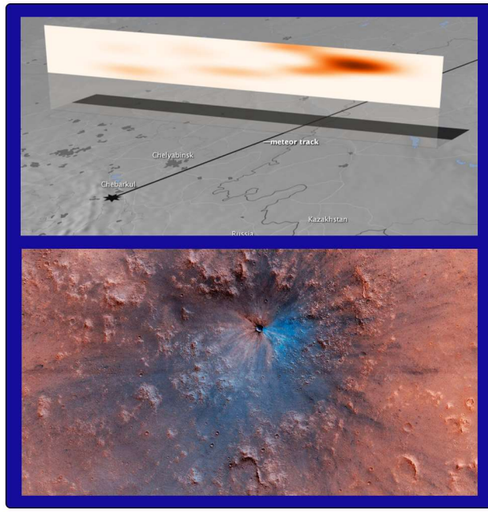
Abstract #8040: Considerations for a Rapid Response Team for Planetary Analog Events

L. P. Keszthelyi, M. E. Rumpf, T. N. Titus, C. M. Dundas, R. G. Vaughan

Why is Rapid Response Important?

Some of the most prominent features on planetary surfaces form as short-lived rare events. This includes impact cratering, some types of volcanism, dam-breach floods, and debris flows. Here we focus on events that last minutes to weeks and have recurrence intervals of decades to centuries. In these cases, failure to obtain data from these events would have serious negative consequences to planetary science for decades to centuries but it is impossible to respond to them through the traditional research and analysis proposal and grant process.



Top: NASA-NOAA Suomi NPP satellite observations of the stratospheric dust plume from the 2013 Chelyabinsk impact. **Bottom:** NASA MRO HiRISE image of the ephemeral effect of the blast and ejecta from a recent impact on Mars. Remote sensing is a key part of rapid response that NASA already does. But to understand the pattern of ejecta from small impacts on Mars, field observations from a Chelyabinsk-scale impact into the ground would be invaluable. Events like this have a recurrence interval of about a century and observations are needed within hours to days of the impact (depending on the weather). Warning times of hours to days is becoming more routine. Images from https://earthobservatory.nasa.gov/images/81844/tracking-the-chelyabinsk-meteor-plume and https://mars.nasa.gov/resources/22574/a-work-of-art/

USGS photo of 2014-2015 eruption at Holuhraun, Iceland. This was the largest effusive eruption of basaltic lava in over 100-years, producing features not seen on smaller eruptions on Earth but analogous to ones found on flood lavas on Mars. Events like these have a duration of months and a recurrence interval of many decades.

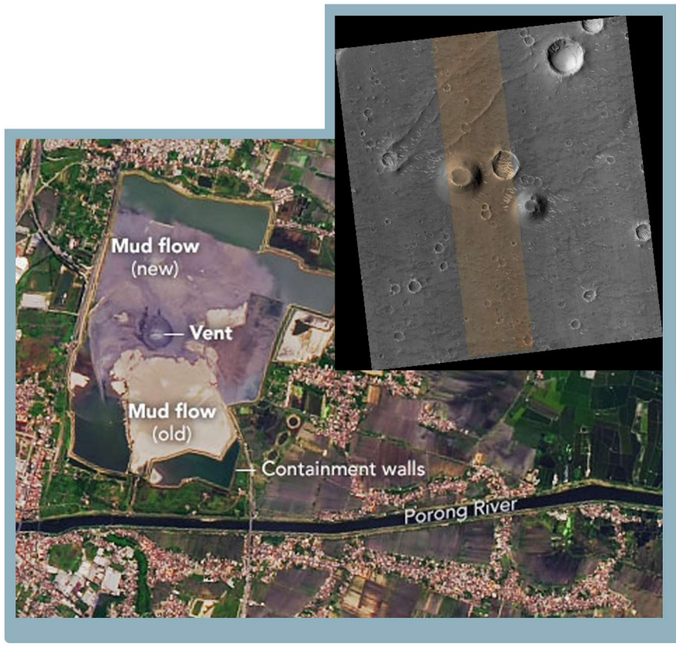
Challeges to Rapid Response

Foremost is the issue that, on Earth, rare geologic events that cause major changes to the landscape are almost universally considered to be disasters. Obtaining data for planetary science in the midst of a natural disaster cannot compete with protecting lives and property.

A close second is the safety (and liability) issues of sending a team into a natural disaster.

A tertiary challenge is the logistics of short notice travel, likely to be international. The need to provide rapid funding is also a significant challenge.

Of course, there is no point in sending a team if it does not have the needed equipment and the skills to properly operate it in difficult field conditions.



Solutions

For NASA, many of the funding and liability issues can be circumvented by relying on NASA civil servants. NASA has a very capable cadre of Earth/planetary scientists with much of the equipment and expertise that is desired.

For working within a natural disaster, it is essential to have strong relationships with the relevant disaster response groups to ensure that the activities that obtain data for planetary science are also beneficial to the effort to protect lives and property.

To establish a culture of safety, there is no substitute for regular practice to maintain proficiency in procedures and efficient team communications.

Suggested (NASA-centric) Plan

(1) At the next Workshop on Terrestrial Analogs for Planetary Exploration, establish a community-driven list of events that deserve this type of rapid response.

(2) Open communications with key disaster response groups, starting with ones that have relationships with NASA (e.g., FEMA, USGS), expanding to international groups over time.

(3) Practice rapid deployements in coordination with relevant disaster response groups. Deployements should be at least once a year and can collect useful data as well as improve safety, communication, and logistics.

Top right: NASA MRO HiRISE browse image of possible mud volcanoes near the Chinese Zhurong rover on Mars. Bottom left: 2019 NASA-USGS Landsat 8 image of the Lusi mud flow in Indonesia that started in 2006. Too little is known about this process to estimate recurrence intervals and expected durations (and some studies suggest it was triggered by human activity) but key observations related to the vent and the establishment of flow pathways were most readily made days to weeks after the flow started. Image from https://earthobservatory.nasa.gov/images/145198/a-muddy-mess-in-indonesia.