WELCOME ATTENDEES

PLEASE Check-In at the Table and:

– Get Name Tag & Agenda

– Pay for Lunch (with sticker as receipt)

See table in the back of Room

8:00 -8:30 am: **Registration Check-In**

Coffee and donuts

Posters Displayed

GSFC EO-1/HyspIRI Team

Betsy Middleton, NASA
Bob Knox, NASA
Steve Ungar, UMBC

Petya Campbell, UMBC
Qingyuan Zhang, UMBC
Fred Huemmrich, UMBC
Ben Cheng, ERT
Larry Corp, Sigma Space

Other Assistants for Symposium:
Hank Margolis, Laval University [TIMEKEEPER]
Sandi Bussard, Jacob Gude, Sheila Humke & Carla Evans
Sigma Space

look for flags on their name tags

LOGISTICS

Restrooms
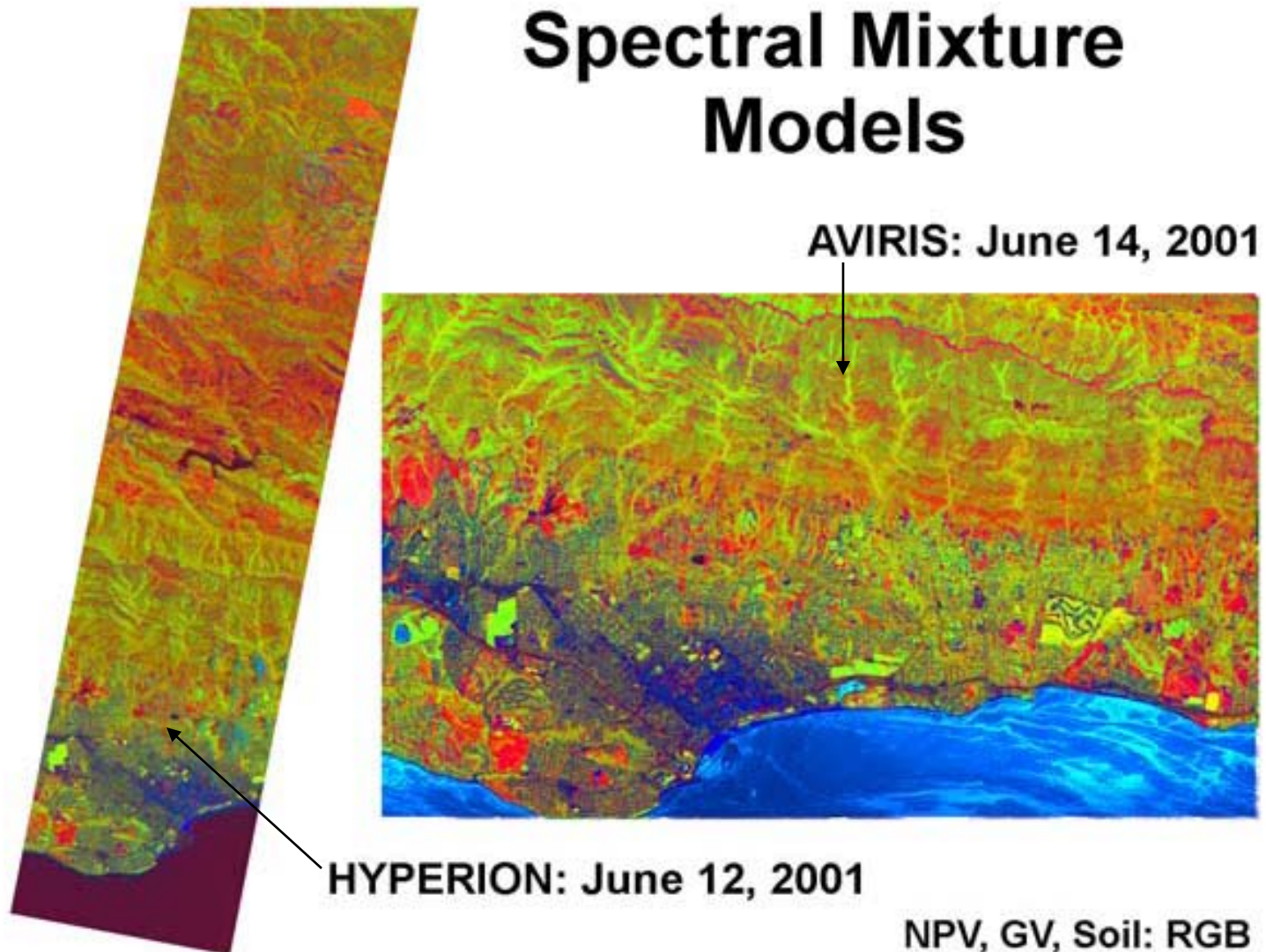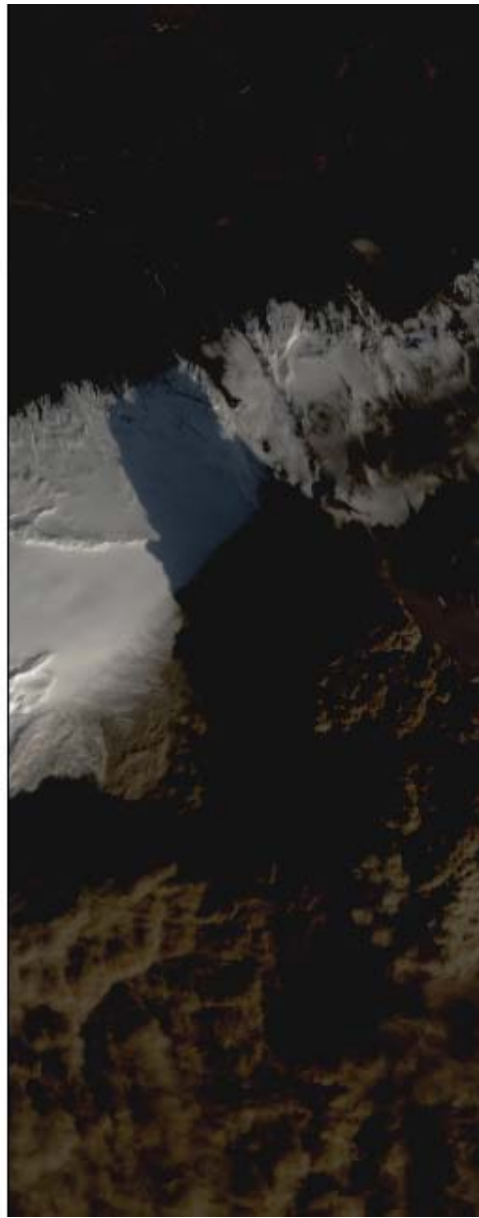
Posters

Lunch

Break-Out Groups

Dinner

Mapping Fuel Condition: Hyperion provides comparable measures to AVIRIS over a larger geographic region

Spectral Mixture Models

AVIRIS: June 14, 2001

HYPERION: June 12, 2001

NPV, GV, Soil: RGB

Roberts et al. (2003)

EO-1 Hyperion Imaging of Eyjafjallajökull Volcano Eruption 17 April 2010

SWIR - thermal vent visible

VIS -plumes coating everything to the South-East making the ice brown/gray

HyspIRI Science Symposium on Ecosystem Data Products

Sponsor: NASA/Goddard Space Flight Center

May 4 & 5, 2010

Building 33, Conference Room H114 (and H118, H120)

Focus: Identifying Potential Higher Level Products for Climate/Carbon End Users

Objectives:

Identify science/application data products to be derived from HyspIRI measurements *by users*;

Discover/Discuss issues underlying data product processing/integration/fusion;
Prioritize the development of product prototypes.

Science Discipline Areas to be addressed: Terrestrial Ecosystems, Agriculture

Science Questions for the HyspIRI Mission
(http://hyspIRI.jpl.nasa.gov)

HyspIRI has three top-level science questions [identified in the NRC Decadal Survey] related to:

1) Ecosystem function and composition,

What is the global distribution and status of terrestrial and coastal-aquatic ecosystems and how are they changing?

2) Volcanoes and natural hazards,

How do volcanoes, fires and other natural hazards behave and do they provide precursor signals that can be used to predict future activity?

3) Surface composition and the sustainable management of natural resources.

What is the composition of the land surface and coastal shallow water regions and how can they be managed to support natural and human-induced change?

VSWIR Questions: 6 over-arching questions. VQ1-6 (with 35 sub-questions)

TIR Questions: 5 over-arching questions, TQ1-5 (with 23 sub-questions)

Combined VSWIR and TIR Questions: 6 over-arching questions, CQ1-6 (with 32 sub-questions)

Terrestrial Ecosystems: *HyspIRI Science Questions*

VQ1: Ecosystem Pattern, Spatial Distribution and Components

What is the global spatial pattern of ecosystem and diversity distributions and how do ecosystems differ in their composition or biodiversity?

VQ2: Ecosystem Function, Physiology and Seasonal Activity

What are the seasonal expressions and cycles for terrestrial and aquatic ecosystems, functional groups, and diagnostic species? How are these being altered by changes in climate, land use, and disturbance?

VQ3: Biogeochemical Cycles

How are the biogeochemical cycles that sustain life on Earth being altered/disrupted by natural and human-induced environmental change? How do these changes affect the composition and health of ecosystems and what are the feedbacks with other components of the Earth system?

VQ4: Disturbance Regimes

How are disturbance regimes changing and how do these changes affect the ecosystem processes that support life on Earth?

TQ2 and CQ2: Wildfires

TQ2: What is the impact of global biomass burning on the terrestrial biosphere and atmosphere, and how is this impact changing over time? CQ2 How are fires and vegetation composition coupled?
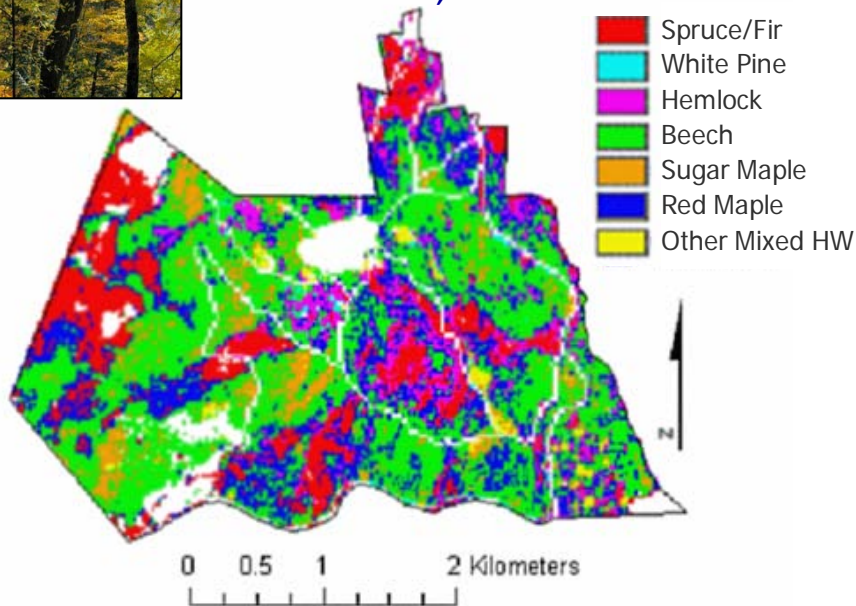
CQ4: Ecosystem Function and Diversity

How do species, functional type, and biodiversity composition within ecosystems influence the energy, water and biogeochemical cycles under varying climatic conditions?
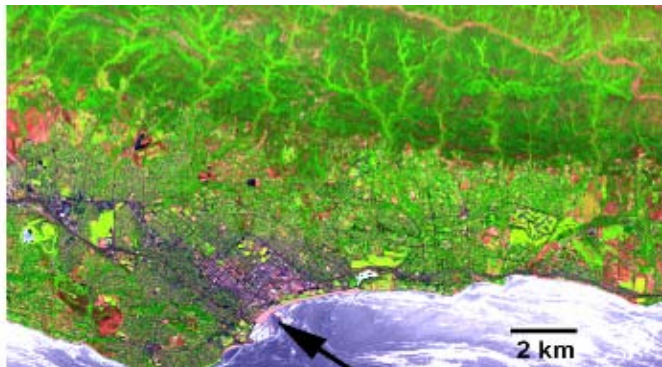
Determine the global distribution, composition, and condition of ecosystems, including agricultural lands

Tree species mapping, Bartlett Forest, NH

Legend:
- Spruce/Fir
- White Pine
- Hemlock
- Beech
- Sugar Maple
- Red Maple
- Other Mixed HW

0   0.5   1   2 Kilometers

N

HyspIRI Airborne Simulator Data Set

2 km

Societal Issue:
• Forests, farmlands and a variety of other ecosystems are critical to life on the Earth. Many ecosystems are changing in ways that are poorly understood.
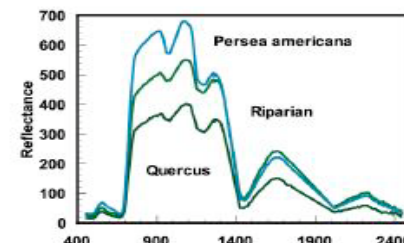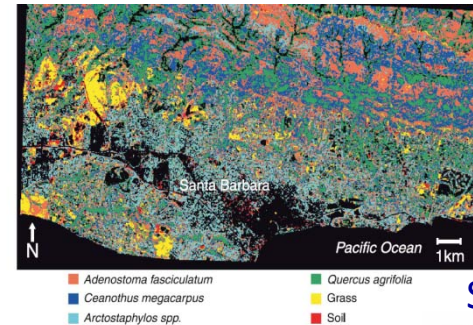
Scientific Issue:
• Understanding the distribution, diversity and status of ecosystems is necessary for understanding how they function and for predicting future changes.

Approach (Why we need HyspIRI):
• HyspIRI will provide an important new capability to detect & monitor ecosystem composition and condition globally, with spectroscopic and thermal measurements.

Species Type Determination

Santa Barbara

Pacific Ocean   1km

N

- Adenostoma fasciculatum
- Ceanothus megacarpus
- Arctostaphylos spp.
- Quercus agrifolia
- Grass
- Soil

Reflectance — Persea americana, Riparian, Quercus
400 900 1400 1900 2400

Species Fractional Cover

1km   0 25 50 75 100
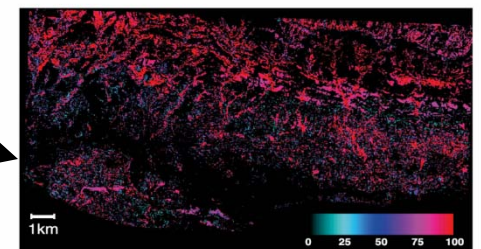
(a) MIVIS
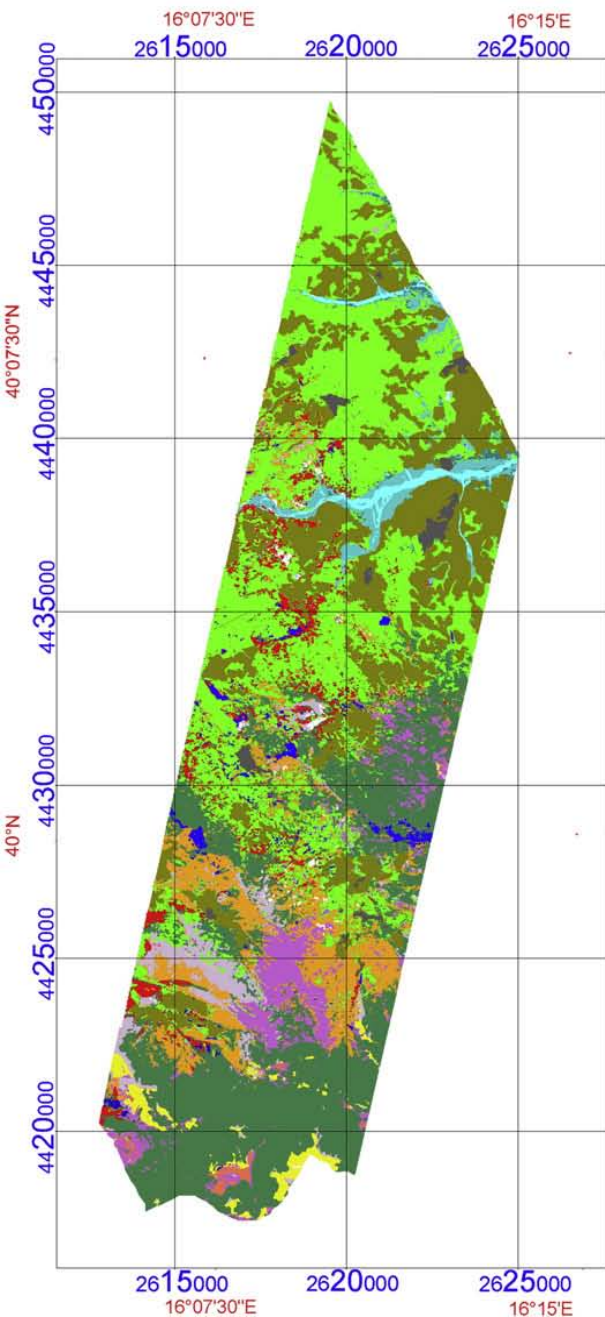
(b) Hyperion
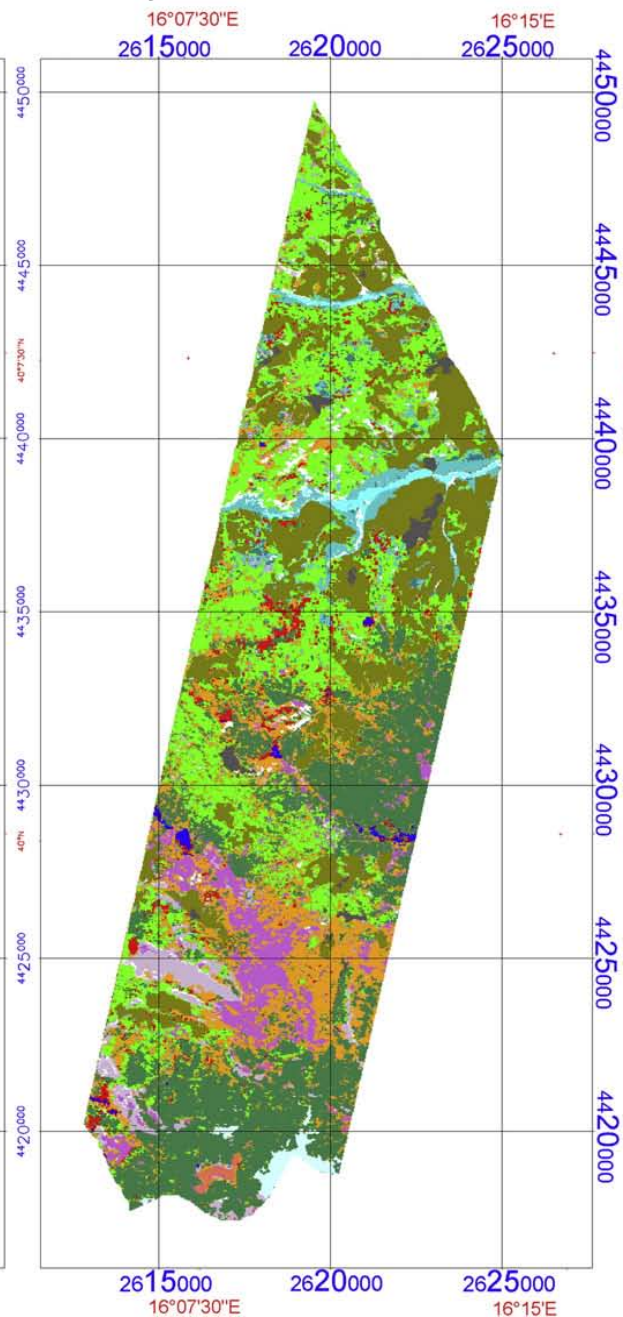
Mapping land cover and vegetation diversity in a fragmented ecosystem

Legend:
- 1.1. Urban areas
- 2. Arable lands
- 3.1.1.1. Quercus ilex (holm oak) and evergreen woods
- 3.1.1.2. Mixed woods with dominant presence of deciduous oaks
- 3.1.1.5. Beech woods
- 3.1.1.6. Riparian woods
- 3.1.2. Conifers woods
- 3.2.1. Prairies, pastures
- 3.2.1.1. Xerophylous prairies
- 3.2.1.1.(a). High mountain prairies
- 3.2.1.4. Mesophylous prairies
- 3.2.2. Deciduous thickets
- 3.3.2. Bare surfaces, Rock outcrops
- 3.3.3. River beds (sand and gravel banks unvegetated)
- 3.3.3.(a). Riparian areas (sand and gravel banks vegetated)
- Snow

Ability to map up to the 4th level of the CORINE legend

CORINE Land Cover 2000

Pignatti et al. (2009)

VSWIR Spectrometer (212 contiguous channels)

Level 0: Digital Numbers

Level 1: 1A - Level 0 reconstructed, time-referenced and annotated with ancillary information, 1B : surface radiance spectra & water leaving radiance spectra at TOA. Cloud screened images.

Level 2: _Description_ - Swath data. **Products** - TOA and Surface Reflectance (%) Spectra.
===

Level 3: _Description_ - Swath _and_ Gridded data, Terrain corrected products.
Products: Albedo, Land cover classifications, Composites (seasonal, regional and global composites), Spectral indices for vegetation function/health, Spectral indicators for canopy contents (pigments, nitrogen, water, Maps of end-member abundance.

Level 4: _Description_ – Time series, Model outputs, Multi-sensor data fusion, Assimilation with other data types (e.g., ET, Fire fuel & fuel moisture).
Products – Regional Scale (60m-1km): _For specific sites, watersheds, geographical units or global samples of ecosystems, but potentially for global maps:_ Gross Primary or Ecosystem Production (GPP, GEP); Net Primary or Ecosystem Production (NPP, NEP); Fractional land cover; Fractional vegetation cover (FVC), based on: photosynthetic vegetation (PV) and non-photosynthetic vegetation (NPV), Soil, Water, Snow, Ice; Fractional PAR absorption (_f_APAR); Leaf area index (LAI); Water Content; Plant functional types (PFT); Fractional vegetation cover by PFT(FVC); Light-use efficiency (LUE); Canopy stress and Physiology (combining PFT, LAI, canopy water, nutrients, pigments); Ecological disturbance (>10% change); Susceptibility to fires (fire fuels & fuel moisture, FVC, canopy water); Susceptibility to hazards (e.g., landslides).
Products -Global Scale (gridded, ¼-1 deg+): _For modeling ecosystems/general cover categories:_ GPP, GEP; NPP, NEP; Fractional land cover (Veg., Soil, Water, Snow, Ice); _f_APAR; LAI; Water Content; Disturbance (>10% change).

TIR Multiband Sensor (8 discrete bands)

Level 0: Digital Numbers

Level 1: 1A - Level 0, reconstructed, time-referenced and annotated with ancillary information; 1B – surface band radiances at TOA, Cloud screened images. *__Products__* – Brightness temperature.

Level 2: *Description* - Swath data. *__Products__* – Land Surface Temperature, LST (day or night); Surface Spectral Emissivity (day or night); Detection of fire events.

===

Level 3: *Description* – Day or night swath and gridded data, Terrain corrected, Day or Night Composites (seasonal, regional and global).

__Products__ – Distribution and variation in land surface temperature, surface spectral emissivity maps, Water stress indicators; Fire severity, directions and associated risks.

Level 4: *Description -* Time series, Model outputs, Multi-sensor data fusion, Assimilation with other data types.

__Products - Regional (60m-1km):__ *For specific sites, watersheds, geographical units, agricultural fields, or global samples of ecosystems, but potentially for global maps:* LST (from temperature/emissivity separation) by functional groups and ecosystem types, LST urban/sub-urban, Evapotranspiration (ET).

__Products - Global (gridded, ¼-1 deg+):__ *For modeling ecosystems/general cover categories:* LST and emissions by Fractional land cover (Vegetation, Soil, Water, Snow, Ice), ET, Increase in sensible heat due to Urban Heat Islands (anthropogenic heat).

Synergy between TIR Day & Night and VSWIR & TIR

Level 4 Products: Time series, Model outputs, Multi-sensor data fusion, Assimilation with other data types.

TIR, day and night - *Products - Regional (60m-1km) & Global (1-5 deg. grids)*:

 Bi-weekly, monthly and/or seasonal averages for day-night temperature & emissivity differences per geographic study unit (watershed, etc.).

VSWIR and TIR – *Products - Regional (60m-1km) & Global (1-5 deg. grids)*:

- Day-night temperature & emissivity differences according to vegetation/ecosystem type,
- LST (from day/night pairs) by functional groups and ecosystem types,
- Water/land boundaries defined,
- Ecosystem & Agricultural Crop Classifications, using both VSWIR & TIR,
- ET per ecosystem or agricultural type, using both VSWIR & TIR,
- Assess fire severity and available fuel by vegetation type,
- Develop spectral Reflectance & Emission libraries by land cover types and/or vegetation functional groups (at regional and global scales),
- Develop *high spectral resolution indicators of ecosystem/crop health,* by combining VSWIR indices and TIR indices; Construct spectral indicators of ecosystem function, disturbance, diversity, maturity to improve modeled predictions.
- Compare high spectral resolution indicators to currently used broadband indicators of ecosystem/crop function.

Expected Outcomes of Symposium

Goal: To Identify and Evaluate Potential Higher Level Products for Climate/Carbon End Users, in Terrestrial Ecosystem & Agriculture Science/Applications.

Objectives/Outcomes:

1] Identify science/application data products that could be derived from HyspIRI measurements ***by users***;

2] Prioritize the development of product prototypes.

3] Discover issues underlying data product processing and related to data integration/fusion.

4] Address the case for relevance of HyspIRI to climate change studies.

5] Develop a report on the community consensus for **1-4** above.

DAY 1 (May 4): Morning Agenda

I. Establish Background

8:30 am: Welcome-- HQ on the HyspIRI mission concept and Decadal Survey status
  [**Woody Turner**]

8:45 am: Objectives and Outline of the Symposium & Expected Results [**Betsy Middleton**]

8:55 am: Overview of the Mission: Description of the VSWIR and TIR instruments
  [**Rob Green & Simon Hook**]

9:15 am: Relevance of HyspIRI to Carbon and Climate [**Susan Ustin**]

9:30 am: Orbit & Platform Information, update from Team X [**Bogdan Oaida**]

9:45 am: Description and Examples of Typical VSWIR and TIR Image Collections [**Bob Knox**]

10:00 am: **Questions/Answers** (10 minutes)

10:10 -10:30 am: Coffee Break & Posters

II. Science & Application Products from the User Community: VSWIR & TIR

10:30 am –noon: Proposed VSWIR and TIR High Level Products [7 speakers, 10 min each]
  [**Phil Townsend**, **John Gamon**, **Anatoly Gitelson**, **Mary Martin**, **Ben Cheng, Simon Hook, Martha Anderson, Susan Ustin**]

*Noon - 1:00 pm: Lunch and Poster Session (Sandwiches/Drinks in conference serving area***)**

DAY 1 (May 4): Afternoon Agenda

III. Factors Affecting Product Integrity and Availability   **1:00 – 2:30 pm (10 min each)**

* Atmospheric Correction [**Rob Green**]

* Data volume/compression, SpaceCube [**Tom Flatley**]

* Intelligent Payload Module (IPM) & algorithms for upload [**Vuong Ly/Dan Mandl**]

* Low-latency Applications, Science, and Operations for HyspIRI [**Steve Chien**]

* On-line tools to facilitate HyspIRI products and analysis [**Petya Campbell**]

* Hyperspectral Input to models [**Fred Huemmrich**]

* Calibration/Validation & CEOS/GEO [**Joanne Nightingale**]

* Impact of Spectral-Spatial Misalignment on Measurement Accuracy [**Steve Ungar**]

IV. Science & Application Products from the User Community: Combined VSWIR & TIR

2:30 -2:50 pm: Combined VSWIR/TIR Products Overview: Issues & Examples
    [**Betsy Middleton/Bob Knox**]

2:50-3:00 pm: **Questions/Answers** (10 minutes)

3:00-3:20 pm – Coffee Break & Posters

3:20- 4:30 pm: Proposed Combined Products (7 speakers, 10 min each)

[**Rasmus Houborg, Louis Giglio, Dar Roberts, Dale Quattrochi**, **Ben Cheng, Ray Kokaly, Craig Daughtry**]
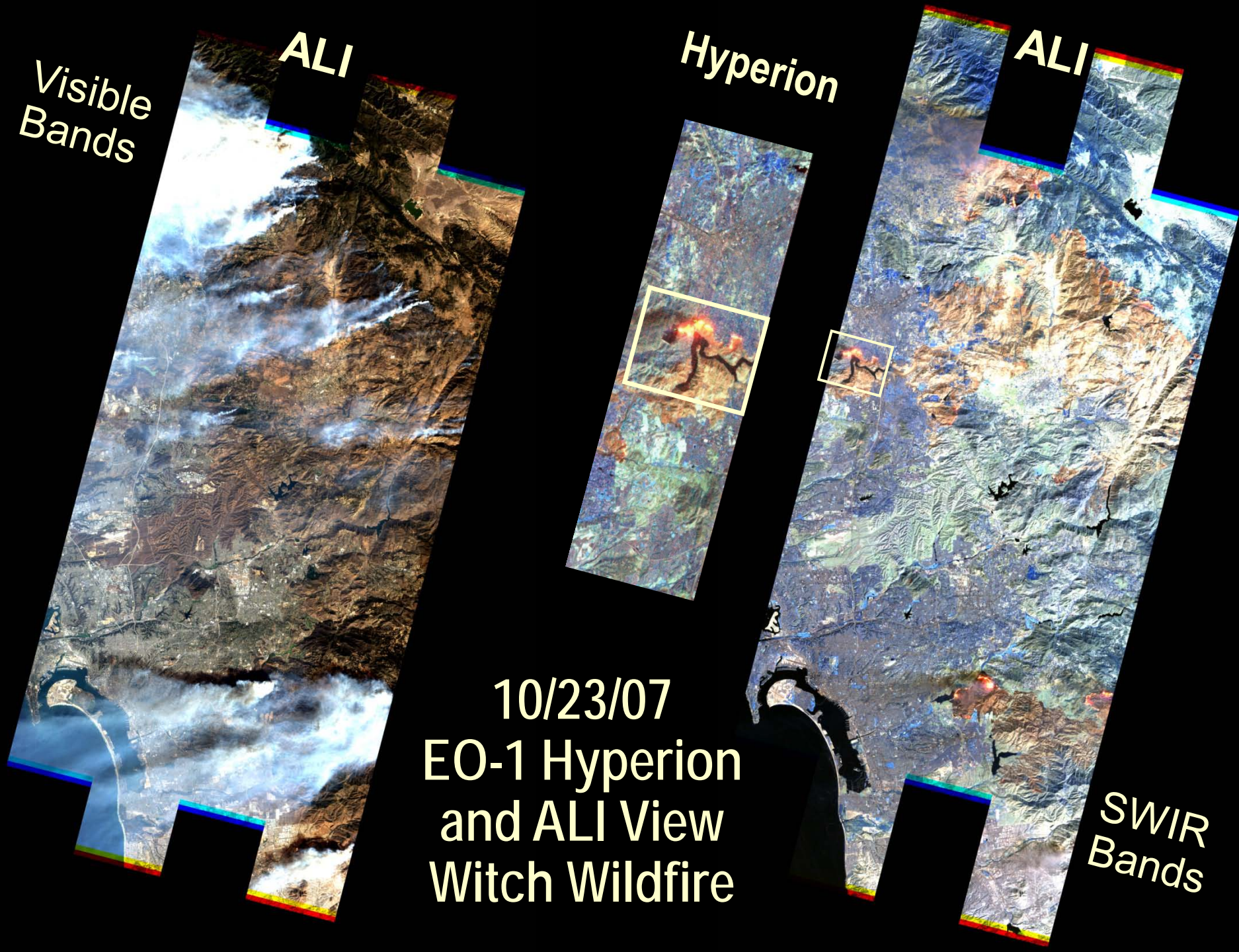
Visible Bands

ALI

Hyperion

ALI

10/23/07
EO-1 Hyperion
and ALI View
Witch Wildfire

SWIR Bands

The Break-Out Group Discussions
[Topics for consideration]

How important is HyspIRI to the User Community, for TE and climate?

What are the most important Products for Terrestrial Ecology?

What are the Tools needed to produce these Products?

What are the road-blocks to having Products that users want?

DAY 1 (May 4): Afternoon Agenda Con't

V. Special & Potential Observation Capabilities
4:30-4:40 pm: Special Opportunities for Highly Sampled Areas
          (orbit overlaps, high latitudes etc.) [**Bob Knox**]
4:40-4:50 pm: Synergy of VSWIR and Lidar for Ecosystem Biodiversity
          [**Bruce Cook/Greg Asner**]

VI. Break-Out Discussions (Guidelines, **Betsy)**
4:55 -6:15 pm: Three Simultaneous Break-Out Discussions
          (H114, H118, H120)
          VSWIR Products [**Phil Townsend/John Gamon**]
          TIR Products [**Simon Hook/Kurt Thome**]
          Combined Products [**Dar Roberts/Susan Ustin**]

6:20 pm – Adjourn, Dinner at Chevy's Restaurant, Carpools Organized

drained
thermokarst lake —

—Barrow Environmental Observatory

2 km

Barrow, AK

Barrow airport—

Point Barrow

July 20, 2009
False-Color and True-Color Images from Hyperion
Barrow, Alaska

LOGISTICS

Posters

Luggage

Transportation to Main Gate

Lunch

AGENDA – DAY 2 (May 5)

8:00 - 8:20 am: Coffee and donuts, Posters

8:30 -8:40 am: Review of Day 1 [**Betsy**]

VII. Related Activities to HyspIRI Mission

8:40 – 9:00 am: 2 Presentations on 2009 Funded HyspIRI Preparatory Studies

[**Petya Campbell, Phil Townsend**]

9:00 – 9:15 am: International collaborations, ISIS & WGCV [**Rob Green**]

9:15 – 9:35 am: A Mission Calibration Plan to support Products

[**Kurt Thome/Rob Green/Simon Hook**]

9:35 – 10:10 am: Synthesis of the Three Break-out Group Inputs (10 min each)

[**Phil/John, Simon/Kurt, Dar/Susan**]

10:10 -10:30 am: Coffee Break & Posters

AGENDA – DAY 2 (May 5) Con't

VIII. Building a Team Consensus

10:30 – 11:00 am: Plenary Discussion, Aligning HyspIRI with Climate Observations
[**Susan Ustin/Dar Roberts**]

11:00 – 11:30 am: Plenary Discussion on Priority Products, [**led by Betsy, Rob & Simon**]

11:30 am – Noon: Consensus on Draft Products for HyspIRI, Outline of Symposium Report
[**Betsy, Rob, Simon**]

Noon – 12:30 pm: Preparation Activities for 3rd Science Workshop
[**Rob, Simon, Woody Turner**]

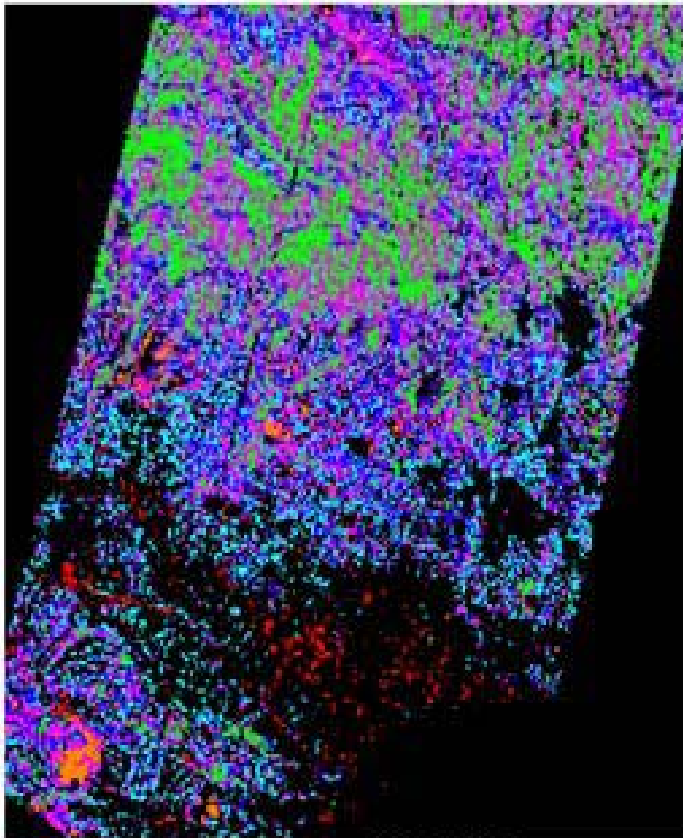12:30 pm: Close General Meeting

Adjourn, or Lunch at Cafeteria

*1:30-3:00 pm: **Optional** Opportunity to show PI presentations in small conference rooms [H118]*
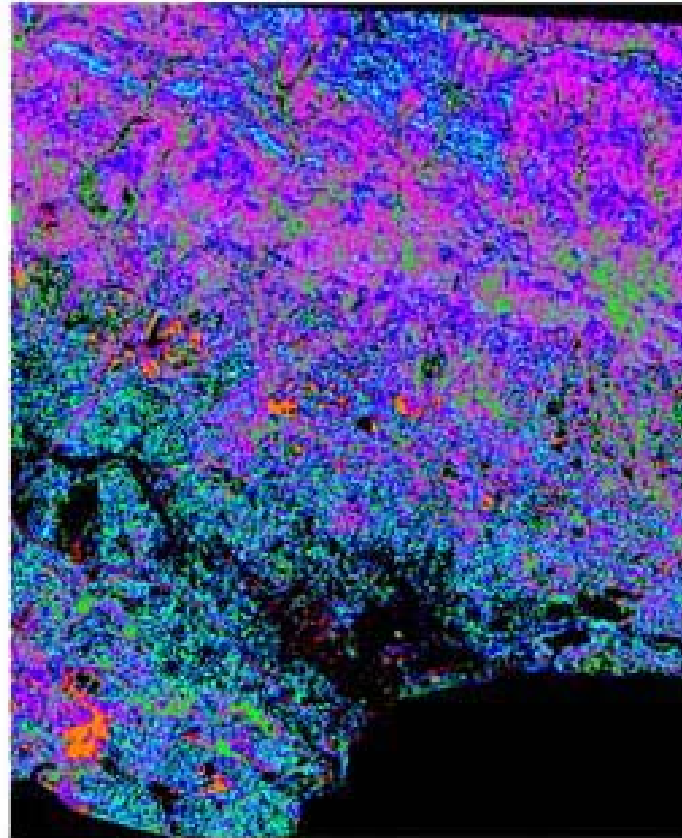
and
Steering Committee Meeting [H120]

Mapping Vegetation Type in a Shrubland

Roberts et al.