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Subject: 2nd draft of Fall AGU OMEGA abstract

Hi folks:

Here is another draft, with mention of ST-7 and OMEGA removed.

Comments by noon, please: especially regarding the title! Once again, sorry about the short time-frame.

Regards,

Ashley.

Observing Active Volcanism on Earth and Beyond With an Autonomous Science Investigation Capability.

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Operational constraints imposed by restricted downlink and long communication delays make autonomous systems a necessity for exploring dynamic processes in the Solar System and beyond. Our objective is to develop an onboard, modular, automated science analysis tool that will autonomously detect unexpected events, identify rare events at predicted sites, quantify the processes under study, and prioritize the science data and analyses as they are collected. A primary target for this capability is terrestrial active volcanism. Our integrated, science-driven command and control package represents the next stage of the automatic monitoring of volcanic activity pioneered by GOES. The resulting system will maximize science return from day-to-day instrument use and provide immediate reaction to capture the fullest information from infrequent events. For example, a sensor suite consisting of a Galileo-like multi-filter visible wavelength camera and an infrared spectrometer, can acquire high-spatial resolution data of eruptions of lava and volcanic plumes and identify large concentrations of volcanic SO2. After image/spectrum formation, software is applied to the data which is capable of change detection (in the visible and infrared), feature identification (both in imagery and spectra), and novelty detection. The latter module detects change in the parameter space of the multi-component black-body volcanic thermal emission model by means of a novel technique called the "Grey-Box" method which analyzes time series data through a combination of deterministic and stochastic models. In this particular case, we use an advanced model of volcanic thermal emission.
This approach can be demonstrated using data obtained by the Galileo spacecraft of ionian volcanism. The system autonomously identifies the most scientifically important targets and prioritizes data and analyses for

return. All of these techniques have been successfully demonstrated in laboratory experiments, and are ready to be tested in an operational environment. After identification of a target of interest, an onboard planner prioritizes resources to obtain the best possible dataset of the identified process. We emphasize that the software is modular, the change detection and feature identification modules can be applied to any imaged dataset, and are not confined to volcanic targets. Applications are therefore widespread, across all NASA Enterprises. Examples include detection and quantification of extraterrestrial volcanism (Io, Triton), the monitoring of features in planetary atmospheres (Earth, Gas Giants), the ebb and flow of ices (Earth, Mars), asteriod, comet and supernova detection, change detection in magnetic fields, and identification of radio outbursts.

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