



SBG-TIR Science summary

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Research Objectives and Priorities

HYDROLOGY



H-1. How is the water cycle changing?

H-2. How do anthropogenic changes in climate, land use, water use, and water storage, interact and modify the water and energy cycles locally, regionally and globally.

H-4. Hazards, extremes, and sea level rise. How does the water cycle interact with other Earth system processes to change the predictability and impacts of hazardous events.

WEATHER



W-3. How do special variations in surface characteristics (influencing ocean and atmospheric dynamics, thermal inertia and water) modify transfer between domains?

ECOSYSTEMS AND NATURAL RESOURCES



E-1. What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space?

E-2. What are the fluxes of carbon, water, nutrients, and energy between ecosystems and the atmosphere, the ocean, and the solid Earth, and how and why are they changing?

E-3. Fluxes within ecosystems. What are the within ecosystems, and how and why are they changing?

CLIMATE



C-3. How large are the variations in the global carbon cycle and what are the associated climate and ecosystem impacts?

SOLID EARTH



S-1. How can large-scale geological hazards be accurately forecast in a socially relevant time frame?

S-2. How do geological disasters directly impact the Earth system and society following an event?

SBG: DECADAL SURVEY MOST AND VERY IMPORTANT RESEARCH OBJECTIVES ACROSS ALL FIVE DS FOCUS AREAS

Hydrology: Snow Temperature



ECOSTRESS image over Mt. Rainier

H-1: How is the water cycle changing? Are changes in evapotranspiration and precipitation accelerating, with greater rates of evapotranspiration and thereby precipitation, and how are these changes expressed in the space-time distribution of rainfall, snowfall, evapotranspiration, and the frequency and magnitude of extremes such as droughts and floods?

Garden City, Kansas
ECOSTRESS
October 4, 2020
14:40 local time

Hydrology: Evapotranspiration, Evaporative Stress Index Water use efficiency

H-2: How do anthropogenic changes in climate, land use, water use, and water storage interact and modify the water and energy cycles locally, regionally, and globally, and what are the short- and long-term consequences?

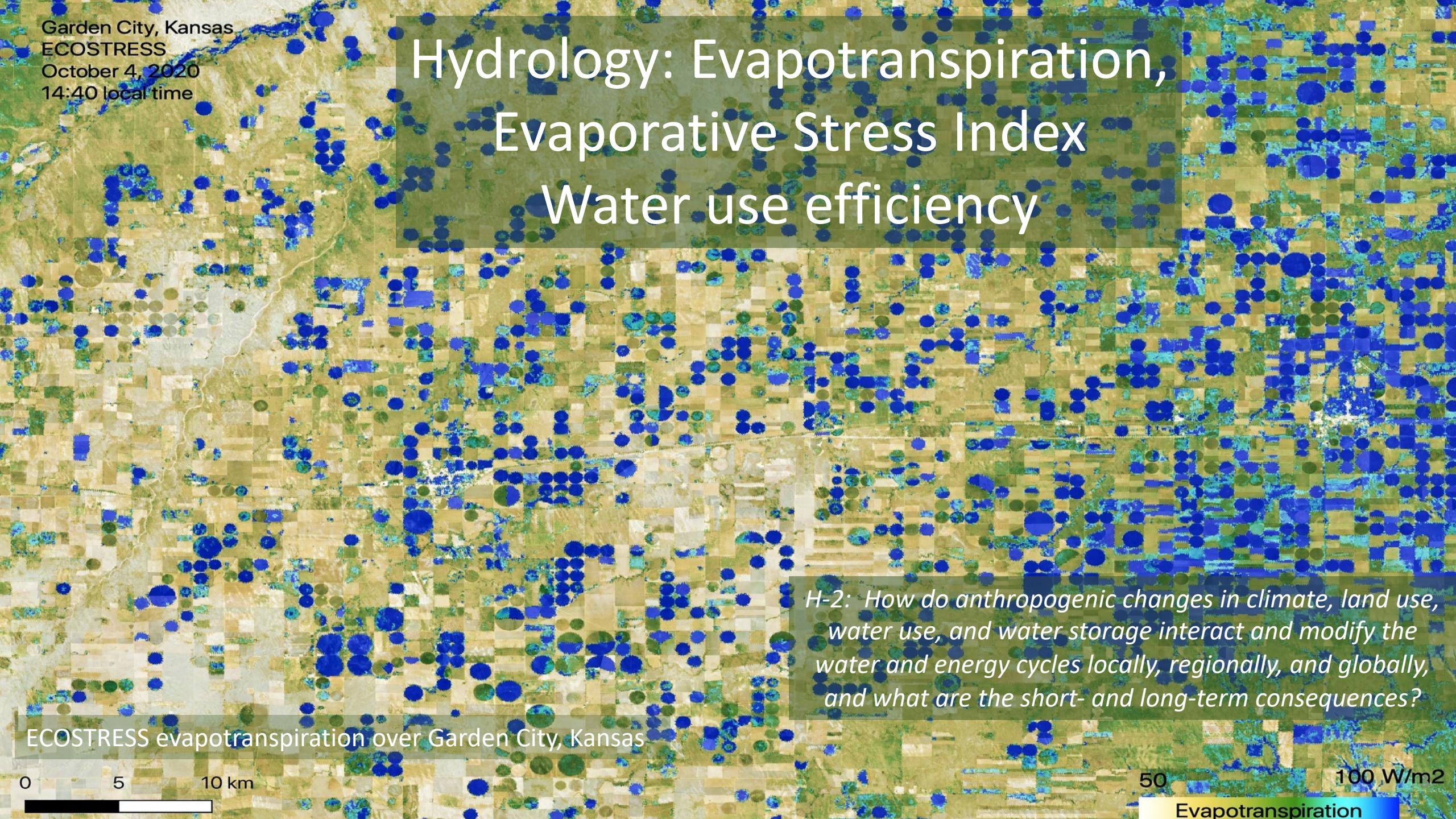
ECOSTRESS evapotranspiration over Garden City, Kansas

0 5 10 km

50

100 W/m²

Evapotranspiration



Hydrology: Urban heat



ECOSTRESS Land Surface Temperature in Los Angeles

H-2: How do anthropogenic changes in climate, land use, water use, and water storage interact and modify the water and energy cycles locally, regionally, and globally, and what are the short- and long-term consequences?

Ecosystems: Evapotranspiration, Evaporative Stress Index Water use efficiency

E-2: What are the fluxes (of carbon, water, nutrients, and energy) between ecosystems and the atmosphere, the ocean, and the solid Earth, and how and why are they changing?

ECOSTRESS evaporative stress over Sundarban WHS

Date-Time (IST): 2019-11-26 03:04:20 PM

Scene-Orbit: 07885-003

Data: ECOSTRESS-Evaporative Stress Index (ESI)

0 10 20 km

Low: 16%	ESI	High: 65%
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Ecosystems: Water Temperature



E-2: What are the fluxes (of carbon, water, nutrients, and energy) between ecosystems and the atmosphere, the ocean, and the solid Earth, and how and why are they changing?

Water surface temperature around the Channel Islands, CA

Solid Earth: Substrate Composition

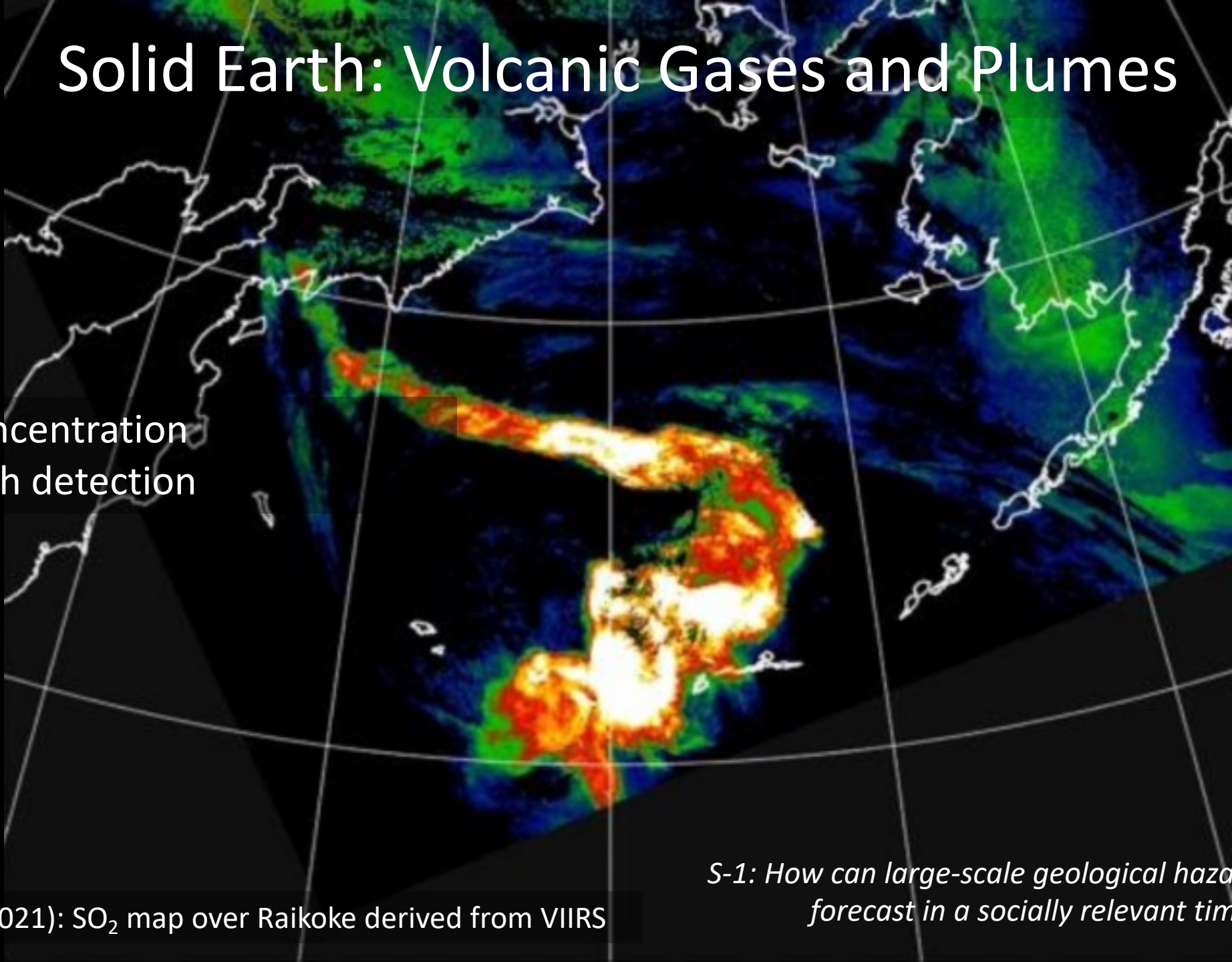


ECOSTRESS emissivity over Namibia

S-1: How can large-scale geological hazards be accurately forecast in a socially relevant time frame?

Solid Earth: Volcanic Gases and Plumes

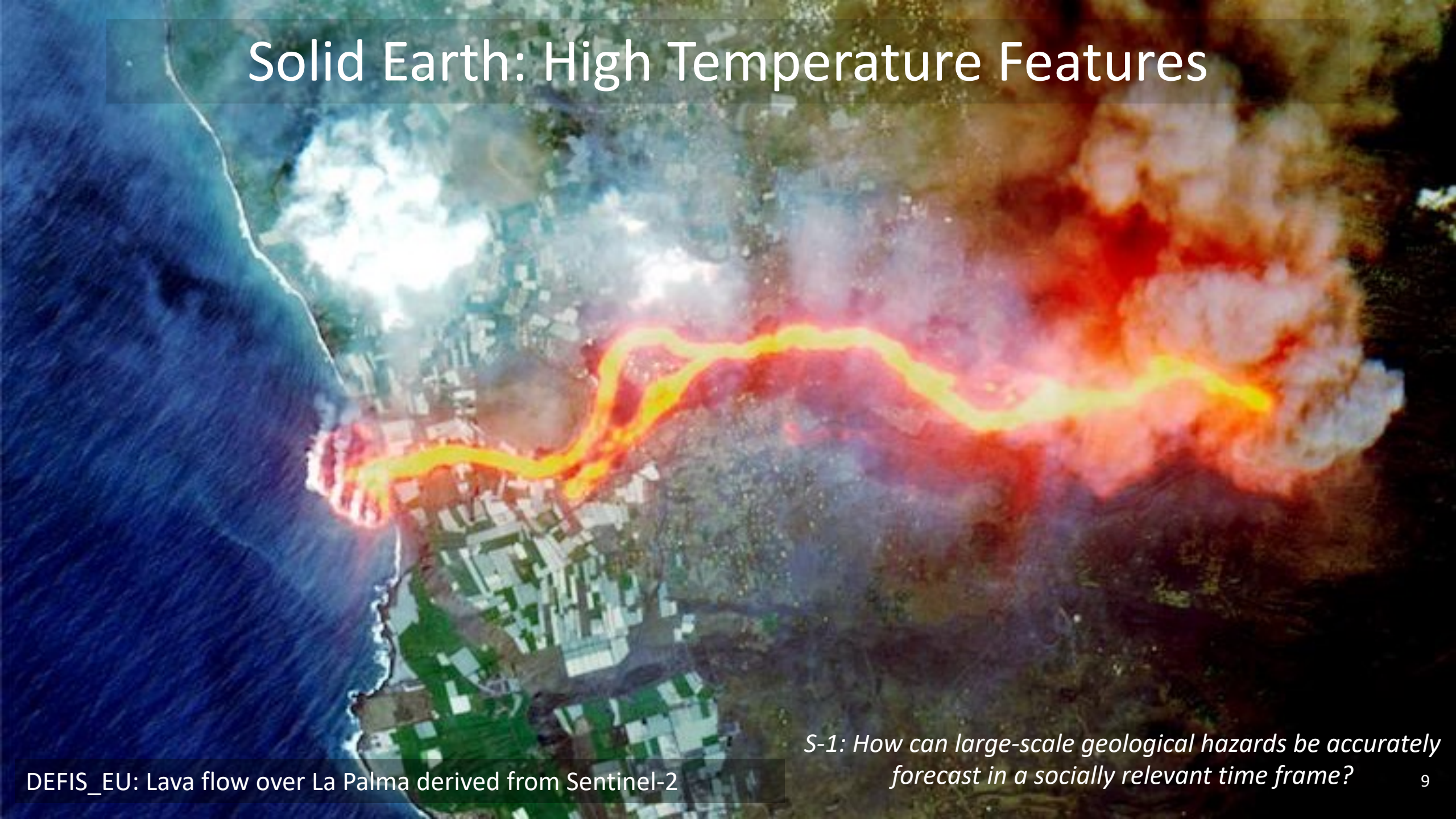
SO₂ gas concentration
Volcanic ash detection



Krotkov et al. (2021): SO₂ map over Raikoke derived from VIIRS

S-1: How can large-scale geological hazards be accurately forecast in a socially relevant time frame?

Solid Earth: High Temperature Features



DEFIS_EU: Lava flow over La Palma derived from Sentinel-2

S-1: How can large-scale geological hazards be accurately forecast in a socially relevant time frame?



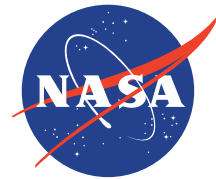
SBG Working Groups



SBG Opportunities for Involvement

- In-person SBG community workshop in early 2024 (more details to come)
- Internship programs at JPL and other NASA centers
- SBG working groups: ongoing, regular meetings and seminars
 - Algorithms (kcawseni@jpl.nasa.gov)
 - Modeling (benjamin.poulter@nasa.gov)
 - Calibration/Validation (kturpie@umbc.edu)
 - Applications (christine.m.lee@jpl.nasa.gov)
 - SBG/AOS synergy activities (david.r.thompson@jpl.nasa.gov)
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