

HyspIRI and Surface Biology and Geology (SBG) Research and Applications Workshop Carnegie Institution for Science, Washington, DC

# Introduction

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## From 2007 to 2018, Here We Are

- Congratulations
- Thank You!





### **Our Evolving HyspIRI Approach – Where We Landed**

### **Key Global Science and Applications Research**

**Climate:** Ecosystem biochemistry, condition & feedback; spectral albedo; carbon/dust on snow/ice; biomass burning; evapotranspiration

**Ecosystems:** *Global* biodiversity, plant functional types, physiological condition, and biochemistry including agricultural lands

**Fires:** Fuel status; fire frequency, severity, emissions, and patterns of recovery *globally* 

**Coral reef and coastal habitats:** *Global* composition and status **Volcanoes:** Eruptions, emissions, regional and *global* impacts **Geology and resources:** *Global* distributions of surface mineral resources and improved understanding of geology and related hazards

Applications: Disasters, EcoForecasting, Health/AQ, Water

### Measurement

#### Imaging Spectrometer (VSWIR)

- 380 to 2510nm in ≤10nm bands
- 30 m spatial sampling
- 16 days revisit
- Global land and shallow water

#### Thermal Infrared (TIR)

- 8 bands between 4-12  $\mu m$
- 60 m spatial sampling
- 5 days revisit; day/night
- Global land and shallow water IPM-Low Latency data subsets





Wavelength (um

### **Global Mission Urgency**

The HyspIRI science and applications objectives are critical today and uniquely addressed by the combined imaging spectroscopy, thermal infrared measurements, and IPM direct



### **Mission Concept Status**

Level 1 Measurement Requirements: Vetted by community at workshops and in literature (many refereed journal articles) Payload: VSWIR Imaging Spectrometer, TIR Multi-spectral Radiometer, and Intelligent Payload Module (IPM) Original 60 m option: Mature

**ISS options:** VSWIR & TIR Mature, ECOSTRESS EVI selected **Separate Smallsat Mission option:** VSWIR and TIR solutions developed with TEAM I/X

**2016 Option:** HyspIRI VSWIR evolved to 30 m and 16-day global revisit. Requires F/1.8 Dyson spectrometer architecture and other current technologies.

**Preparatory Airborne Campaigns:** Measurements used to advance and refine science, applications, algorithms, and processing

Current Decadal Survey: >25 HyspIRI-related Dec. Sur. RFIs

## **Decadal Survey Implementation**

#### TABLE S.2 Observing System Priorities

Targeted Observable	Science/Applications Summary	Candidate Measurement Approach	Designated	Explorer	Incubation
Aerosols	Aerosol properties, aerosol vertical profiles, and cloud properties to understand their effects on climate and air quality	Backscatter lidar and multi- channel/multi-angle/polarization imaging radiometer flown together on the same platform	X		
Clouds, Convection, and Precipitation	Coupled cloud-precipitation state and dynamics for monitoring global hydrological cycle and understanding contributing processes including cloud feedback	Radar(s), with multi-frequency passive microwave and sub-mm radiometer	X		
Mass Change	Large-scale Earth dynamics measured by the changing mass distribution within and between the Earth's atmosphere, oceans, ground water, and ice sheets	Spacecraft ranging measurement of gravity anomaly	X		
Surface Biology and Geology	Earth surface geology and biology, ground/water temperature, snow reflectivity, active geologic processes, vegetation traits and algal biomass	Hyperspectral imagery in the visible and shortwave infrared, multi- or hyperspectral imagery in the thermal IR	X		
Surface Deformation and Change	Earth surface dynamics from earthquakes and landslides to ice sheets and permafrost	Interferometric Synthetic Aperture Radar (InSAR) with ionospheric correction	X		

# **SBG: Where We Go From Here**

- ESD will direct responsibility for the designated observables (DOs) to the NASA centers
- Instruments and spacecraft will be provided by partners or competed
- ESD requested multi-center plans for each DO to perform broad trade-space studies to meet research and applications objectives
- 4 Multi-Center plans for DO studies submitted July 16
- Included SBG plan from 5 Centers (JPL, GSFC, ARC, LARC, MSFC)



# **SBG: Where We Go From Here**

- HQ ESD 3-week evaluation
- Study Coordinator JPL/Jamie
  Nastal integrating responses
- Series of Center and Center-HQ calls to discuss and iterate points in evaluation
- Revised SBG study plan → statement of work to initiate study
- Plan includes broad engagement of academic, interagency, international, and other potential stakeholders and end users
- This workshop is your first opportunity to contribute ideas as the SBG study kicks off



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## **Next Three Days**

Day 1 - HyspIRI: Our Foundation



### Days 2 and 3 - SBG: Looking Ahead

### **A SATM Framework for This Workshop**

Research / Applied Science Question	Research / Applied Science Objective(s)	Partners	Partner Data Baseline	Physical Parameters	Observables	Requirements	Anticipated / Desired Capability	Mission Functional Requirements	DS Ref.
What areas within an urban region are most impacted or vulnerable to heat stress?	AS-I. Determine areas with highest rates of intensity of heat stress / urban heat island for XXXX dates.	Public Health County Water and Power Utilities	X weather stations in ABC County. Historical daily weather station data, minimal geospatial datasets. ?	Optimally, LST with uncertainty XYZ, with spatial ABC resolution and DEF temporal resolution for GHI years.	Optimally, LST with uncertainty XYZ, with spatial ABC resolution and DEF temporal resolution for GHI years.	pixel size, swath width, wavelength range, dynamic range, NEDT at sensor		Need to have coverage of LA County Region. LAC Region is in the XYZ orbit.	
	AS-II Determine differences in heat stress as determined by HI vs HVI	Public Health County Water and Power Utilities		Spatial Resolution, Temporal Resolution, Spatial Coverage, Uncertainty	Spatial Resolution, Temporal Resolution, Spatial Coverage, Uncertainty			Heat wave info is determined daily by X weather stations. XYZ instrument will fill spatial gaps on days data are available.	W-2, W-3
	AS-III. Determine urban heat island and vulnerability climatology data over 15 years to inform long term planning metrics to mitigate impacts of heat stress	City or County Planning			Urban vegetation (?)				

## **Thank You**