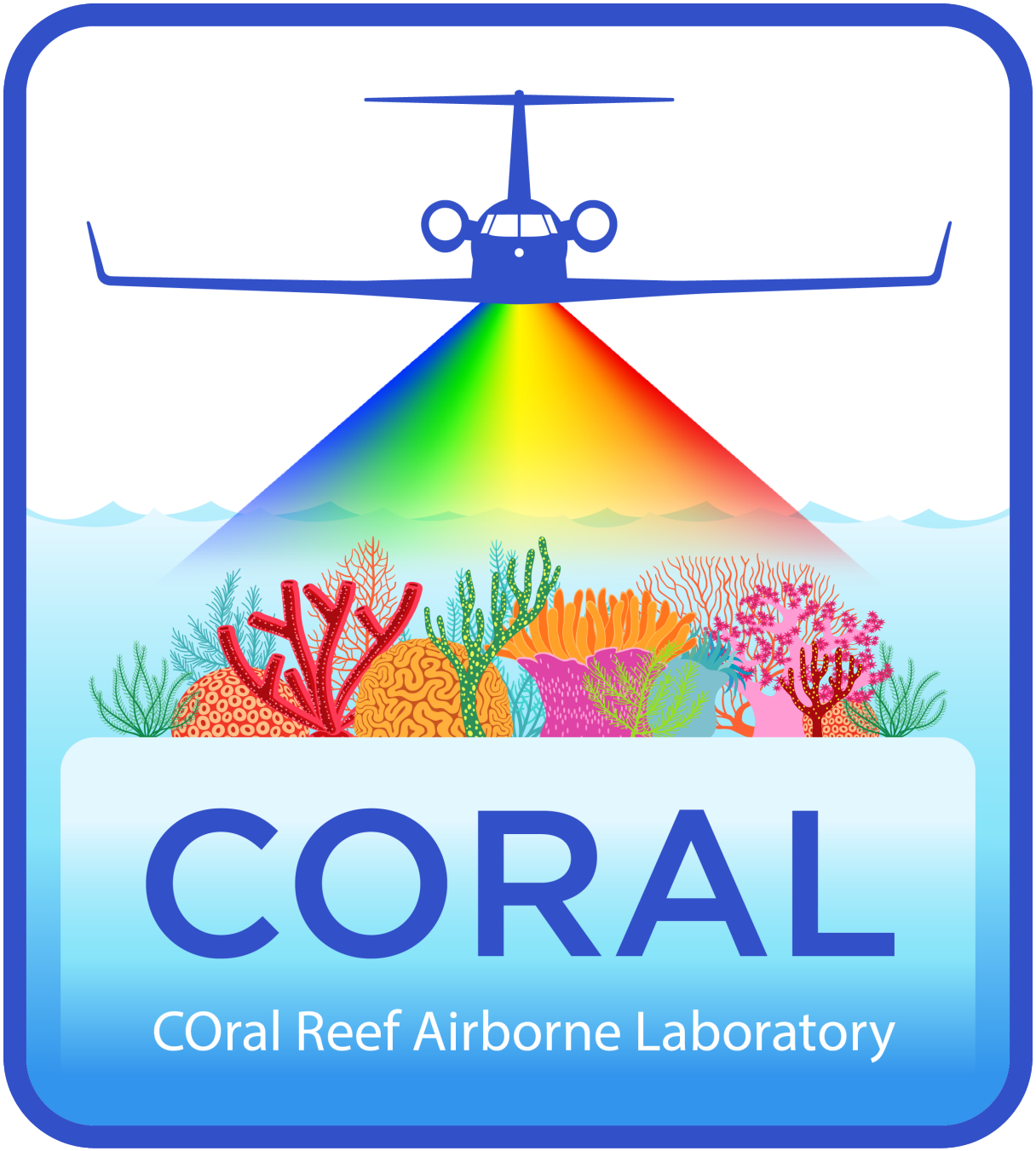
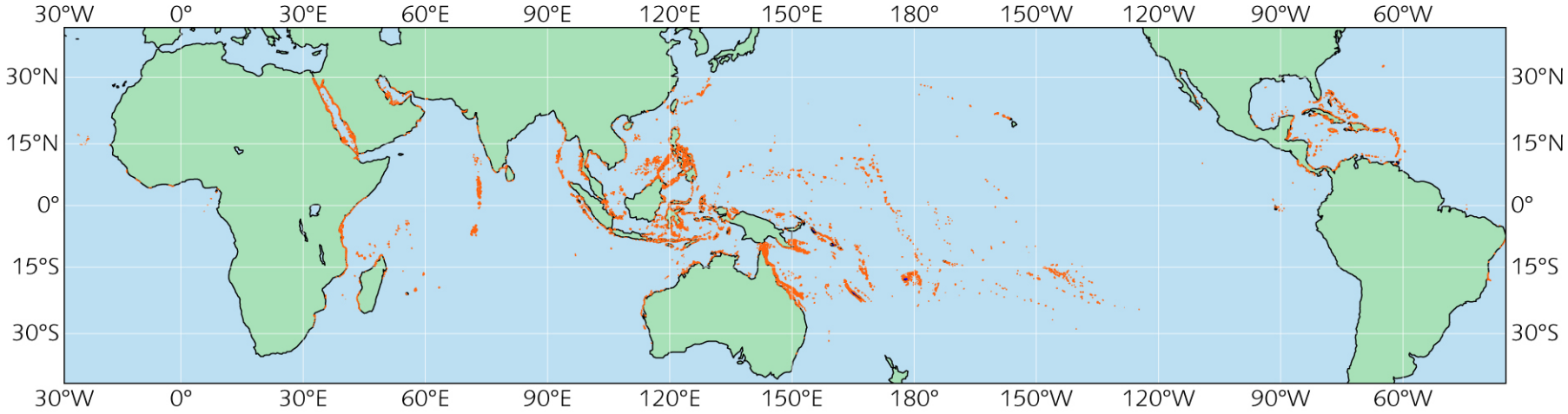


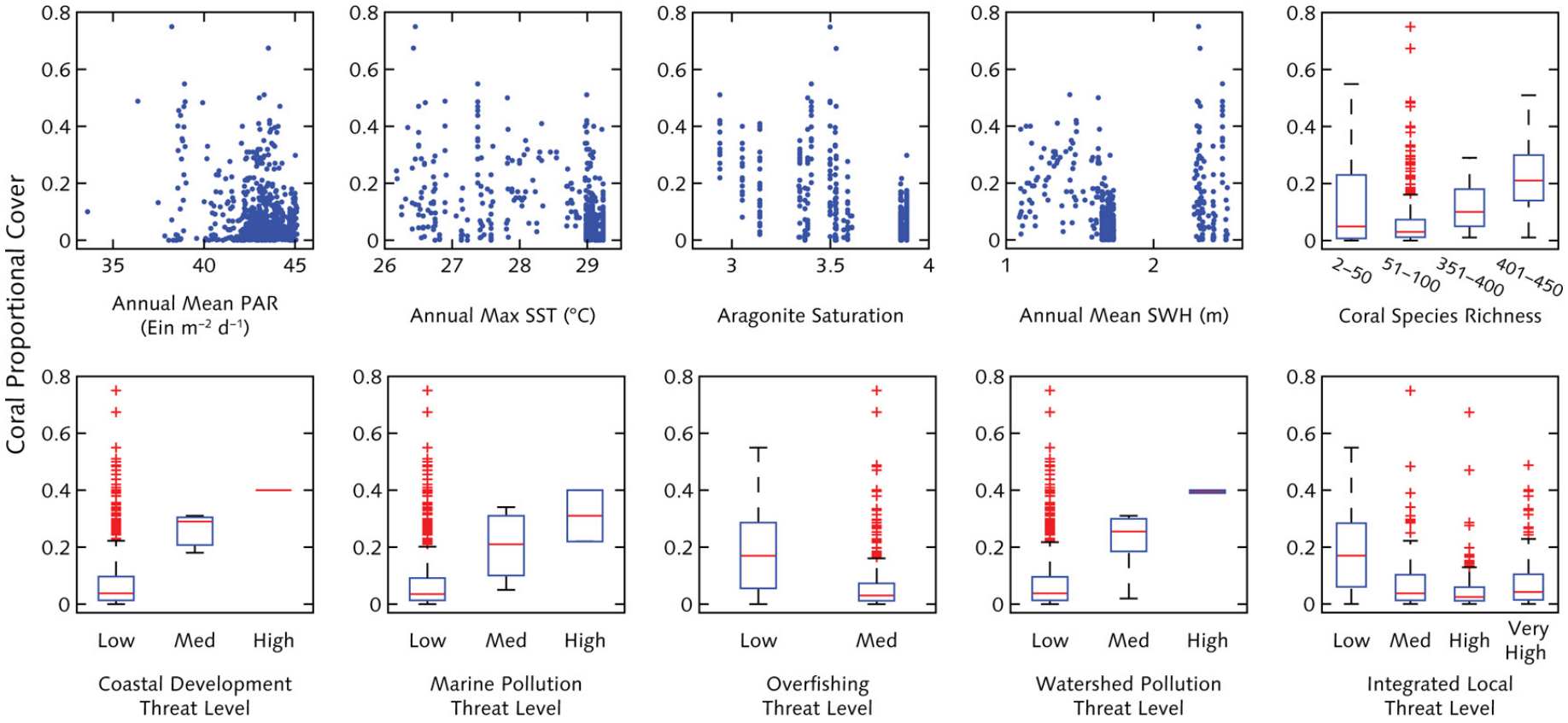
CORAL Status and Preliminary Results

Eric J. Hochberg
Bermuda Institute of Ocean Sciences



- 9,000 reef systems in the world
- 500,000 km^2 total area
- Spread across 200,000,000 km^2 of ocean
- Quantitative in situ surveys of 10s to 100s km^2 worldwide
- *Only 0.01–0.1% of world's reef area*

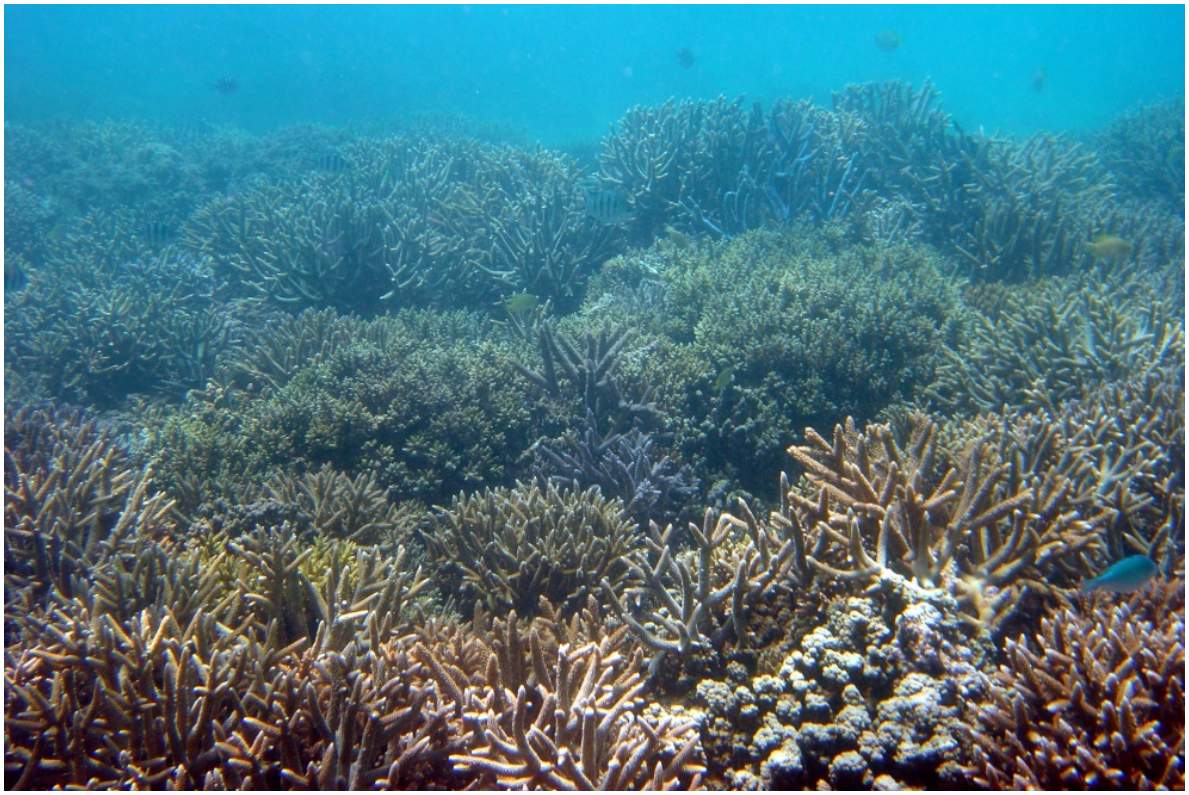
A Potentially Serious Problem



Existing survey data (US Caribbean, Hawaii, Great Barrier Reef) do not follow expected trends with respect to environmental factors. For example, coral cover should increase with aragonite saturation and decrease with marine pollution.

Either our understanding of reefs is incorrect, or our data are inadequate (low density, mismatched scales). Or maybe both.

CORAL
COral Reef Airborne Laboratory



Principal Investigator:
Eric J. Hochberg (BIOS)

Project Scientist:
Michelle Gierach (JPL)

Project Manager:
William Mateer (JPL)

EVS-2 Mission Manager:
Jennifer Olson (LARC)

Program Scientist:
Paula Bontempi (NASA HQ)

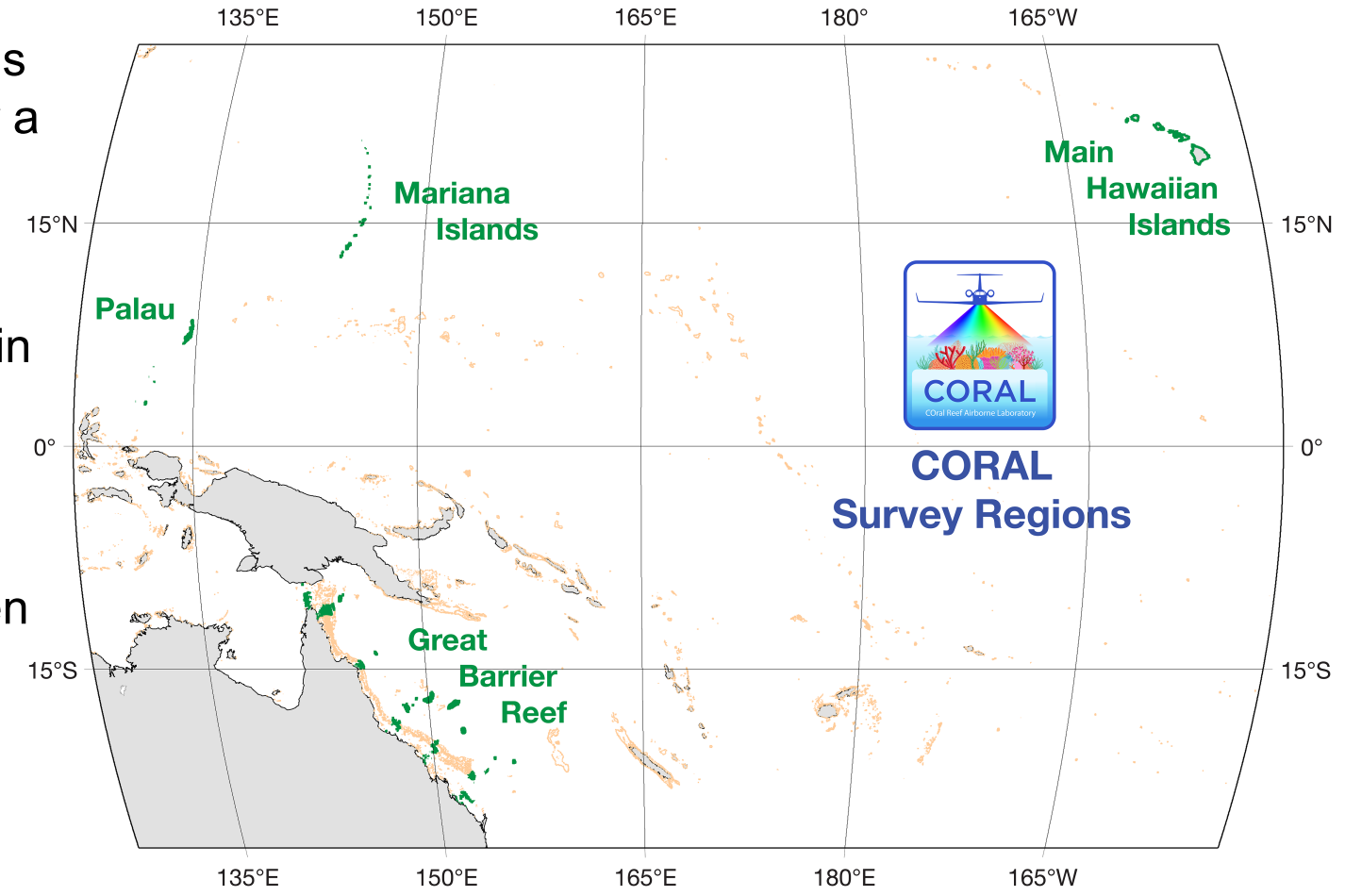
Overarching Science Question

Q1. What is the relationship between coral reef condition and biogeophysical forcing parameters?

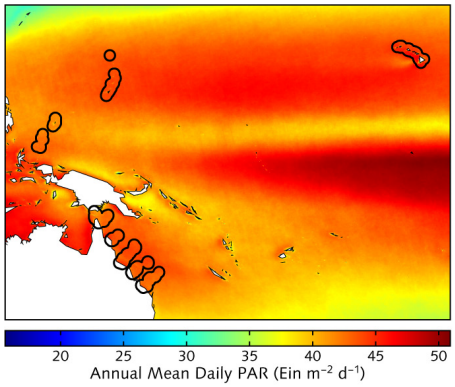
CORAL Science Objectives

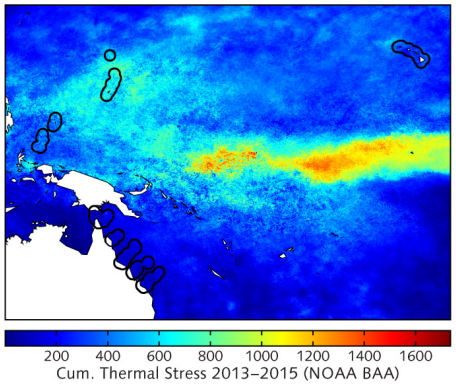
O1. Make high-density observations of reef condition for a large fraction of world's reef area (green in map, 10^3 more than current, in situ observations).

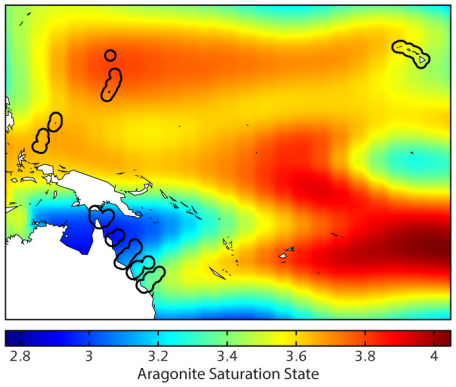
O2. Model relationship between reef condition and biogeophysical forcing parameters.

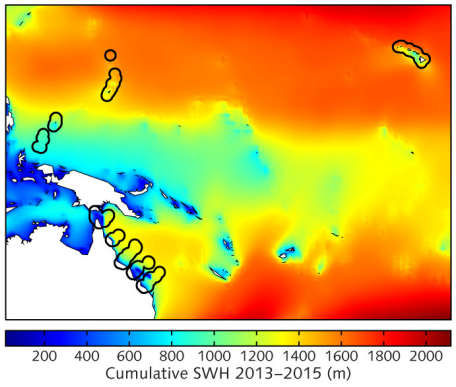


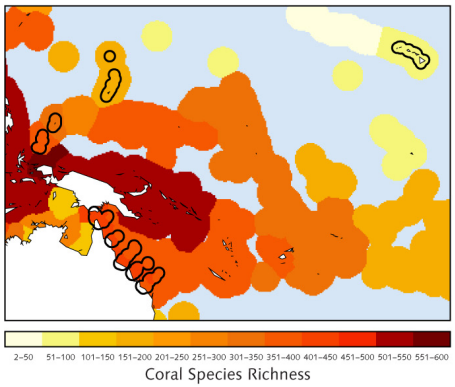
Reef Forcing Parameters

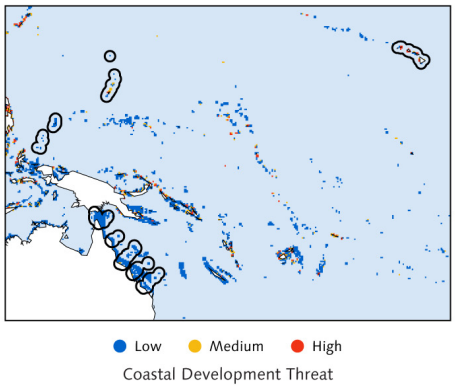


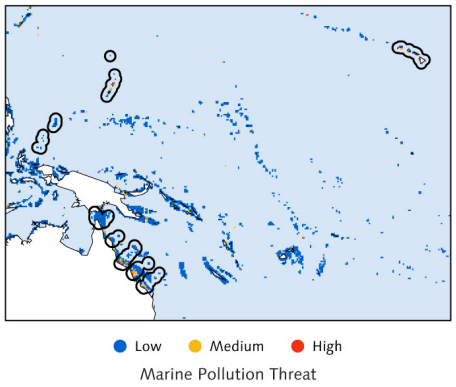


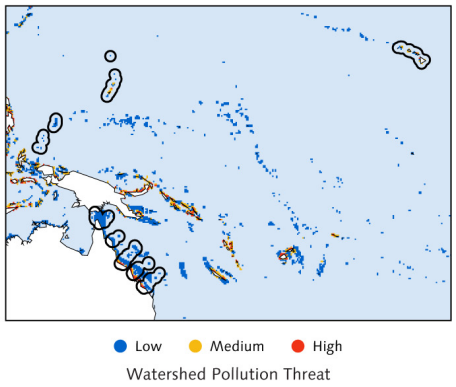




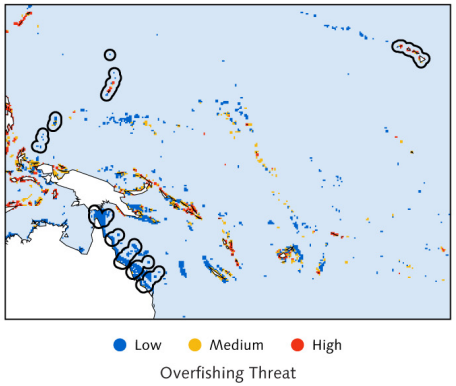


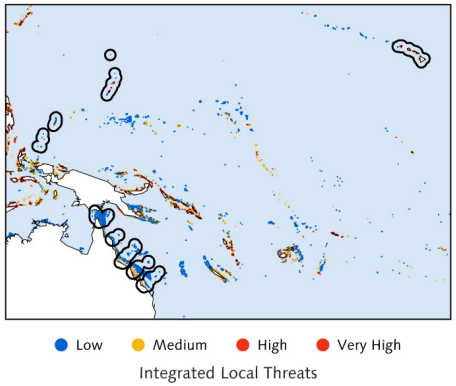






Science study areas selected because they span much of the biogeophysical parameter space

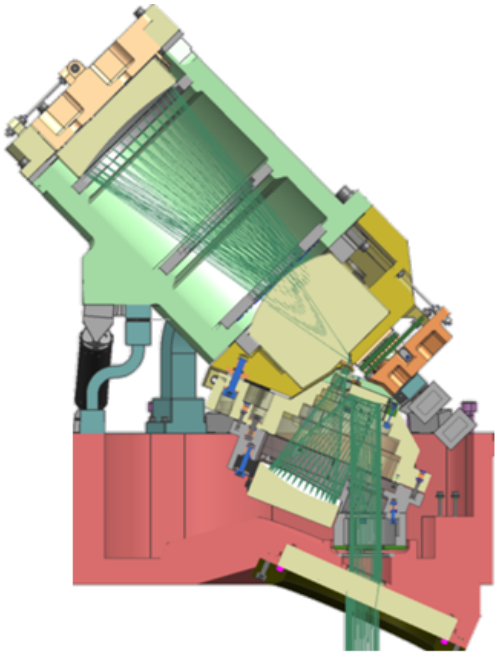


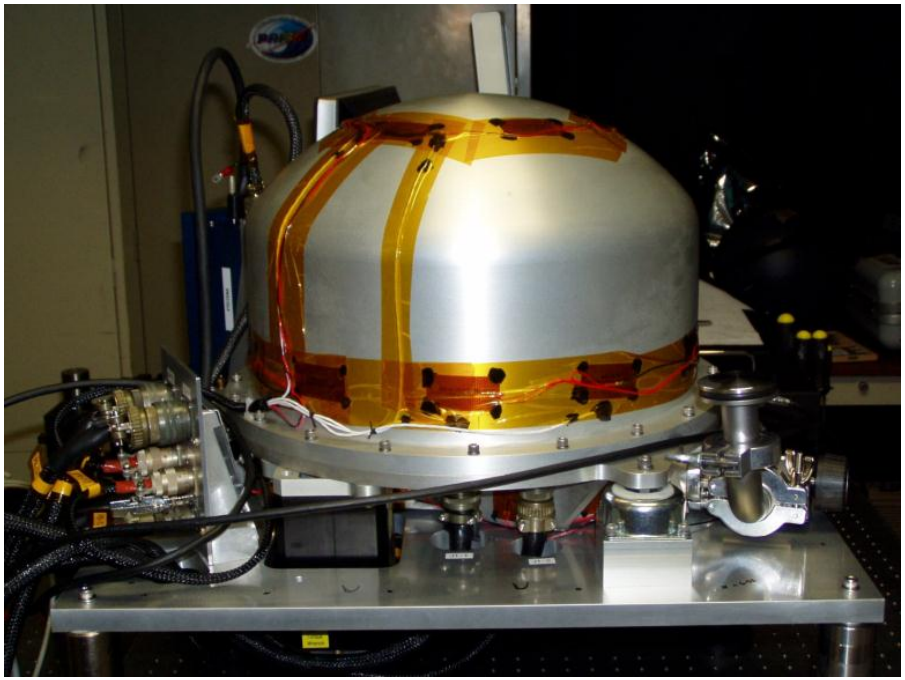


Logistics/access also considered

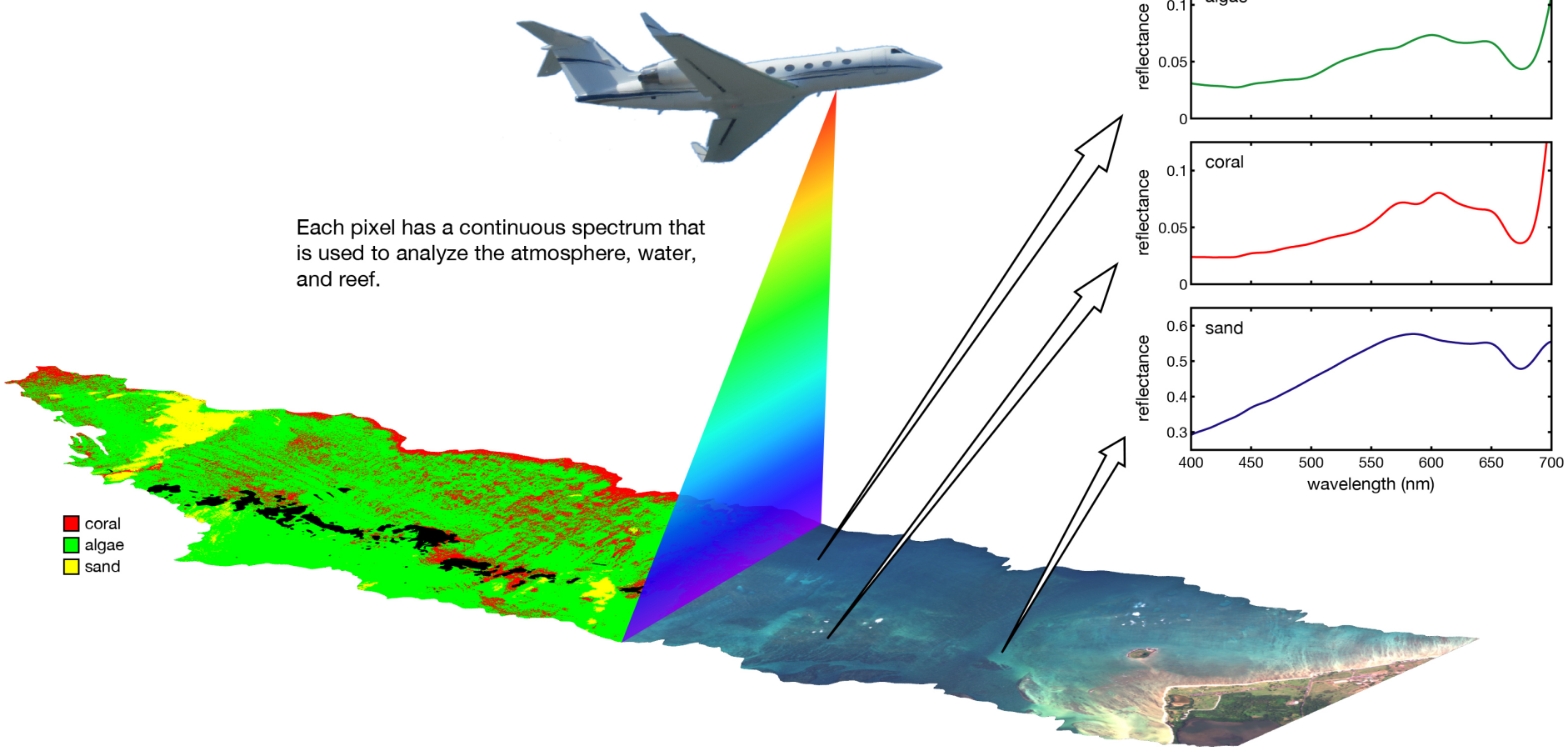
PRISM (Portable Remote Imaging SpectroMeter)

Observables/Parameter	CORAL Requirements	PRISM Performance
Spectral Range	400-800 nm	350-1050 nm
Spectral Sampling	≤10 nm	2.85 nm, 1242 & 1608 nm
Radiometric SNR	>300 @ 400-800 nm	> 600 @ 400-800 nm
Polarization Sensitivity	≤1%	<1%
Spectral Uniformity *Cross-Track, IFOV Mixing*	>90%, <10%	>95%, <5%
Spatial Resolution	≤10 m	@28kft ≤8 m

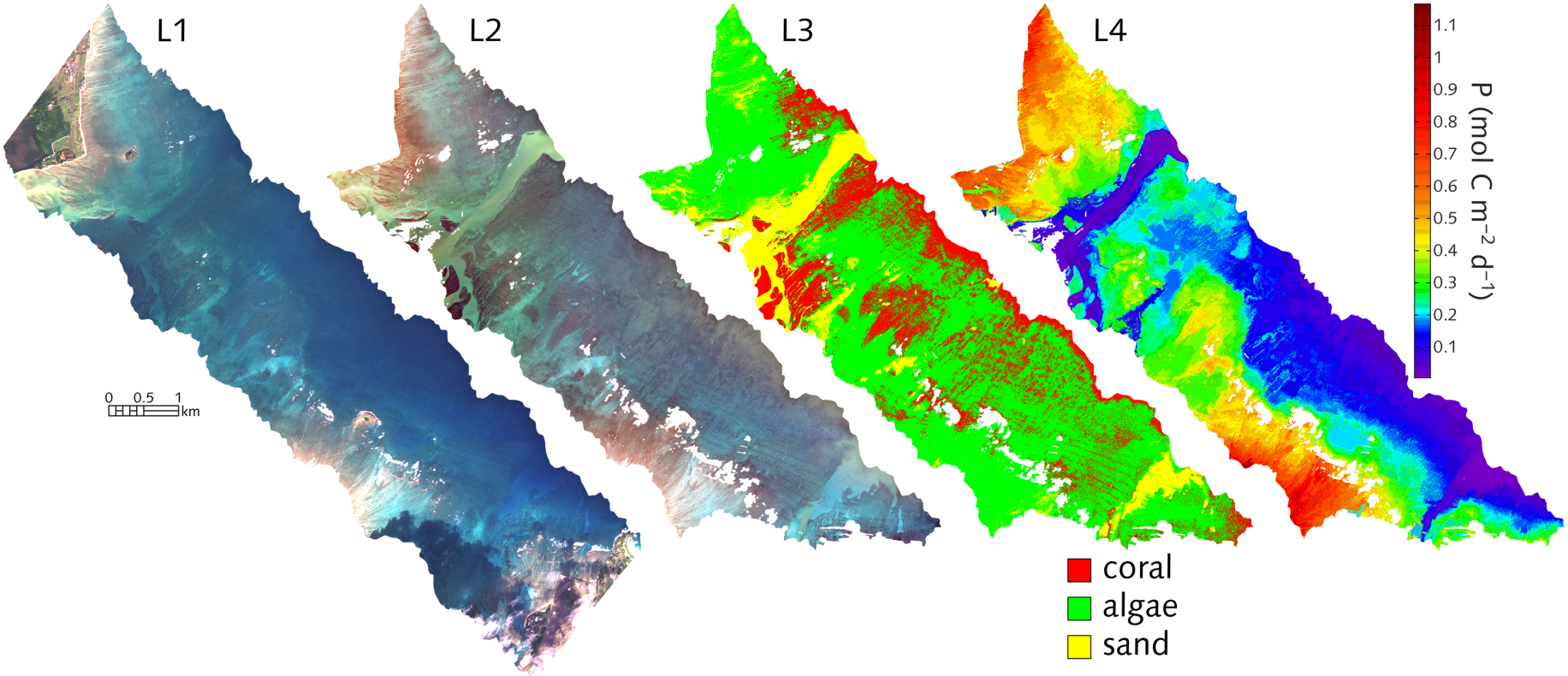




Airborne platform: Tempus G-IV

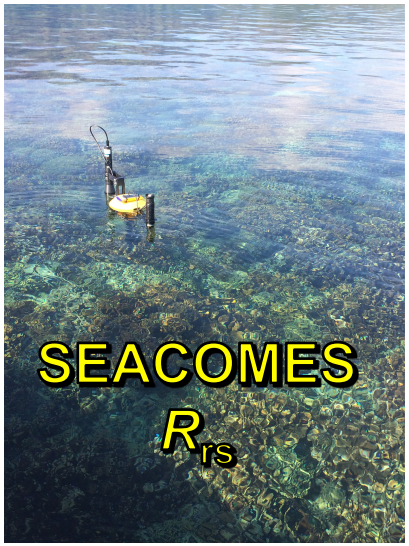


CORAL Image Products



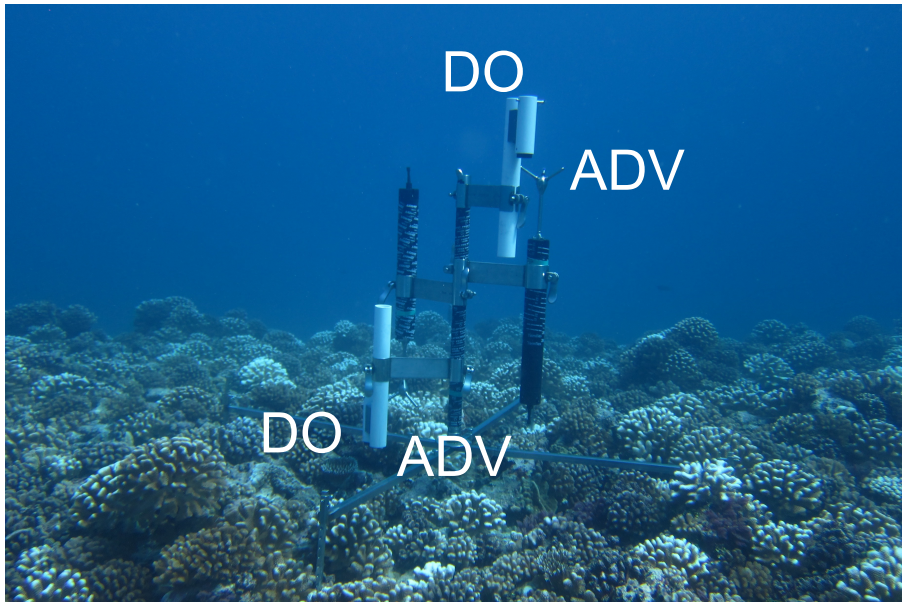
Benthic Reflectance Validation

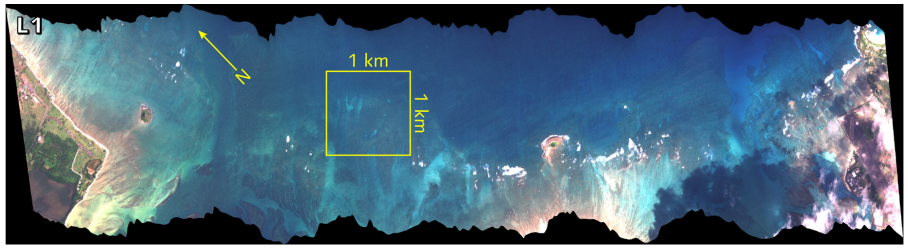
Water Optical Property Validation



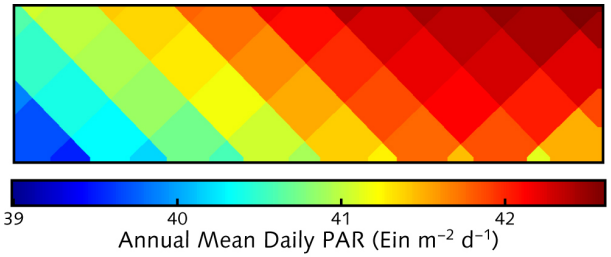
Benthic Cover Validation

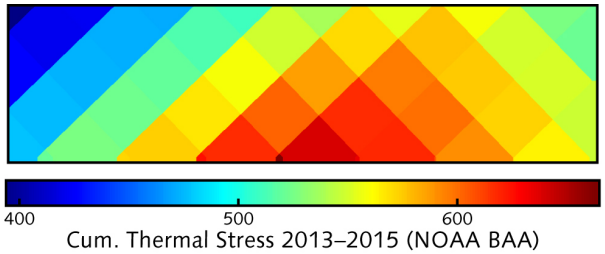
Benthic Metabolism Validation

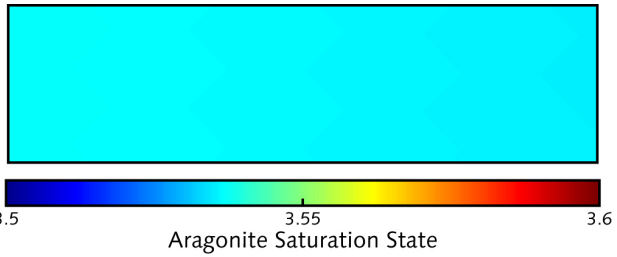


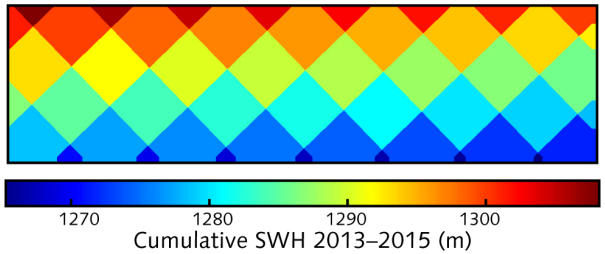


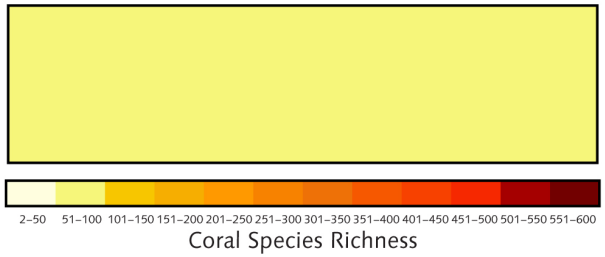
- CORAL products integrated to km-scale
- Biogeophysical parameters interpolated to same scale

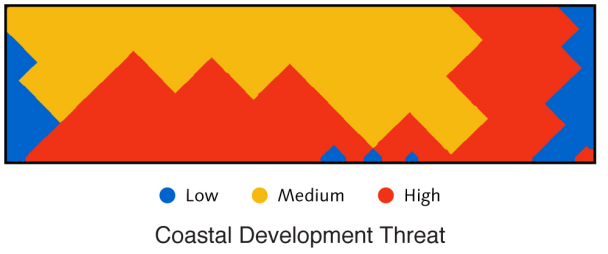


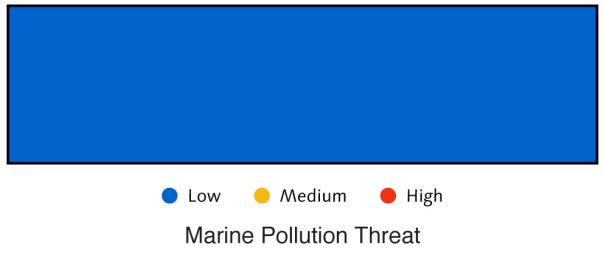


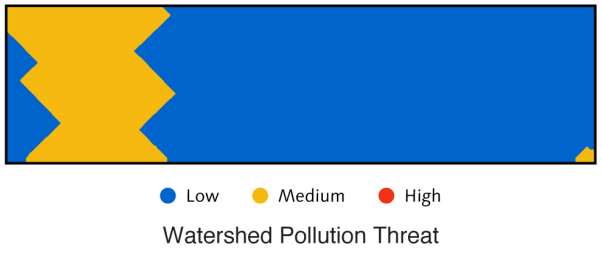


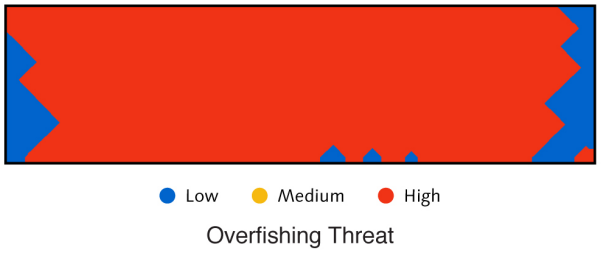


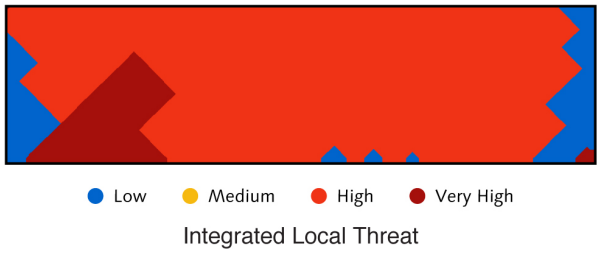




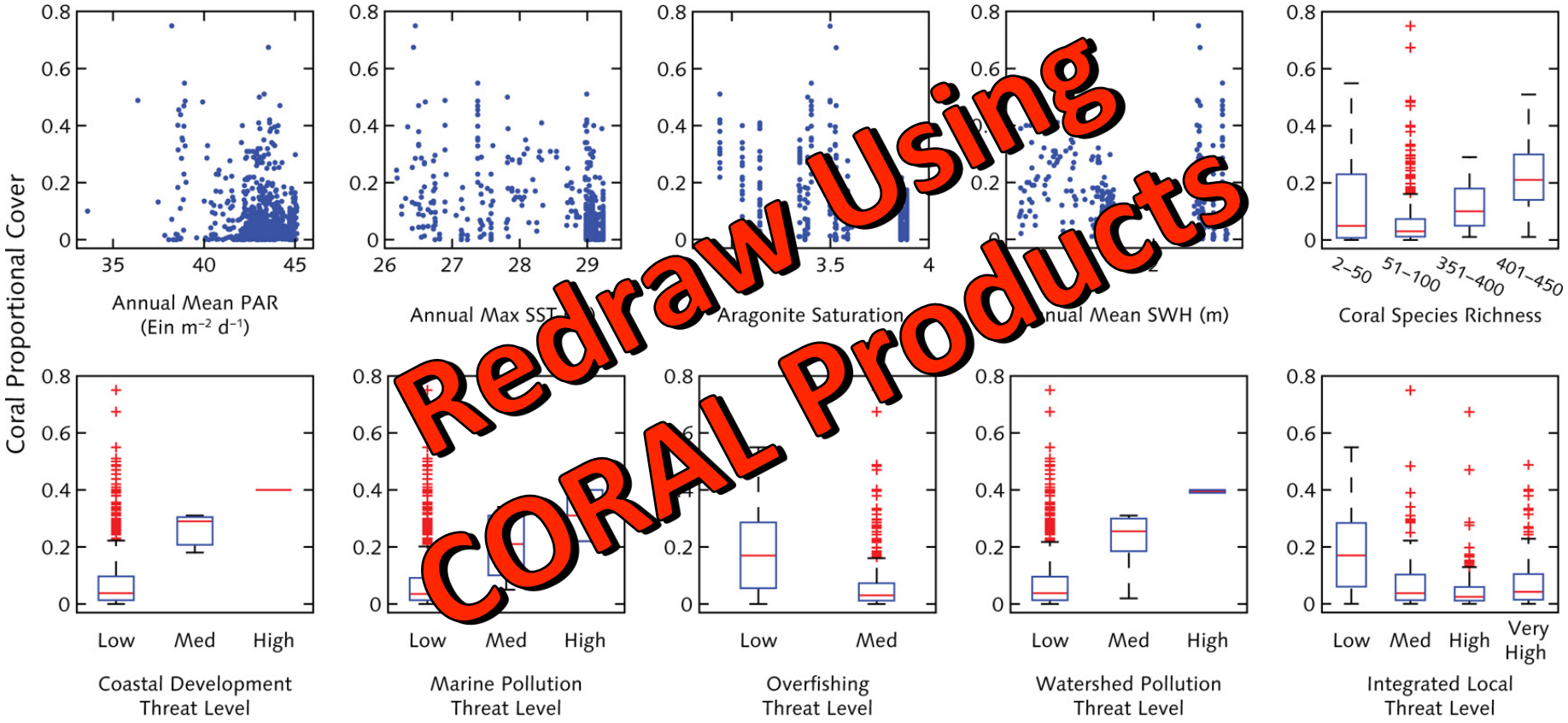






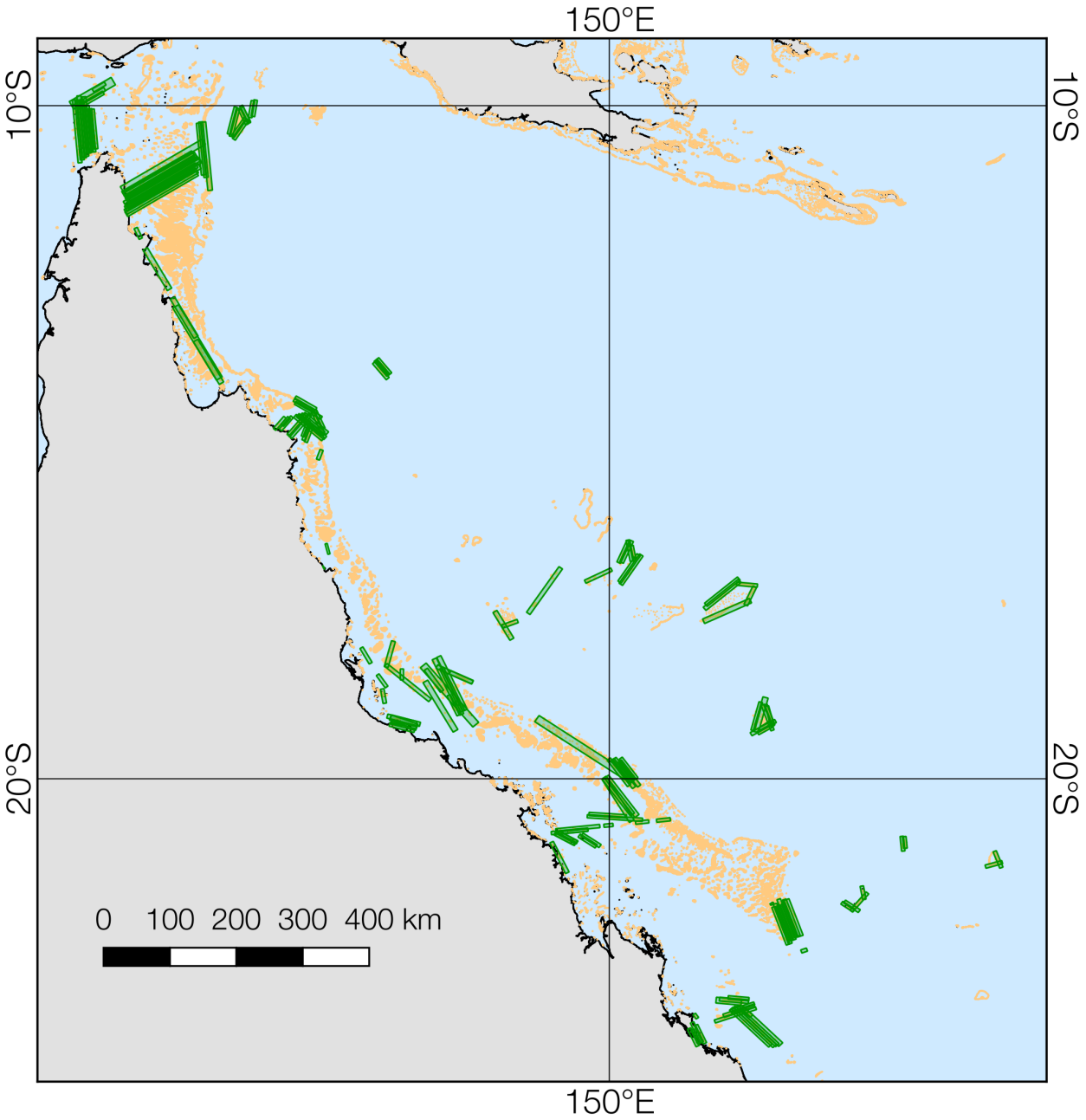


CORAL Science Analysis

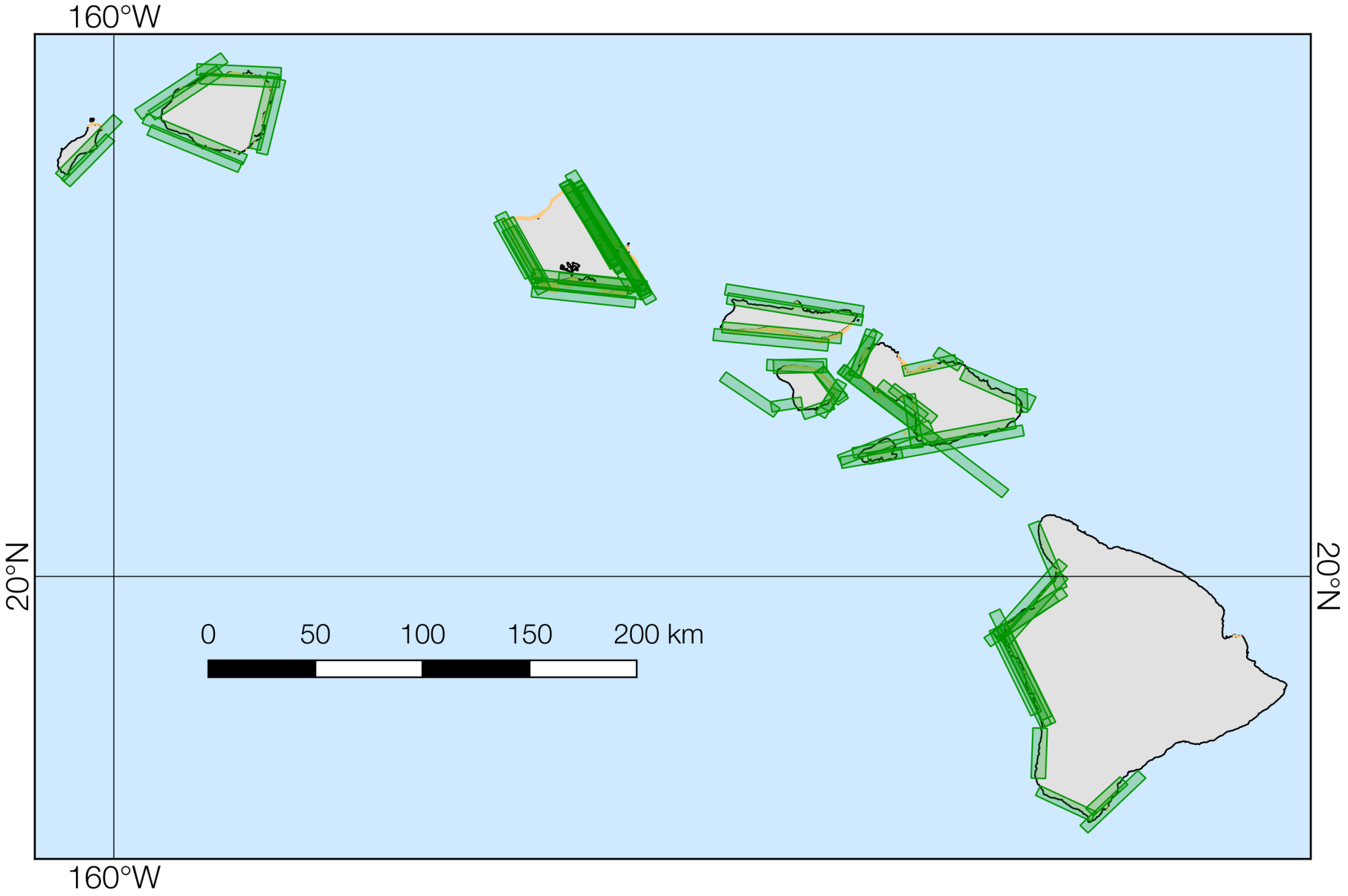


Redraw Using CORAL Products

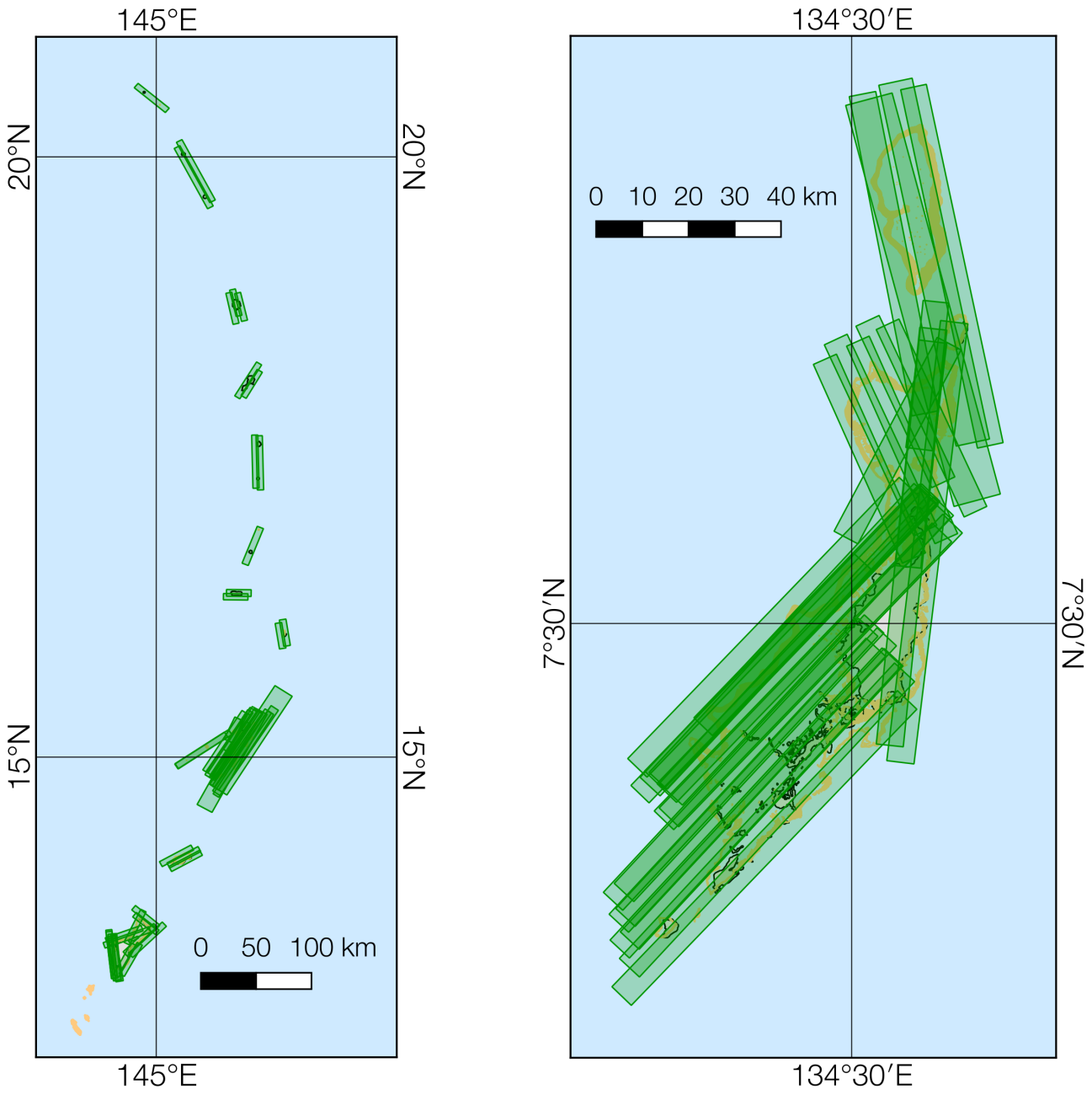
Sep–Oct 2016



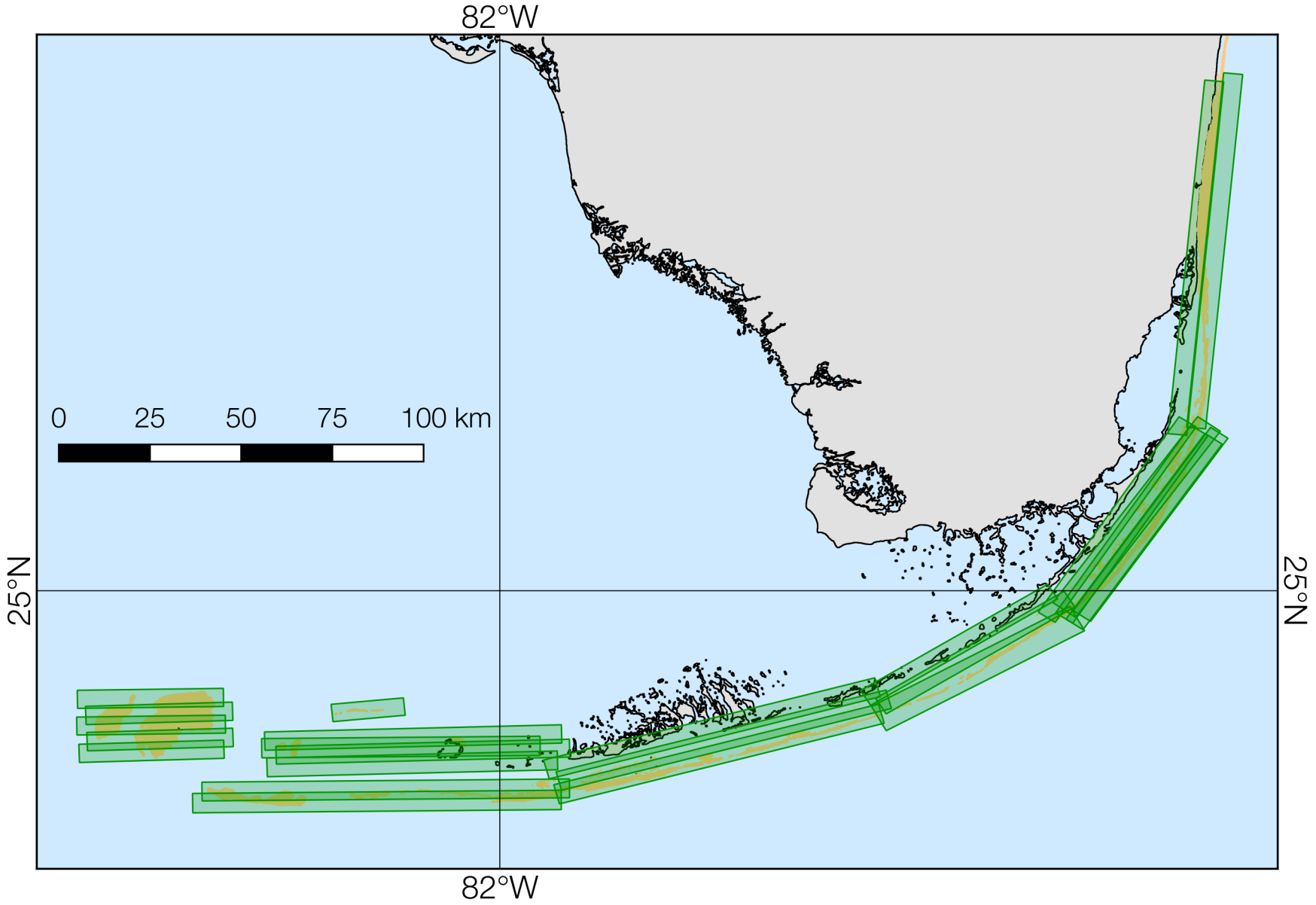
Feb–Mar 2017



Apr–May 2017



May 2017

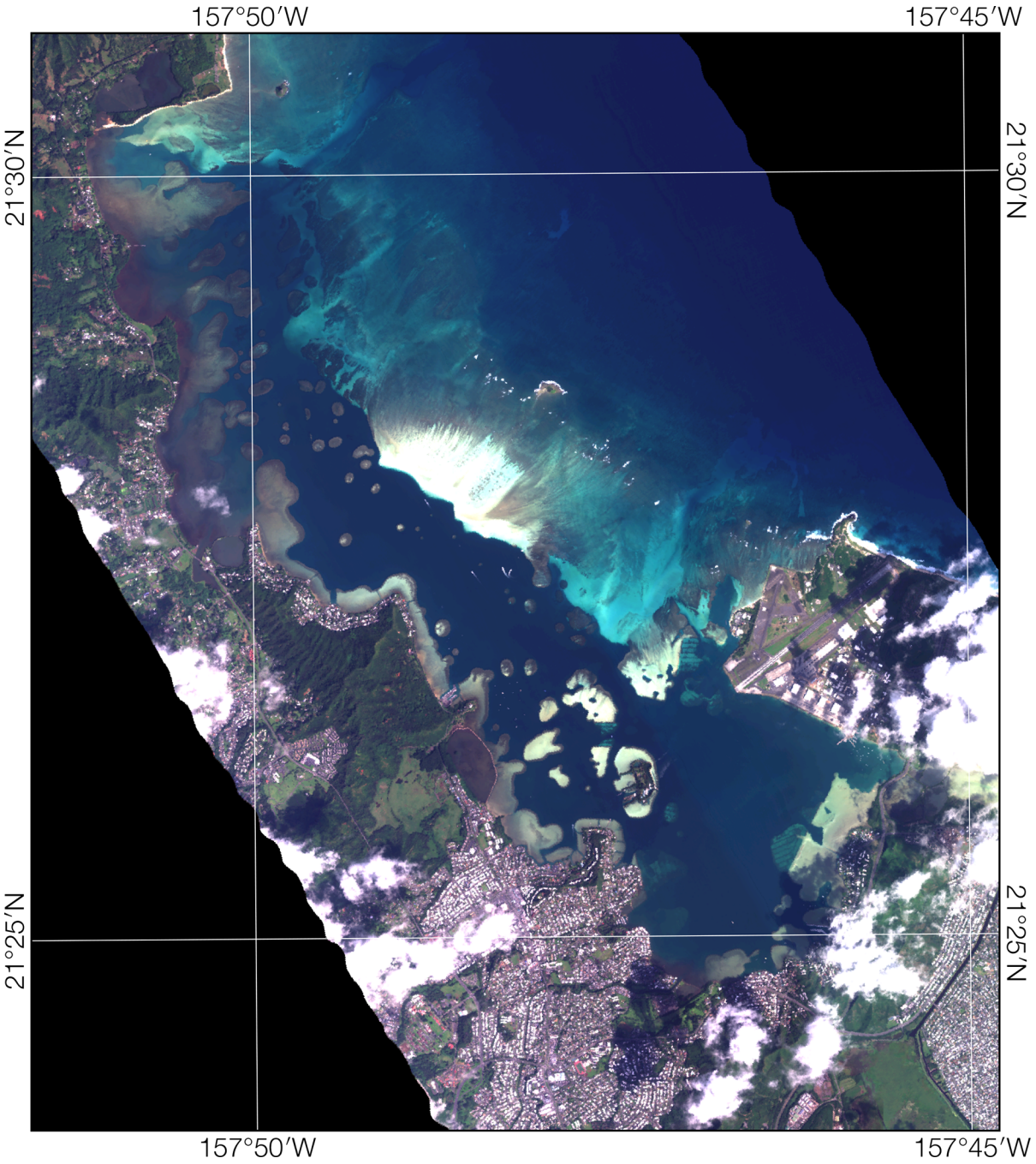


Mission Data Volumes

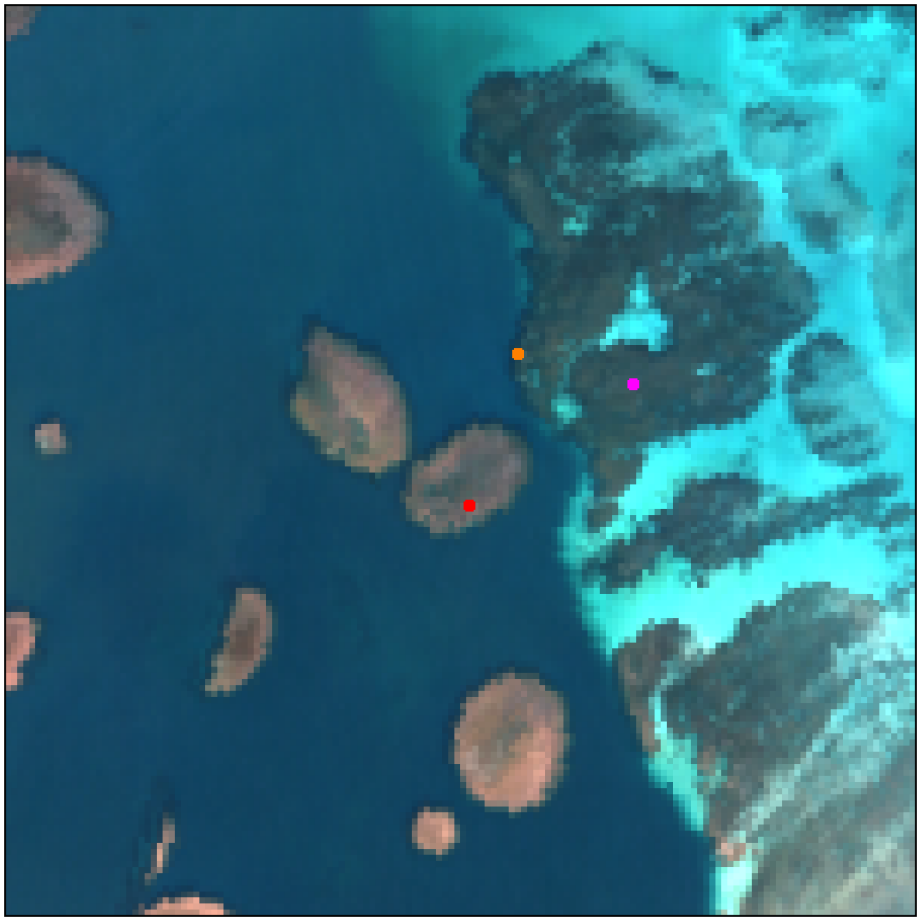
Campaign	# of flight lines	L0 (GB)	L1B (GB)	L2 (GB)	L3 (GB)
Hawaii ORT	23	543	215	256	1.3
Australia	174	3600	947	1030	9.4
Hawaii	76	1250	328	345	3.1
Guam	36	726	174	168	1.0
Palau	41	1200	428	440	4.0
FL Keys	25	661	182	190	0.8
Total	375	7980	2274	2429	19.6

Mission Total (L0 – L3): **12.7 TB**

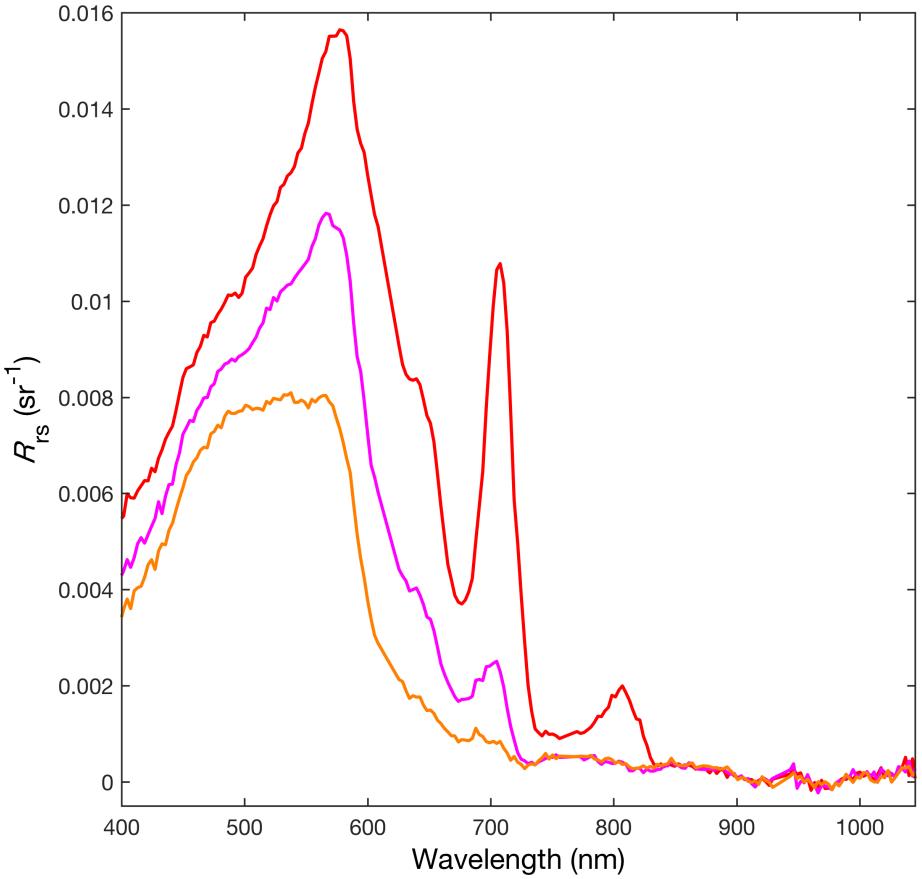
L1B data available through CORAL data portal
L2 & L3 data to be available upon QA/QC
Validation data delivered to OB.DAAC upon QA/QC


157°50′W
157°45′W
21°30′N
21°30′N
21°25′N
21°25′N
157°50′W
157°45′W

L1B

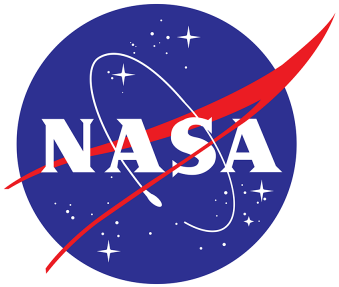


L2 – Atm. Corrected



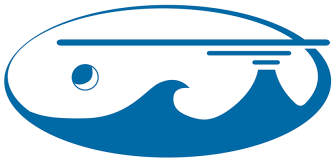
CORAL Science Team

Team Member	Org.	Role	Primary Responsibilities
Dr. Eric Hochberg	BIOS	PI	CORAL Science; Benthic cover, primary productivity & calcification products (Levels 3–4); Benthic reflectance validation (Level 2)
Dr. Michelle Gierach	JPL	PS	CORAL Science; Data archives
Dr. Bob Carpenter	CSUN	Co-I	Benthic community productivity & calcification validation (Level 4)
Dr. Patrick Colin	CRRF	Co-I	Palau coral reef science
Dr. Heidi Dierssen	UConn	Co-I	Water column optical validation (Level 2)
Dr. Steve Dollar	UH	Co-I	Benthic cover validation (Level 3)
Dr. Bo-Cai Gao	NRL	Co-I	Atmosphere & glint correction products (Level 2)
Dr. Robert Green	JPL	Co-I	Calibration & imaging spectroscopy: DNs to benthic cover (Levels 0-3)
Dr. ZhongPing Lee	UMB	Co-I	Water column correction products (Level 2); Sea surface optical validation (Level 2)
Dr. Stéphane Maritorena	UCSB	Co-I	Primary productivity & calcification products (Level 4)
Dr. Pantazis Mouroulis	JPL	Co-I	Digital Numbers (DNs) & radiance products (Levels 0-1)
Dr. Stuart Phinn	UQ	Collaborator	GBRMPA liaison; GBR mission planning
Dr. Chris Roelfsema	UQ	Collaborator	GBR coral reef remote sensing; GBR validation partner
Dr. Arnold Dekker	CSIRO	Collaborator	Australia strategic advisor & Government liaison; GBR mission planning
Ms. Janet Anstee	CSIRO	Collaborator	GBR airborne logistics; GBR water optics
Dr. Tim Malthus	CSIRO	Collaborator	GBR mission planning; Torres Strait validation



BIOS
Bermuda Institute of Ocean Sciences

JPL
Jet Propulsion Laboratory
California Institute of Technology



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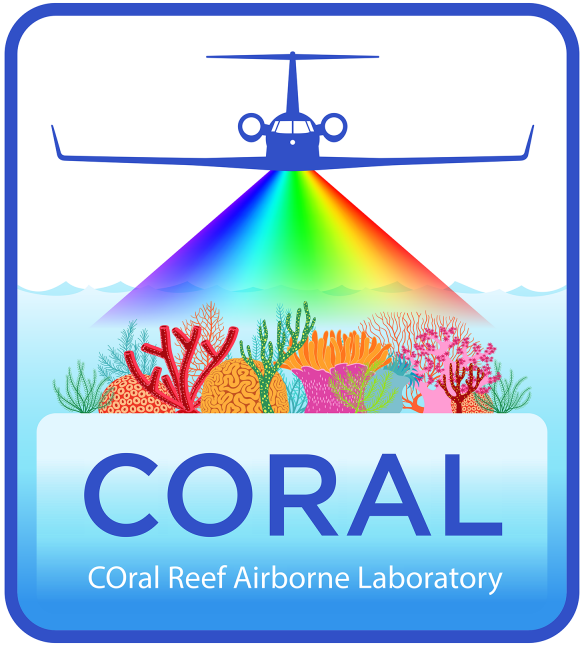
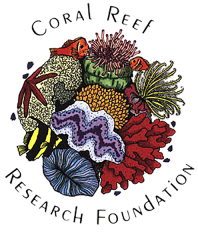
UNIVERSITY OF HAWAI'I AT MĀNOA



CSUN



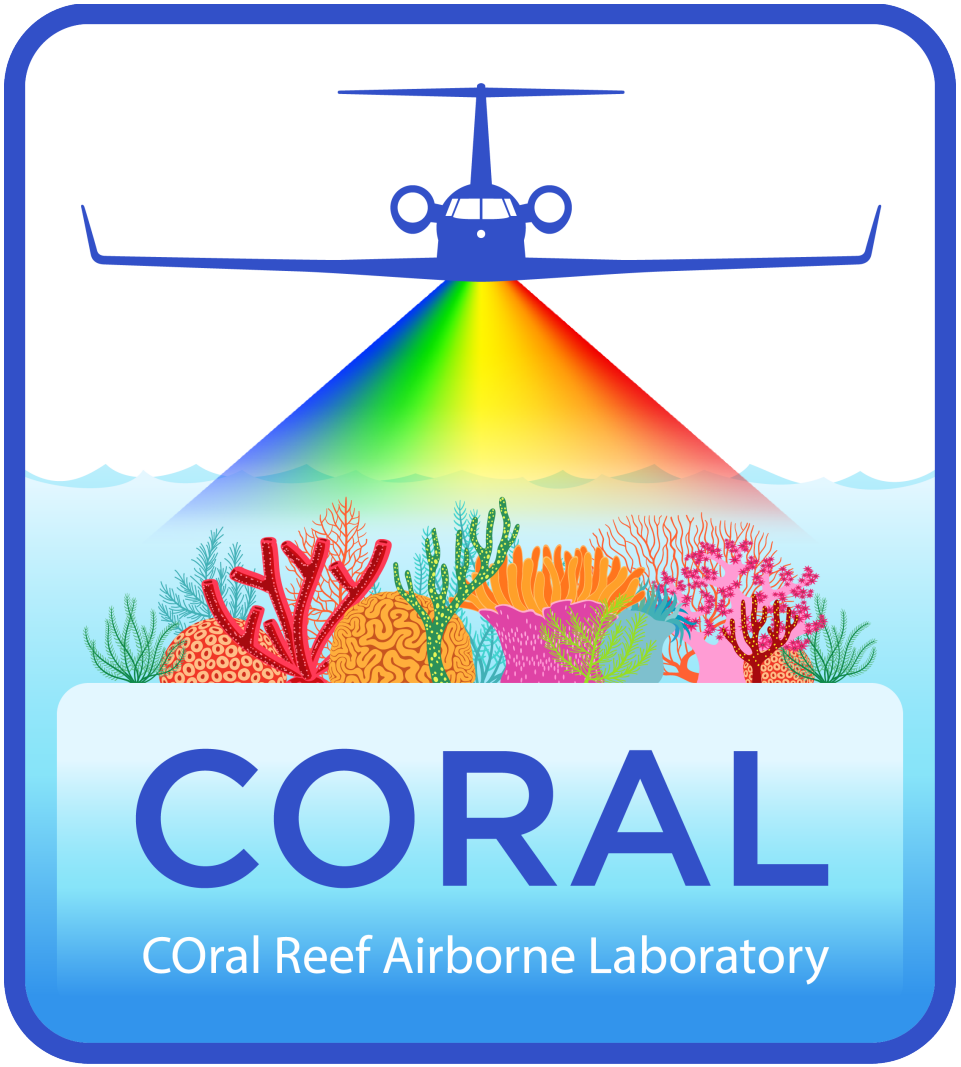
U.S. NAVAL RESEARCH LABORATORY

UCSB

UMASS BOSTON

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

UCONN
UNIVERSITY OF CONNECTICUT



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