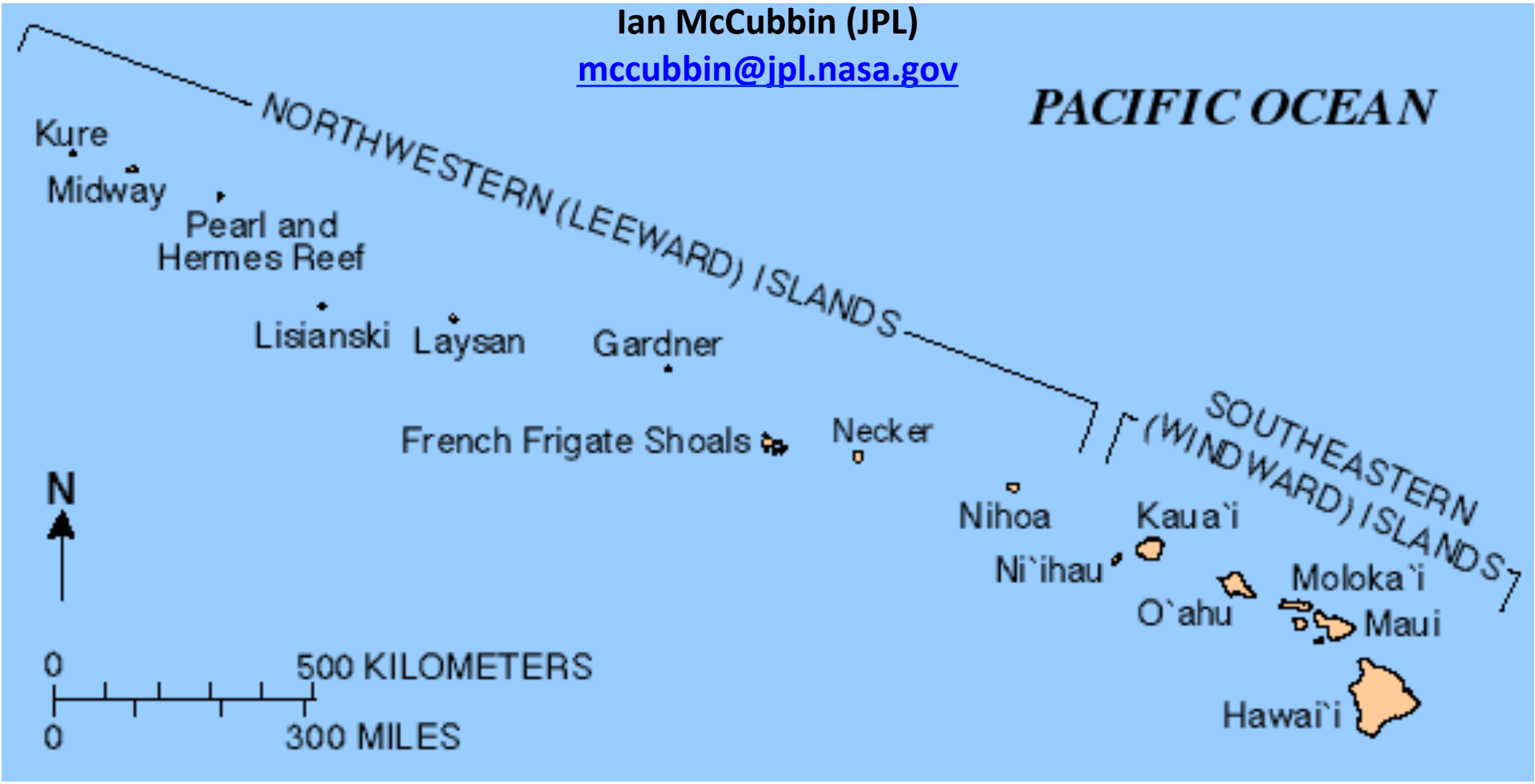
Plans for the HyspIRI Volcano and Coral Reef Airborne Campaign

Ian McCubbin (JPL)
mccubbin@jpl.nasa.gov



Background

NNH14ZDA001N-HYSP

A.45 HyspIRI Preparatory Airborne Activities and Associated Science: Coral Reef and Volcano Research

NASA Earth Science Division solicited proposals using airborne measurements resulting from a planned airborne campaign in 2016 in the Hawaiian Islands for volcano and coral reef research. For this campaign, NASA plans to fly the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) and the MODIS/ ASTER Airborne Simulator (MASTER) instruments on a NASA high-altitude aircraft to collect precursor datasets in advance of the Hyperspectral Infrared Imager (HyspIRI) mission. NASA solicited proposals that would use these airborne data to address one or more of the science questions for the HyspIRI mission relevant to volcano or coral reef research. A goal of this solicitation is to generate important science and applications research results that are uniquely enabled by HyspIRI-like data, taking advantage of the contiguous spectroscopic measurements of the AVIRIS, the full suite of MASTER thermal infrared bands, or combinations of measurements from both instruments.

ER-2 Deployment

- January 17 – March 1, 2017
- Marine Corps Base Hawaii (Kaneohe Bay, Oahu)
- MODIS ASTER Airborne Simulator (MASTER)
- Classic Airborne Visible and Infrared Imaging Spectrometer (AVIRIS-C)
- Hysperspectral Thermal Emissions Spectrometer (HyTES)
- Volcano and Coral Reef Targets
- Volcano In Situ focus Jan 18
  - UAS Deployment from JPL/ARC/WFF
  - Day Night ASTER Collections Jan 24/26, Feb 9/11, Feb25/27
- Coral Reef Focus Feb 8 – Feb 28
  - EVS2 CORAL PRISM Flight Start Mid-Feb

The Coral Reef PI Team :

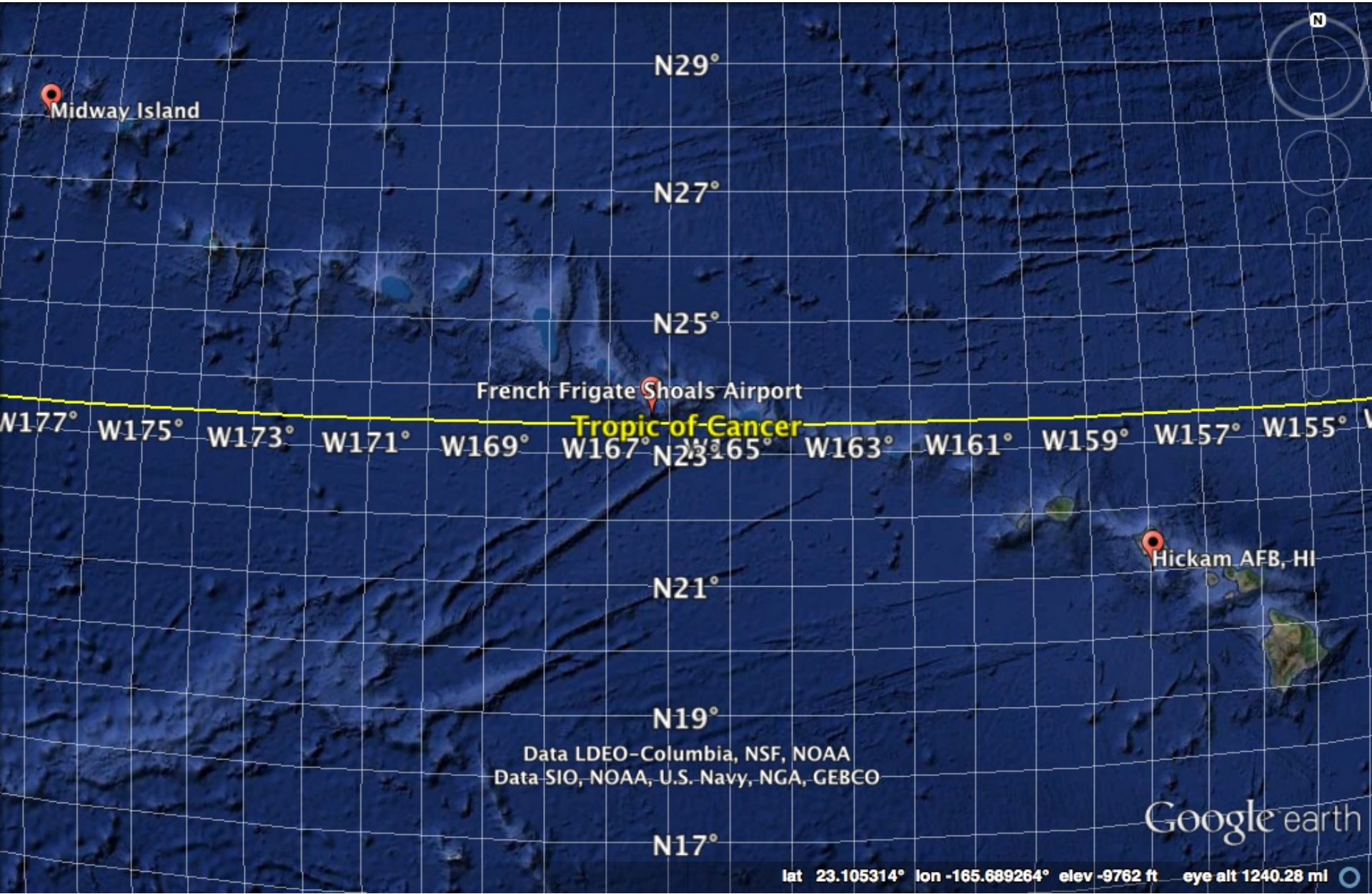
Hiedi Diersen	Univeristy of Connecticut	Hyperspectral remote sensing of coral reefs: Assessing the potential for spectral discrimination of coral symbiont diversity
Steven Ackleson	Naval Research Laboratory	Assessing Simulated HyspIRI Imagery for Detecting and Quantifying Coral Reef Coverage and Water Quality Using Spectral Inversion and Deconvolution Methods
Kyle Cavanaugh	University of California, Los Angeles	Using HyspIRI to Identify Benthic Composition and Bleaching in Shallow Coral Reef Ecosystems
Paul Haverkamp	University of California Davis	Modeling of Environmental Variables and Land-Use/Land-Cover Change Influence on Declining Hawaiian Coral Reef Health Since 2000 Using HyspIRI-Like Images
Eric Hochberg	Bermuda Institute of Ocean Science	Coral Reef Condition Across the Hawaiian Archipelago and Relationship to Environmental Forcing
ZhongPing Lee	University Of Massachusetts, Boston	Evaluation and Application of the AVIRIS Data for the Study of Coral Reefs

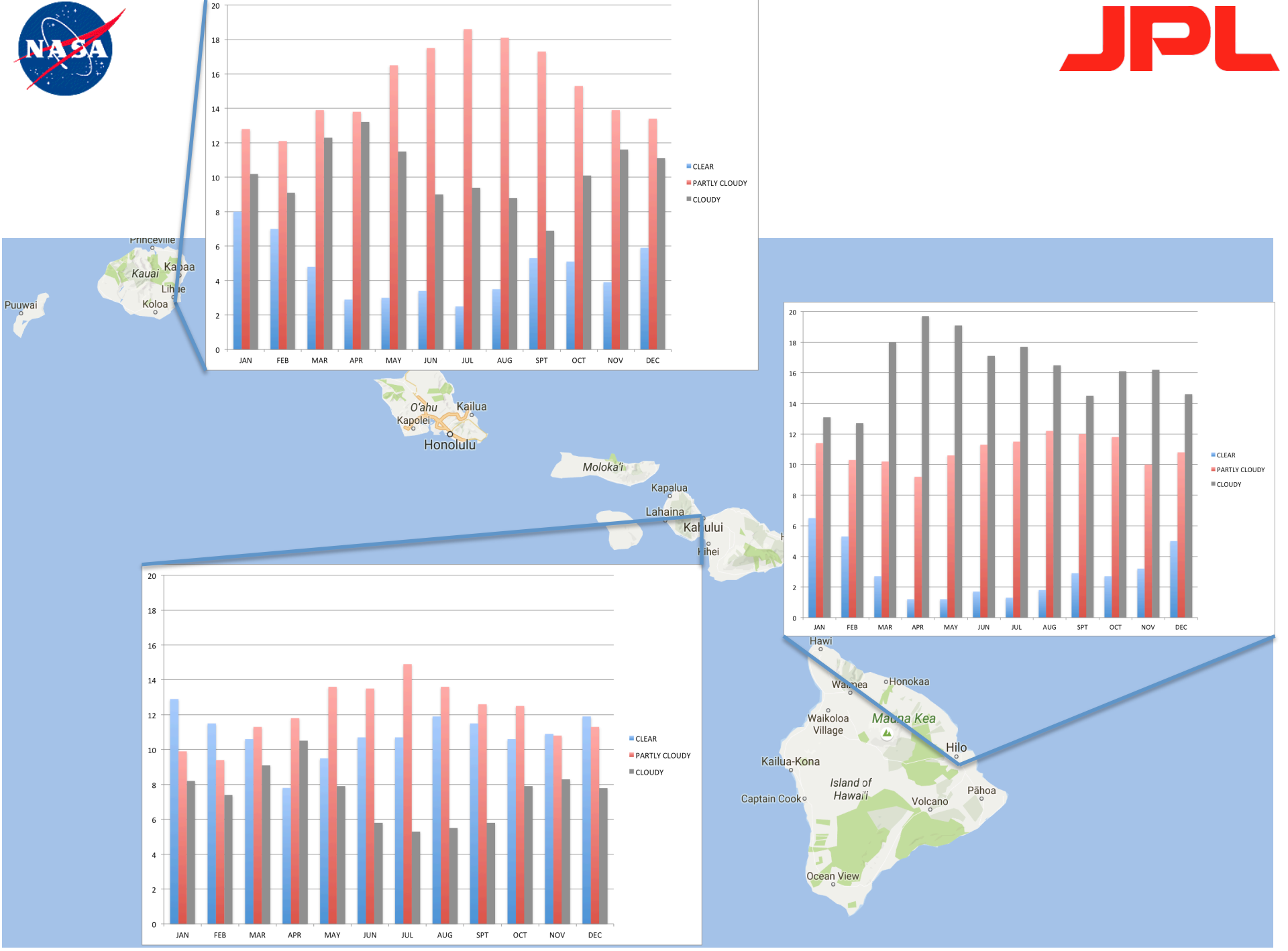
The volcano PI Team :

David Pieri	Jet Propulsion Laboratory	In Situ Validation of Remotely Sensed Volcanogenic Emissions Retrievals Using Aerostats and UAVs
Michael Ramsey	University of Pittsburgh	Quantifying Active Volcanic Processes and Mitigating their Hazards With HyspIRI Data
Vincent Realmuto	Jet Propulsion Laboratory	Mapping the Composition and Chemical Evolution of Plumes from Kilauea Volcano
Greg Vaughn	United States Geologic Survey	Developing an automated volcanic thermal alert algorithm using moderate spatial resolution VSWIR and TIR data: Implications for the future HyspIRI mission
Chad Deering	Michigan Technological University	Understanding Basaltic Volcanic Processes by Remotely Measuring the Links Between Vegetation Health and Extent, and Volcanic Gas and Thermal Emissions Using HyspIRI-Like VSWIR and TIR Data

Oahu to Sites
Transit to HI from AFRC =6.1 hours

Science Times on Station (8-hr Mission):	
Big Island Hawaii	6.5
French Frigate Shoals	5.1
Midway Is	1.7




20
18
16
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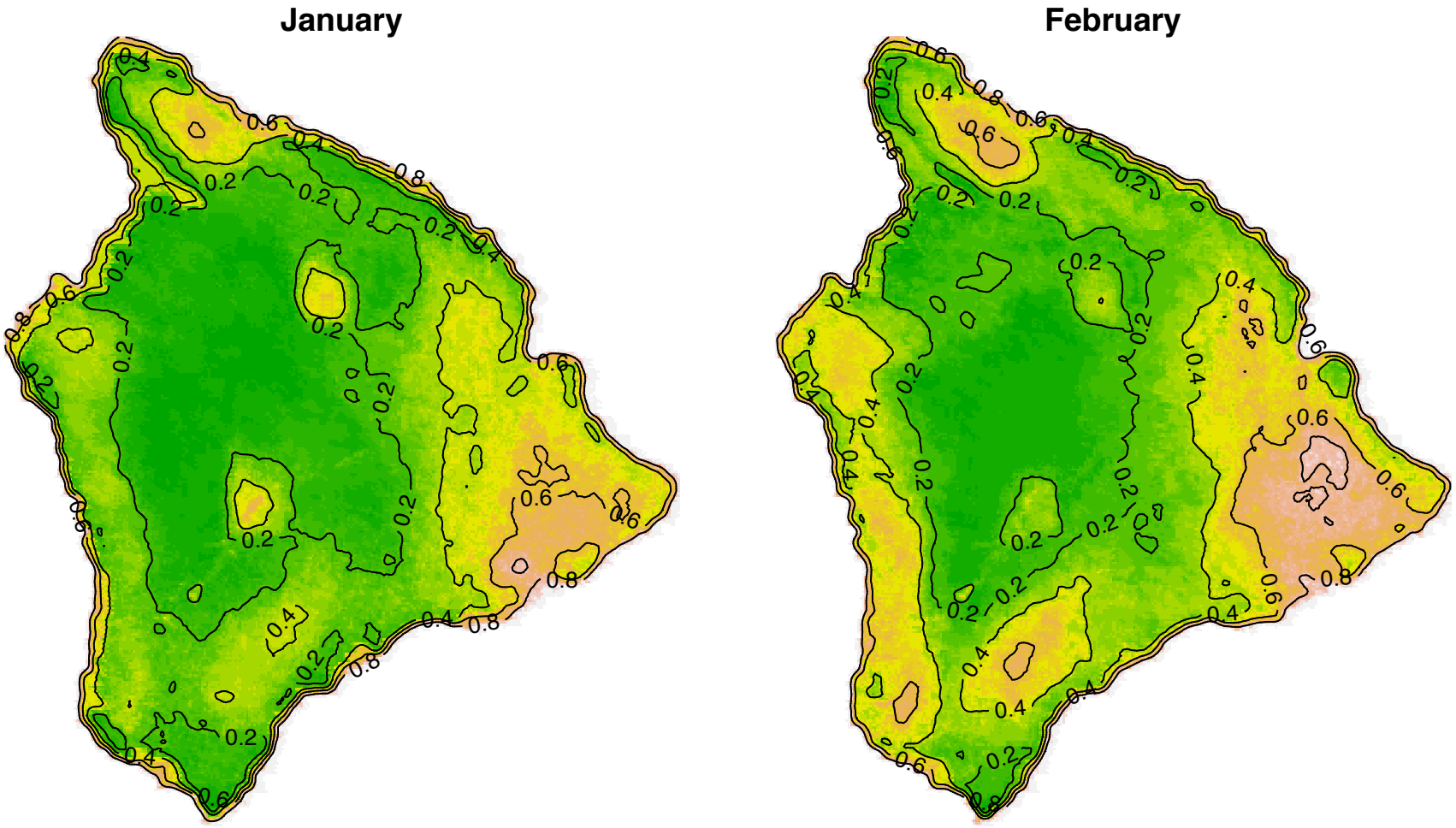
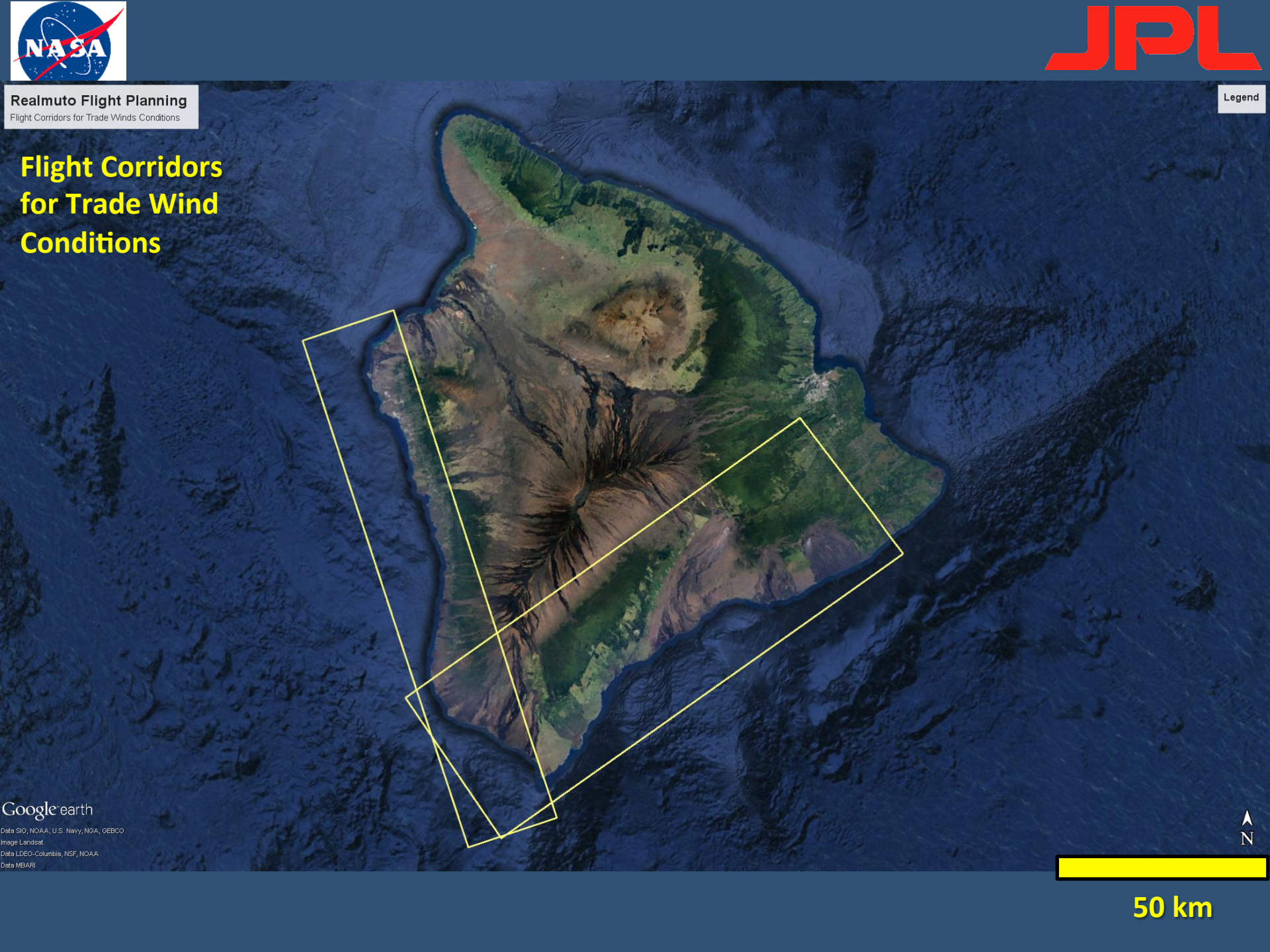
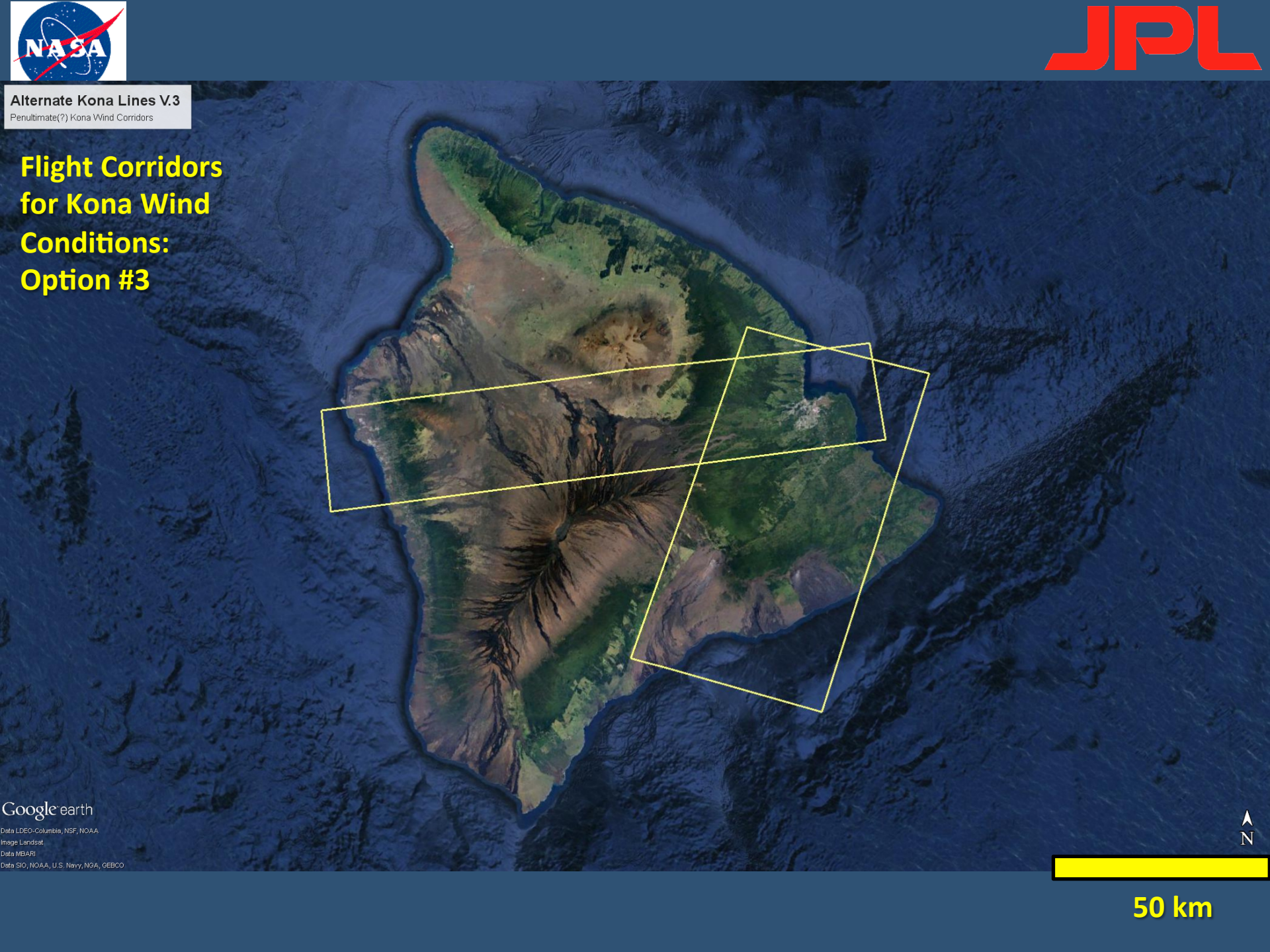
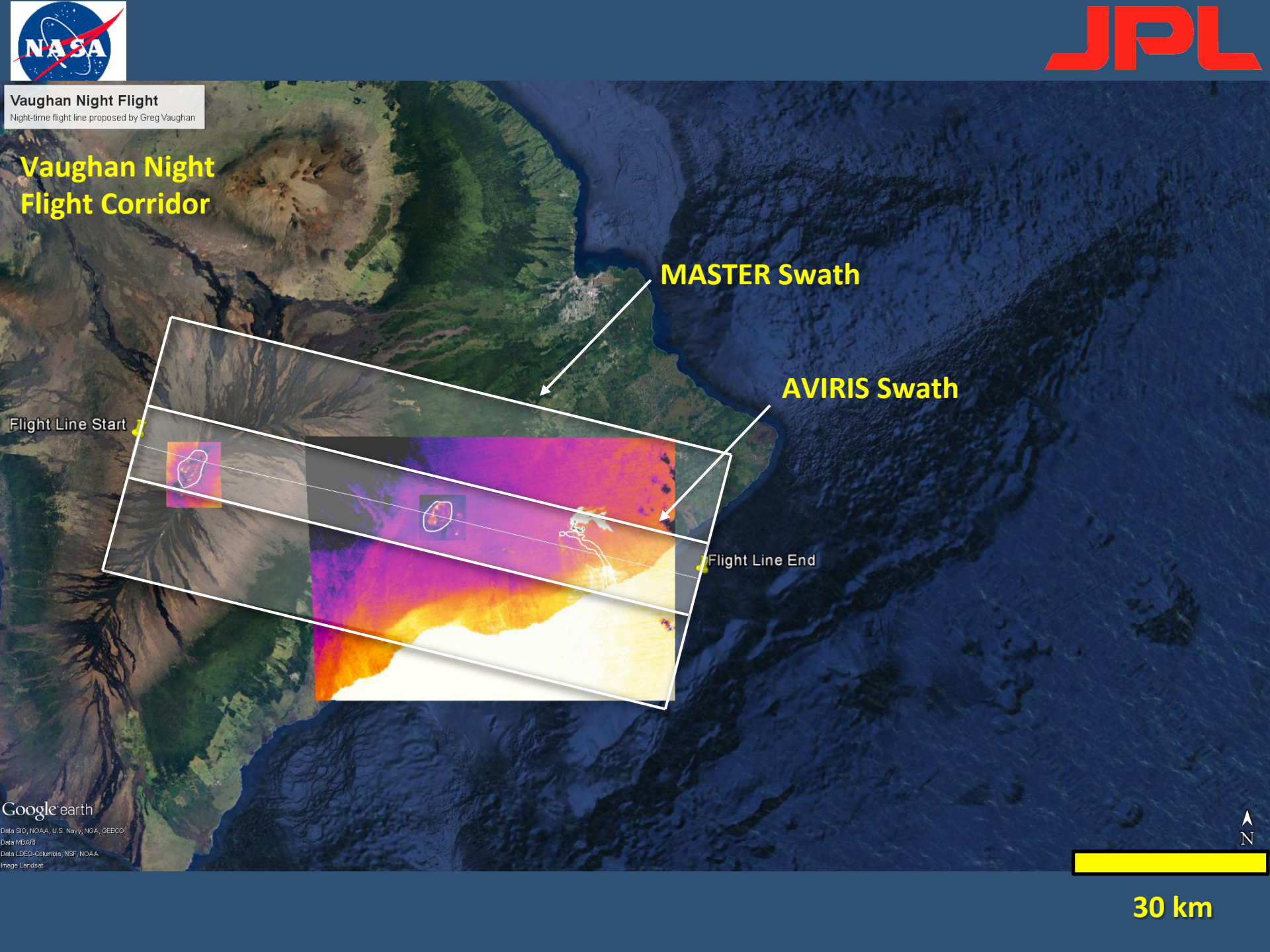
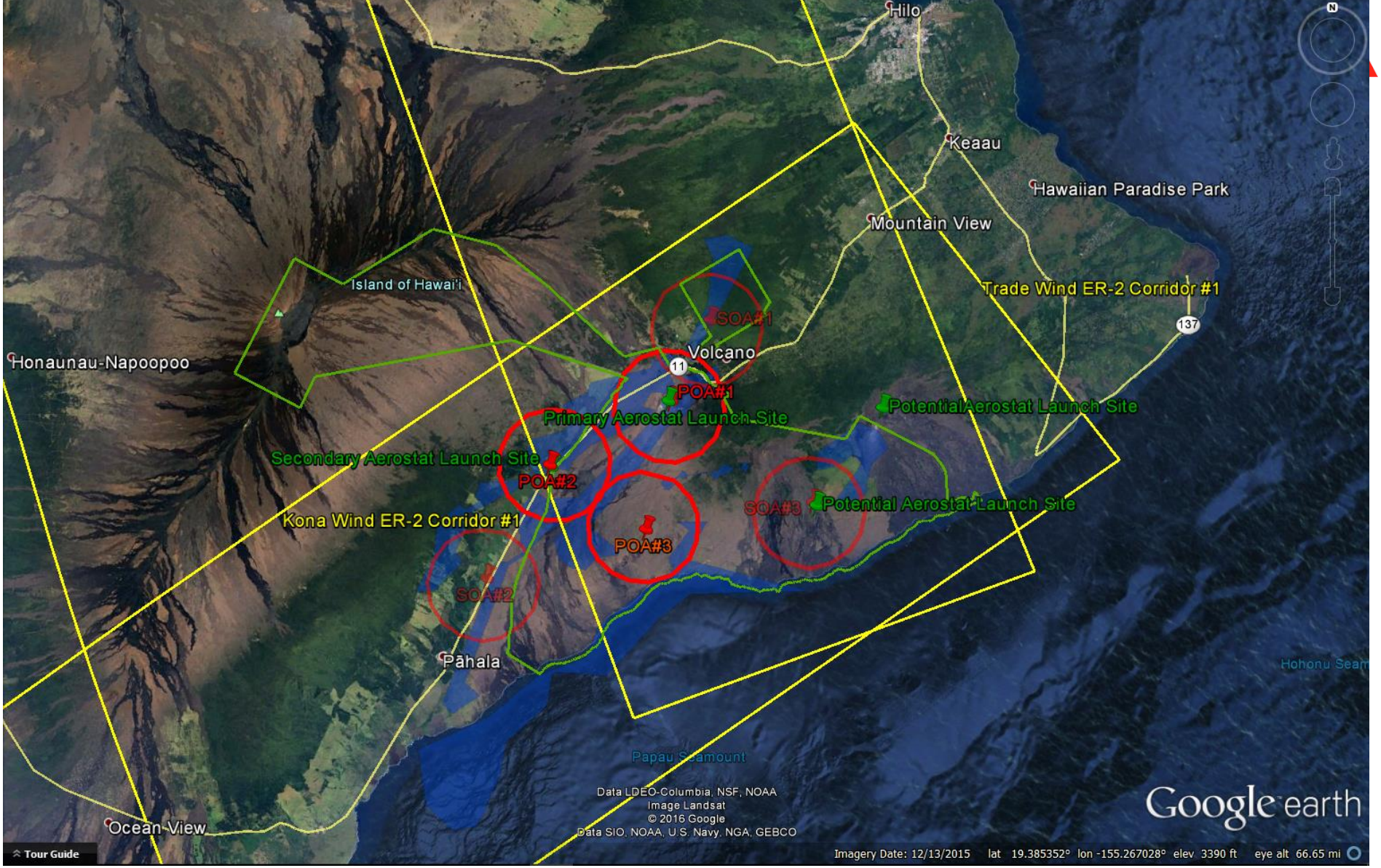
0
JAN FEB MAR APR MAY JUN JUL AUG SPT OCT NOV DEC
CLEAR
PARTLY CLOUDY
CLOUDY
Princeville
Kauai
Puuwai
Koloa
O'ahu
Kailua
Kapolei
Honolulu
Moloka'i
Kapalua
Lahaina
Hawi
Waimea
Honokaa
Waikoloa Village
Mauna Kea
Hilo
Kailua-Kona
Island of Hawai'i
Captain Cook
Volcano
Pāhoa
Ocean View
20 mi


January
February


Realmuto Flight Planning
Flight Corridors for Trade Winds Conditions
Legend
Flight Corridors for Trade Wind Conditions
Google earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Data LDEO-Columbia, NSF, NOAA
Data MBARI
N
50 km


Alternate Kona Lines V.3
Penultimate(?) Kona Wind Corridors
Flight Corridors for Kona Wind Conditions: Option #3
Google earth
Data LDEO-Columbia, NSF, NOAA
Image Landsat
Data MBARI
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
N
50 km


Vaughan Night Flight
Night-time flight line proposed by Greg Vaughan
Vaughan Night Flight Corridor
MASTER Swath
AVIRIS Swath
Flight Line Start
Flight Line End
Google earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data MBARI
Data LDEO-Columbia, NSF, NOAA
Image Landsat
N
30 km

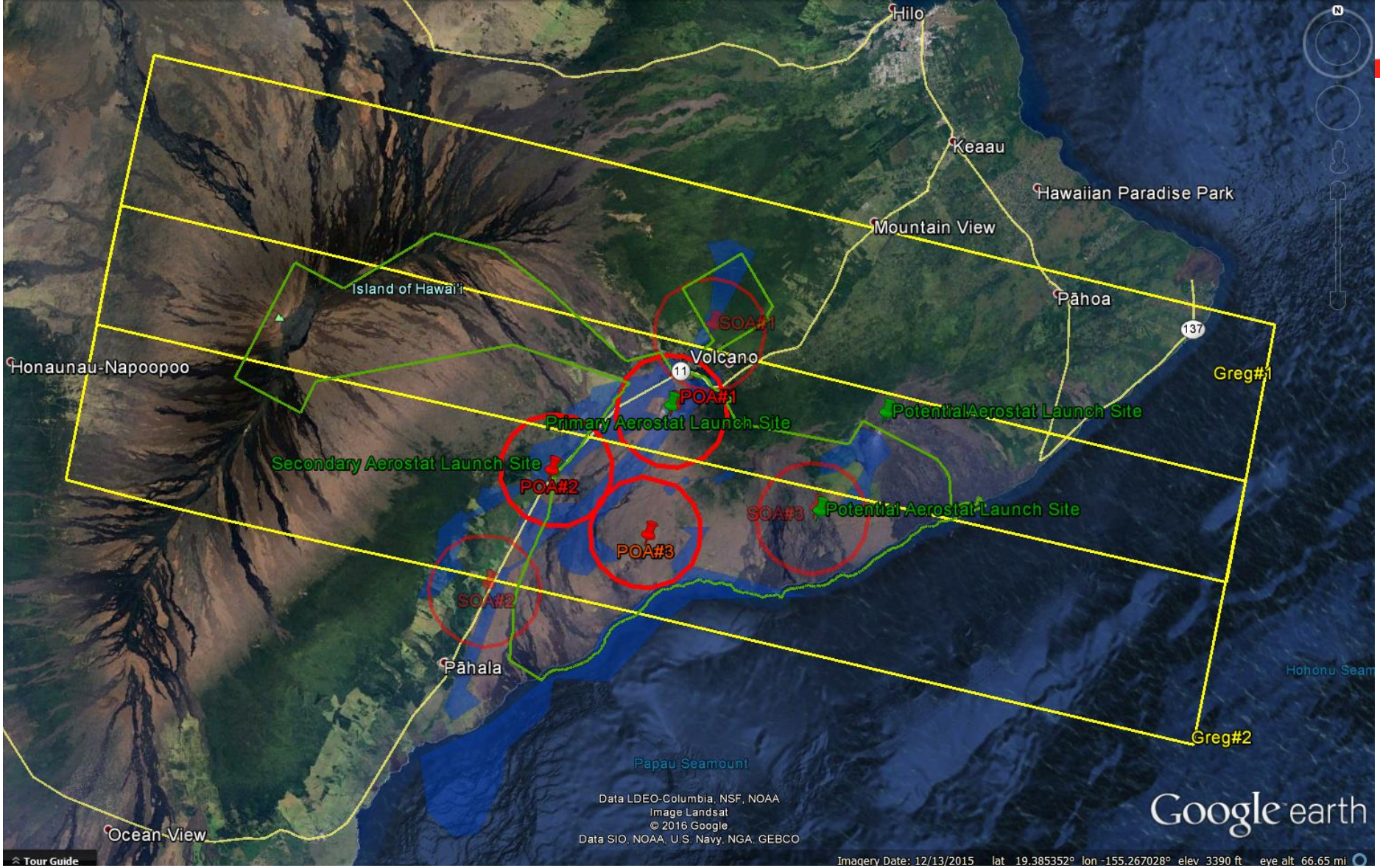


Dave's UAV operations areas (Red Circles) and Vince's ER-2 Flight Corridors (Yellow Boxes).

UAV Primary Operations Areas (POA#1,2,3)—Bright Red Circles
UAV Secondary Operations Areas (SOA#1,2,3)—Subdued Red Circles

Aerostat Launch Sites (tentative) – Green Pins

National Park Boundaries – Green Borders
Shaded Blue—Most frequent SO_2 detection areas from ASTER TIR (2000-2016)



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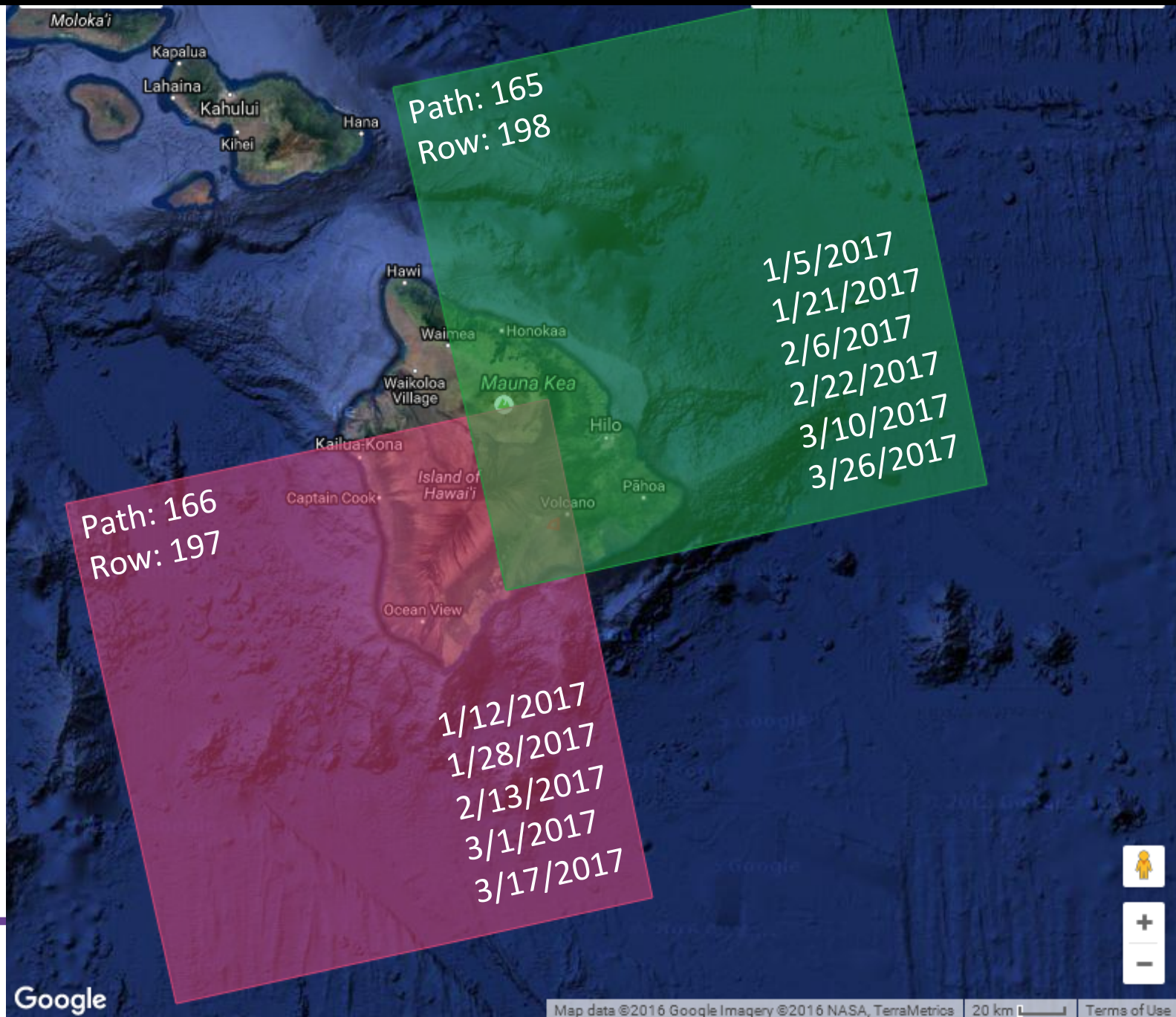
Flight planning for Jan-Mar 2017 MASTER / AVIRIS Hawaii airborne campaign to simulate HyspIRI



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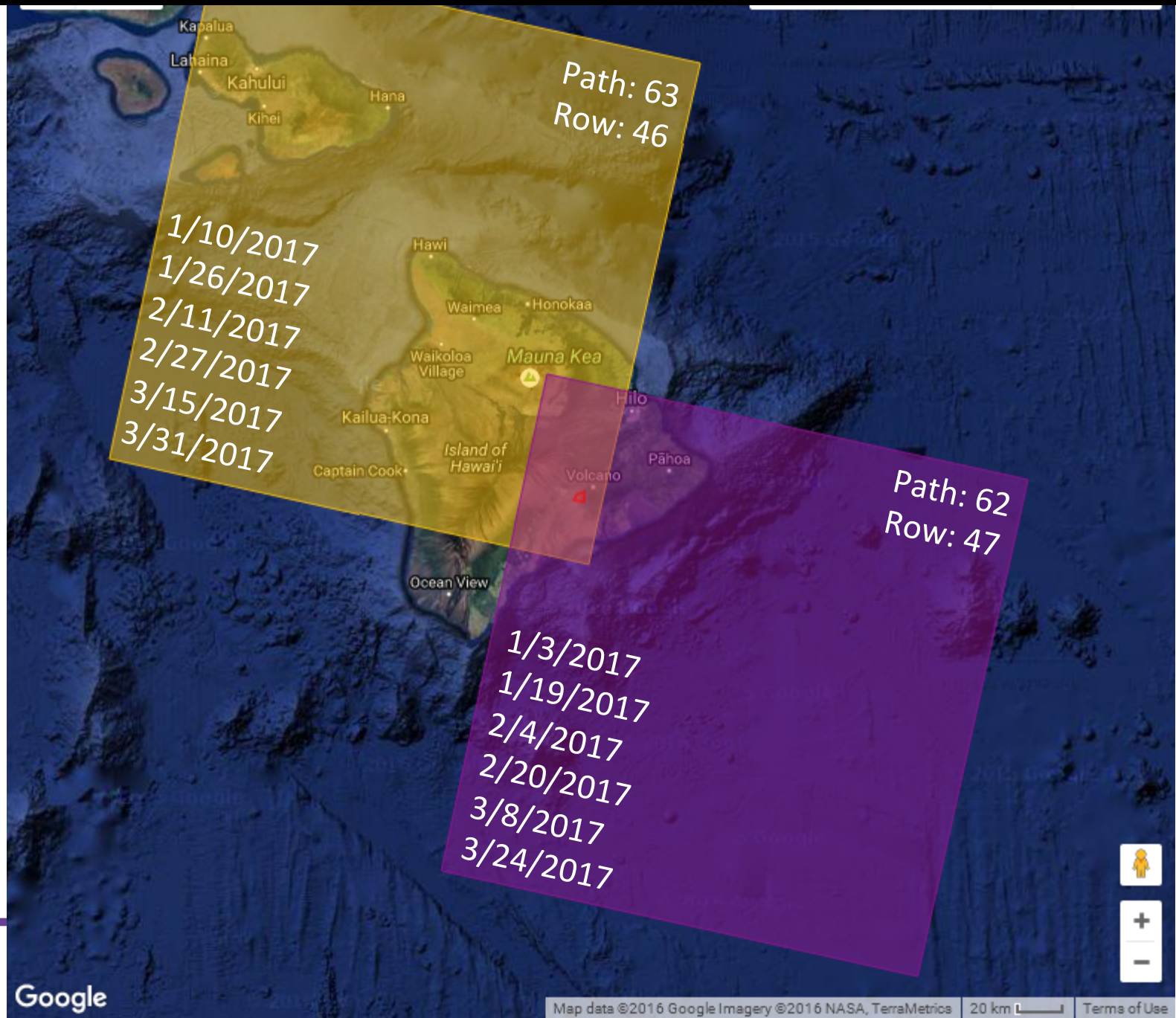
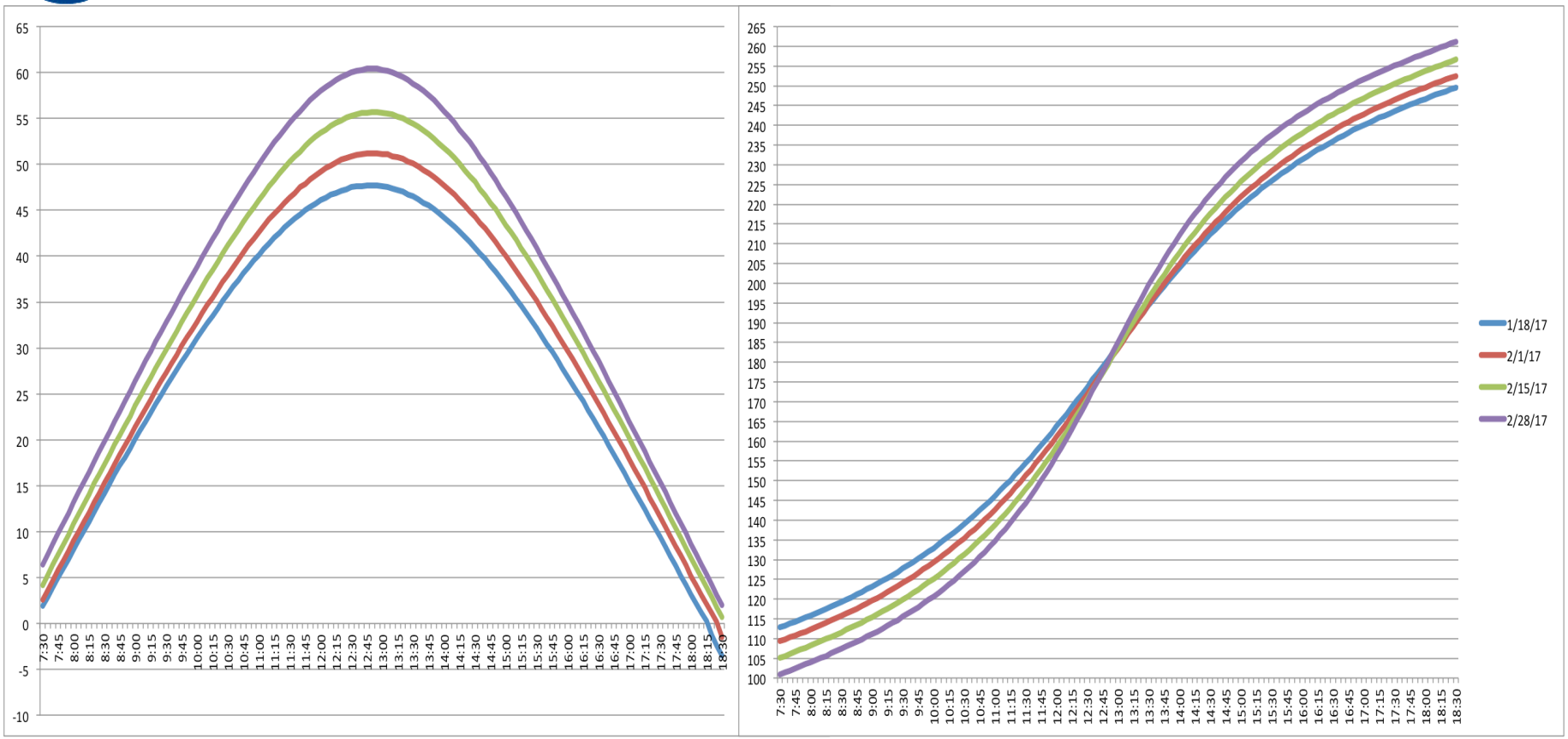


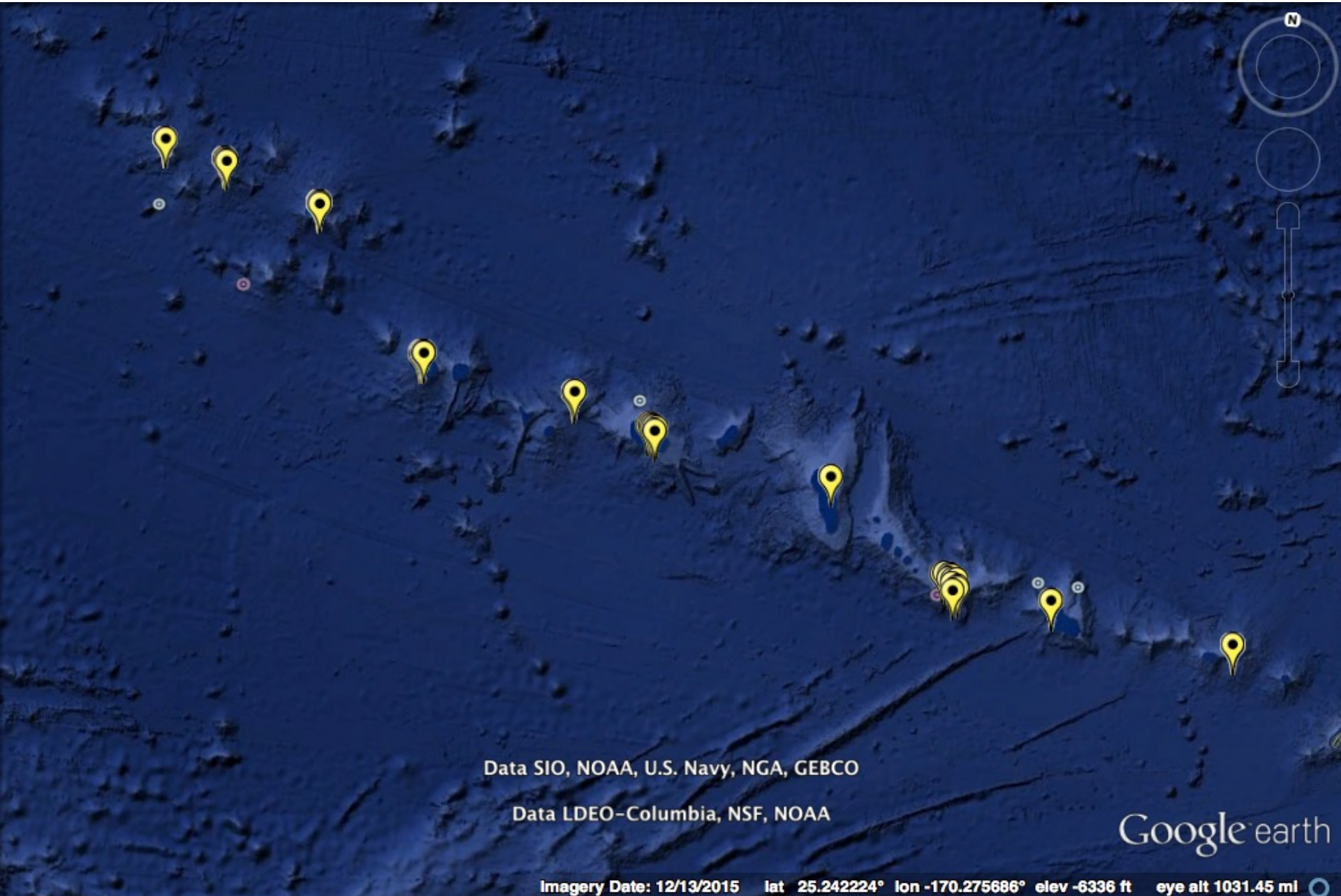
Team members	Field Sites	Planned Data Collection	Priority image sites
Paul Haverkamp, Jamie Goodman, Susan Ustin	Kaneohe Bay, South coast Molokai	Underwater photos; Underwater transects identifying functional types; Spectral measurements (possibly) - coral, sand, algae; possibly more	Kaneohe Bay, south coast Molokai, French Frigate Shoals
Steven Ackleson, Lauren Freeman, Simon Freeman, Joesph Smith, and Bryan Laboy.	Kaneohe Bay	Spectral reflectance of benthic features (coral, algae, sand, etc.), water column + bottom reflectance (autonomous kayak), in situ passive acoustics.	Kaneohe Bay, Maui, French Frigate Shoals, Pearl and Hermes Atoll, Kure Atoll, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, Necker Island, Nihoa Island
ZhongPing Lee, Jianwei Wei	Kaneohe Bay	Water-leaving radiance, remote sensing reflectance, bathymetry, benthic video recording, absorption, attenuation and backscattering, aerosol optica thickness	Kaneohe Bay, Maui, Molokai, etc
Hochberg, CORAL	Oahu (Kaneohe Bay, possibly Mamala Bay) Big Island (Kealakekua to Kawaihae) Maui (Makena to Kapalua) Lanai (NE shore)	Kaneohe Bay – water optics, benthic community metabolism, benthic cover, benthic reflectance Big Island – benthic cover, benthic reflectance Maui - benthic cover, benthic reflectance Lanai - benthic cover, benthic reflectance	Sample full chain, from Big Island to Kure
Kyle Cavanaugh, Greg Okin, Tom Bell	Kaneohe Bay, west coast Hawaii, west coast Maui	Underwater photos, spectral measurements	Kaneohe Bay, west coast Hawaii, west coast Maui



Coral Reef Flight Line Planning will optimize for reducing sun glint:
Heading of aircraft in and out of solar principal plane
Collection window will be planned for solar elevation from 30 degree to 45 degrees
Works well with data time collections over Big Island of Hawaii, which is is focused on high sun angle collections

EVS2 CORAL Hawaii Flight Lines

NOAA/NRL Sites in NW Islands



Conclusion

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