HYSPIRI SCIENCE AND APPLICATIONS

Simon J. Hook[1]
Elizabeth Middleton
Robert O Green
[1]Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California 91109
Tel: 818-354-0974[1]
Fax: 818-354-5148
Email: Simon.J.Hook@jpl.nasa.gov

Abstract

In 2004, the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS) requested the National Research Council (NRC) identify and prioritize the satellite platforms and associated observational capabilities that should be launched and operated over the next decade for Earth observation. In addition to providing information for the purpose of addressing scientific questions, the committee identified the need to ensure that the measurements helped benefit society and provide policymakers with the necessary information to make informed decisions on future policies affecting the Earth.

The resulting NRC study Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond, also known as the Earth Science Decadal Survey, (NRC, 2007) recommended launching 15 missions in three time phases. These three time phases are referred to as Tier 1, Tier 2, and Tier 3, respectively. The Hyperspectral Infrared Imager (HyspIRI) mission is one of the Tier 2 missions recommended for launch in the 2013–2016 timeframe. This global survey mission provides an unprecedented capability to assess how ecosystems respond to natural and human-induced changes. It will help us assess the status of biodiversity around the world and the role of different biological communities on land and within inland water bodies, as well as coastal zones and at reduced resolution in the ocean. Furthermore, it will help identify natural hazards; in particular volcanic eruptions and any associated precursor activity, and it will map the mineralogical composition of the land surface. The mission will advance our scientific understanding of how the Earth is changing as well as provide valuable societal benefit, in particular, in understanding and tracking dynamic events such as volcanoes and wildfires.

The HyspIRI mission includes two instruments: a visible shortwave infrared (VSWIR) imaging spectrometer operating between 0.38 and 2.5 µm at a spatial scale of 60 m with a swath width of 145 km and a boresighted thermal infrared (TIR) multispectral scanner operating between 4 and 12 µm at a spatial scale of 60 m with a swath width of 600 km. The VSWIR and TIR instruments have revisit times of 19 and 5 days, respectively. Several of the other Tier 1 and Tier 2 missions provide complementary measurements for use with HyspIRI data, in particular, the DESDynI, ACE, ICESat-II, and GEO-CAPE Decadal Survey missions each of which addresses very different spatial scales compared to the local and landscape scales observable with HyspIRI. While the synergy between HyspIRI and other sensors, including those on operational satellites, benefits all missions and would support relevant scientific endeavors, the ability of HyspIRI to achieve its primary mission goals is not dependent on data from these other instruments.

The HyspIRI mission is science driven. In other words, one can trace back the measurement requirements for the mission to a particular science question. HyspIRI has three top-level science questions related to 1) Ecosystem function and composition, 2) Volcanoes and natural hazards, and 3) Surface composition and the sustainable management of natural resources. The NRC Decadal Survey called out these three areas. The top-level science questions for the HyspIRI mission are:

Ecosystem function and composition

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

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?

Surface composition and 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?

These questions provide a scientific framework for the HyspIRI mission. NASA appointed the HyspIRI Science Study Group (SSG) to refine and expand these questions to a level of detail that was sufficient to define the measurement requirements for the HyspIRI mission.

The SSG developed a more detailed set of overarching thematic questions that were separated into three groups. The first two groups deal with overarching questions that may be addressed by only one of the two instruments. The third group requires data from both instruments. All three groups may require supporting measurements from other instruments, whether spaceborne, airborne, or ground. The three question groups are referred to as the 1) VSWIR questions (VQ), 2) TIR questions (TQ) and 3) Combined questions (CQ), respectively. Within each of these overarching thematic questions, there are a set of thematic subquestions, and it is these subquestions that provide the necessary detail to understand the measurement requirements

All HyspIRI data will be available in a timely manner and current plans will allow a subset of the data to be transmitted in near real time. It is expected that the near real time data will be particularly valuable for applications related studies such as monitoring volcanic events or assessing the water needs of crops. In this paper the HyspIRI mission will be described together with the unique capabilities that relate to applications research.

References