# NASA Studies Landslides?! (and happy Pi day!)

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# About me: my roots

- Grew up in Minnesota
- Really liked math, but wanted to see how I could apply it to the "real world"
- Studied Geosciences at Princeton
- Went on to graduate school at Columbia to study remote sensing and natural disasters
- Was offered a position at NASA Goddard Space Flight Center in 2009

# What do I do?

- **Research** – How can we best use satellite data to understand where and when landslides are changing?
- **Outreach** – How can we best communicate what we are doing to the general public, K-12 students, etc.
- **Coordination** – Responding to disasters with others from across NASA
- **Strategic Planning and Organizing** – Leading teams, organizing NASA Applied Sciences for GSFC, etc.

*"To reach for new heights and reveal the unknown so that what we do and learn will benefit all humankind."*

**What We Study**

- How is the global Earth system changing?
- What causes these changes in the Earth system?
- How will the Earth system change in the future?
- How can Earth system science provide societal benefit?

# Operating NASA Earth Science Missions

ACT-America
Operating

Aqua
Operating

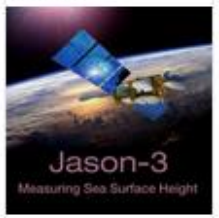
ATom
Operating

ATTREX
Operating

GRACE
Operating

Jason-2
Operating

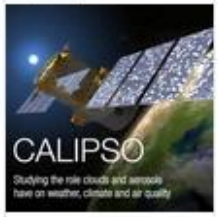
Jason-3
Operating




LAGEOS 1&2
Operating

Aura
Operating

CALIPSO
Operating



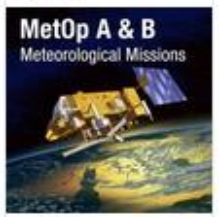

CloudSat
Operating

CORAL
Operating

Landsat 7
Operating

Landsat 8
Operating

MetOp A&B
Operating

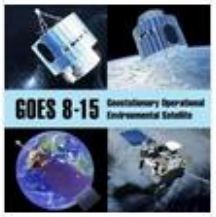



NOAA Spacecraft
Operating

DSCOVR
Operating

Earth Observing-1 (NMP)
Operating

GOES (8-15)
Operating

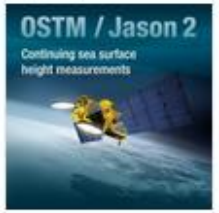



GPM
Operating

OCO-2
Operating

Operation IceBridge
Operating

OSTM/Jason-2
Operating




QuikSCAT
Operating

SMAP
Operating

SORCE
Operating

Suomi NPP
Operating

Terra
Operating

# Landslides: Why study them?

Landslide: a rapidly moving mass of debris, rock, earth, and/or mud triggered by intense and/or prolonged rainfall, earthquakes, freezing, coastal/river weathering, and human influence

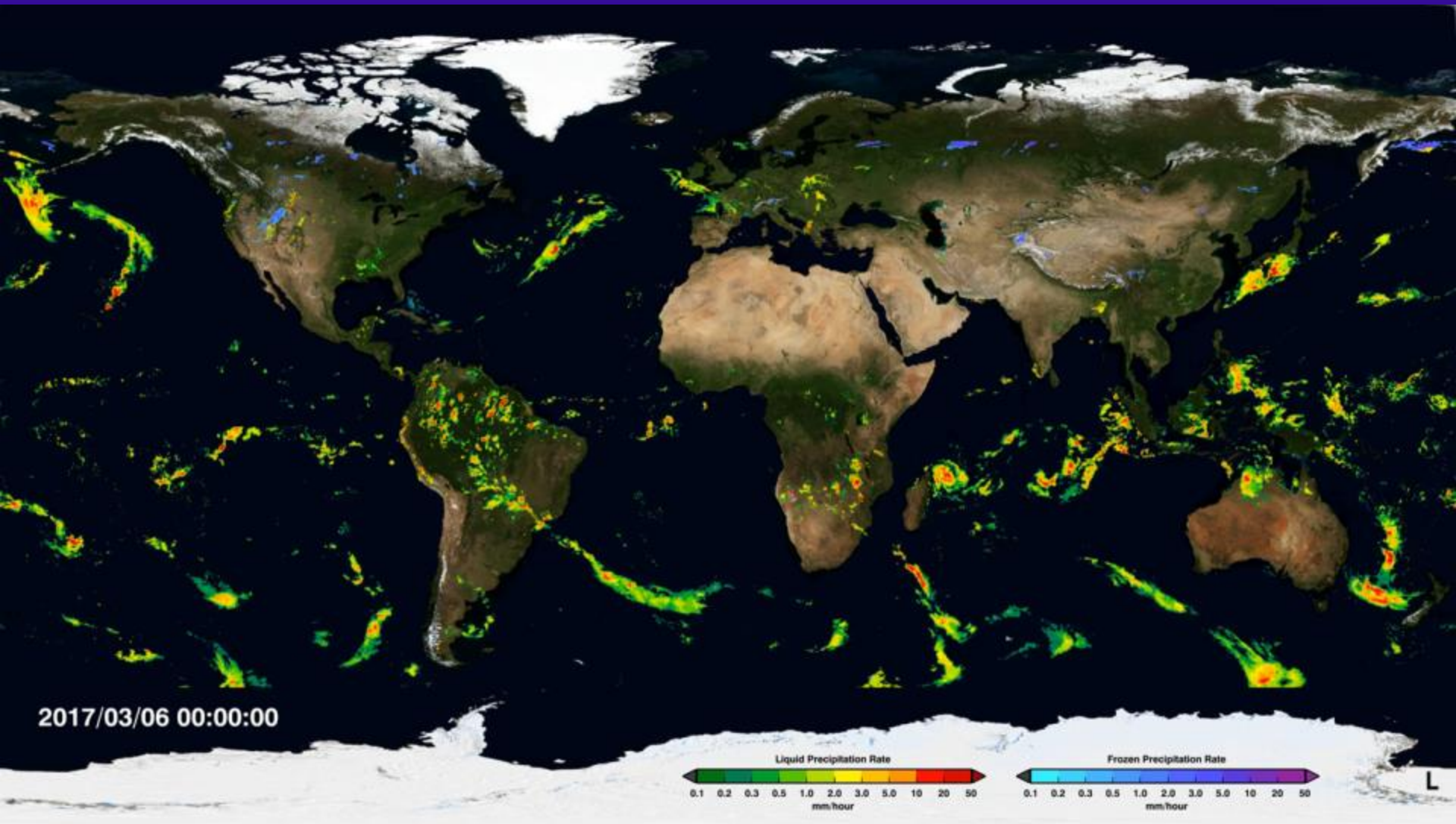
https://svs.gsfc.nasa.gov/20226

We can estimate the processes that create potential for landslides and observe their impact remotely

# Global Precipitation Measurement (GPM)

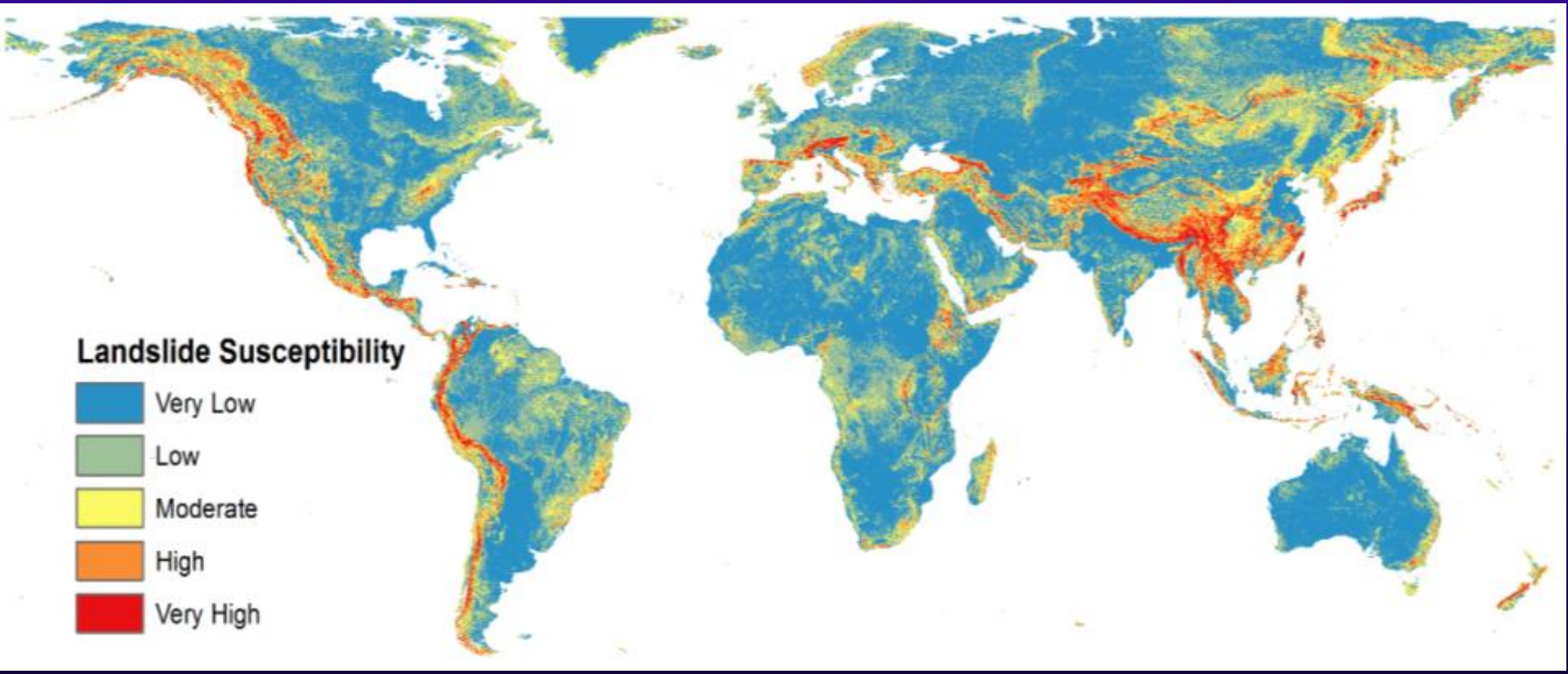
TRMM versus GPM coverage animation: http://svs.gsfc.nasa.gov/goto?11165
GPM constellation animation:
http://gpm.nasa.gov/education/videos/global-precipitation-measurement-constellation

# Trigger: Precipitation

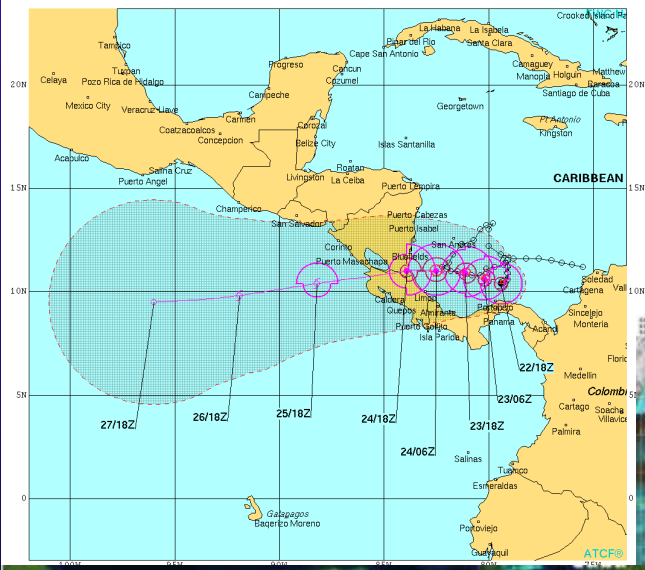



https://svs.gsfc.nasa.gov/4285

# Global Landslide Susceptibility



# Hurricane Otto, November 2016

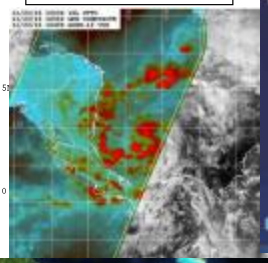


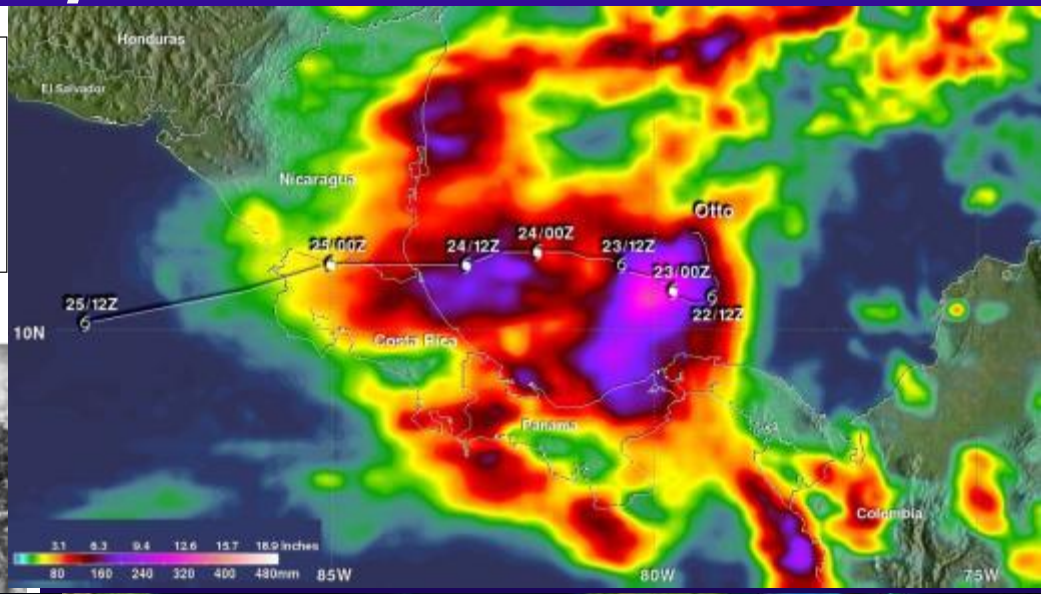

HURRICANE OTTO (16L) WARNING #8
WTNT1 KNGU 222100
2218002 POSIT: NEAR 10.4N 79.4W
MOVING 270 DEGREES TRUE AT 03 KNOTS
MAXIMUM SIGNIFICANT WAVE HEIGHT 20 FT.
22/18Z, WINDS 065 KTS, GUSTS TO 080 KTS
23/06Z, WINDS 070 KTS, GUSTS TO 085 KTS
23/18Z, WINDS 075 KTS, GUSTS TO 090 KTS
24/06Z, WINDS 080 KTS, GUSTS TO 100 KTS
24/18Z, WINDS 070 KTS, GUSTS TO 085 KTS
25/18Z, WINDS 045 KTS, GUSTS TO 055 KTS
26/18Z, WINDS 035 KTS, GUSTS TO 045 KTS
27/18Z, WINDS 030 KTS, GUSTS TO 040 KTS

| CPA TO: | NM | DTG |
|---|---|---|
| PUNTARENAS | 54 | 25/00Z |
| SOTO_CANO | 232 | 25/11Z |
| SAN SALVADOR | 205 | 25/21Z |
| COMAYAGA | 280 | 26/05Z |

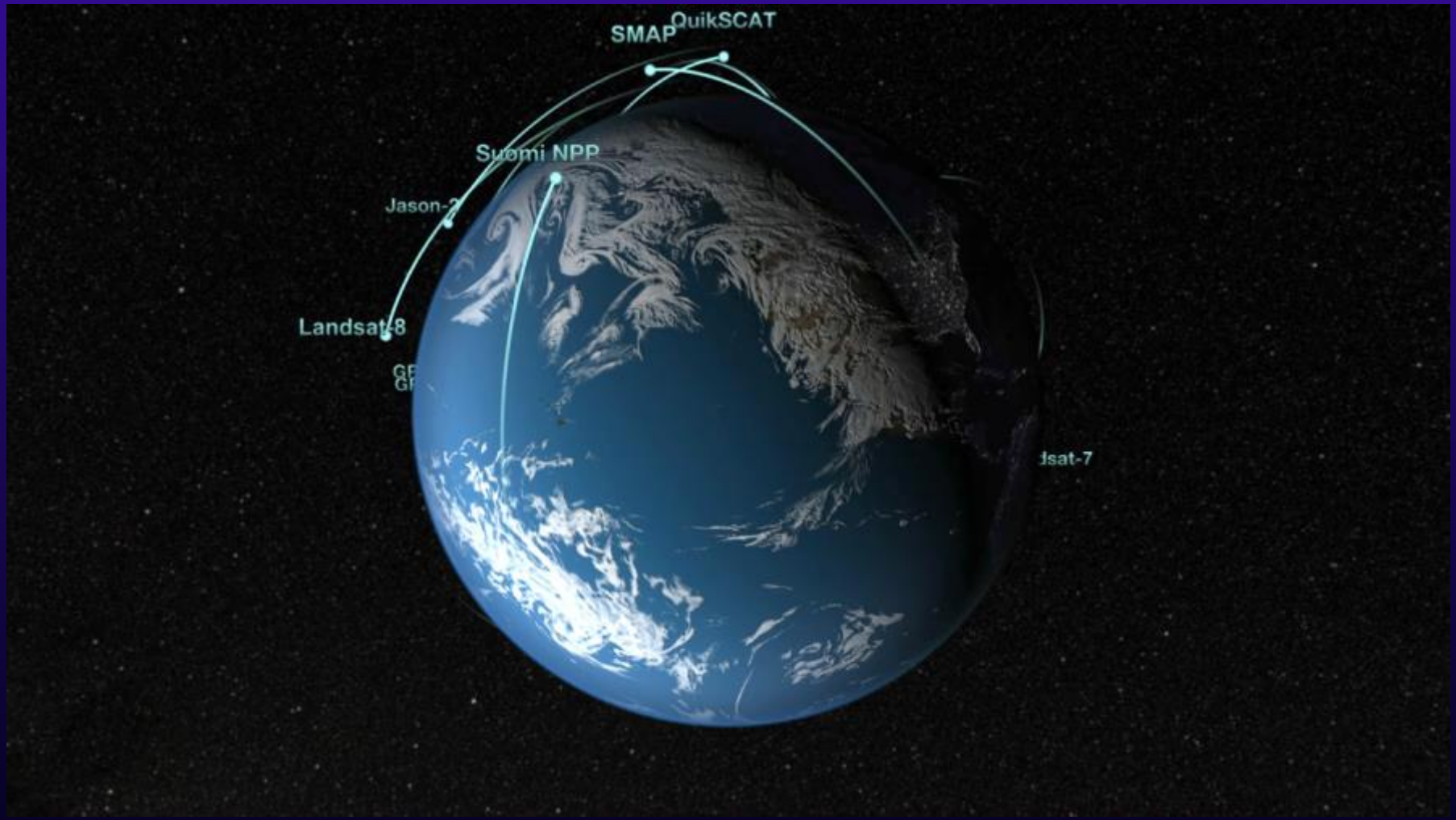
| BEARING AND DISTANCE | DIR | DIST (NM) | TAU (HRS) |
|---|---|---|---|
| BALBOA | 319 | 199 | 24 |
| COLON | 324 | 119 | 24 |
| PUNTARENAS | 076 | 225 | 24 |

○ LESS THAN 34 KNOTS
◊ 34-63 KNOTS
◆ MORE THAN 63 KNOTS
PAST 6 HOURLY CYCLONE POSITS IN BLACK
FORECAST CYCLONE POSITS IN COLOR





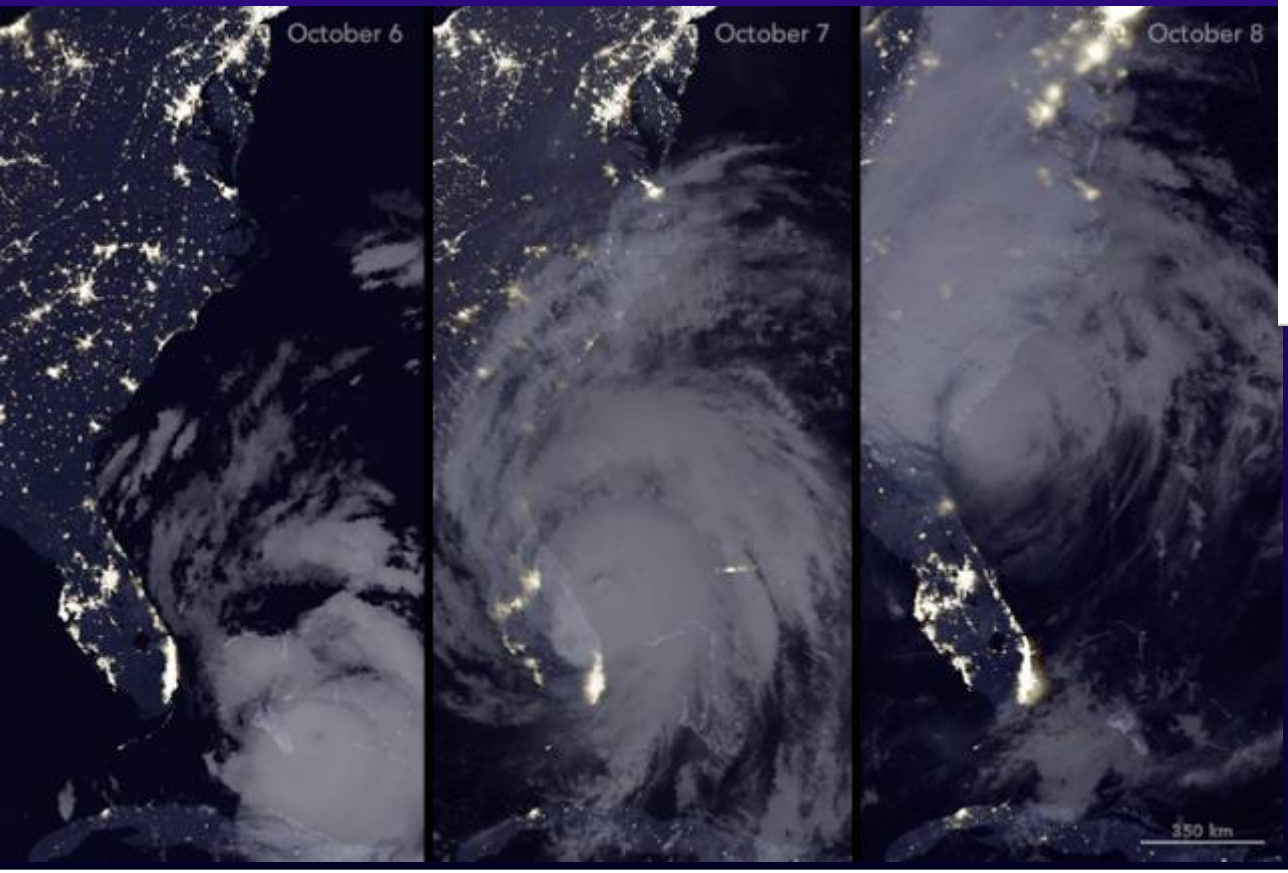
# But with a whole fleet of satellites…

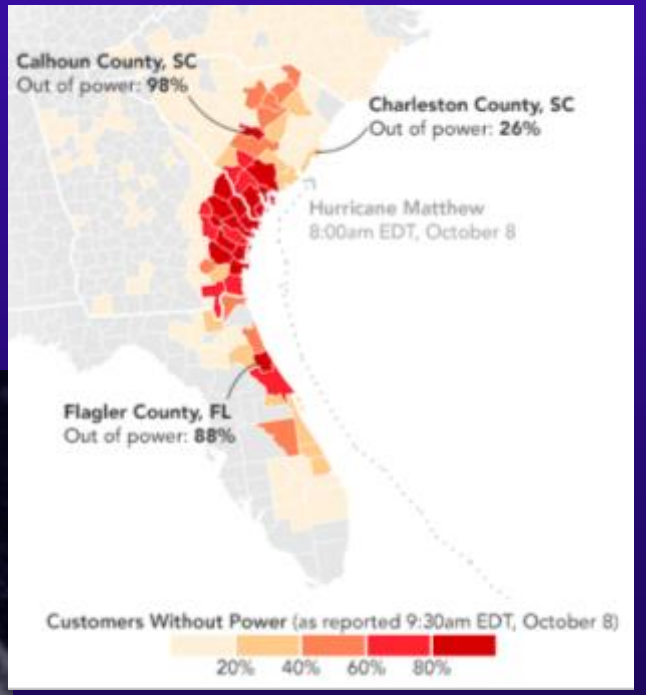



https://svs.gsfc.nasa.gov/30496

# Satellites Detects Power Outages Caused by Hurricane Matthew

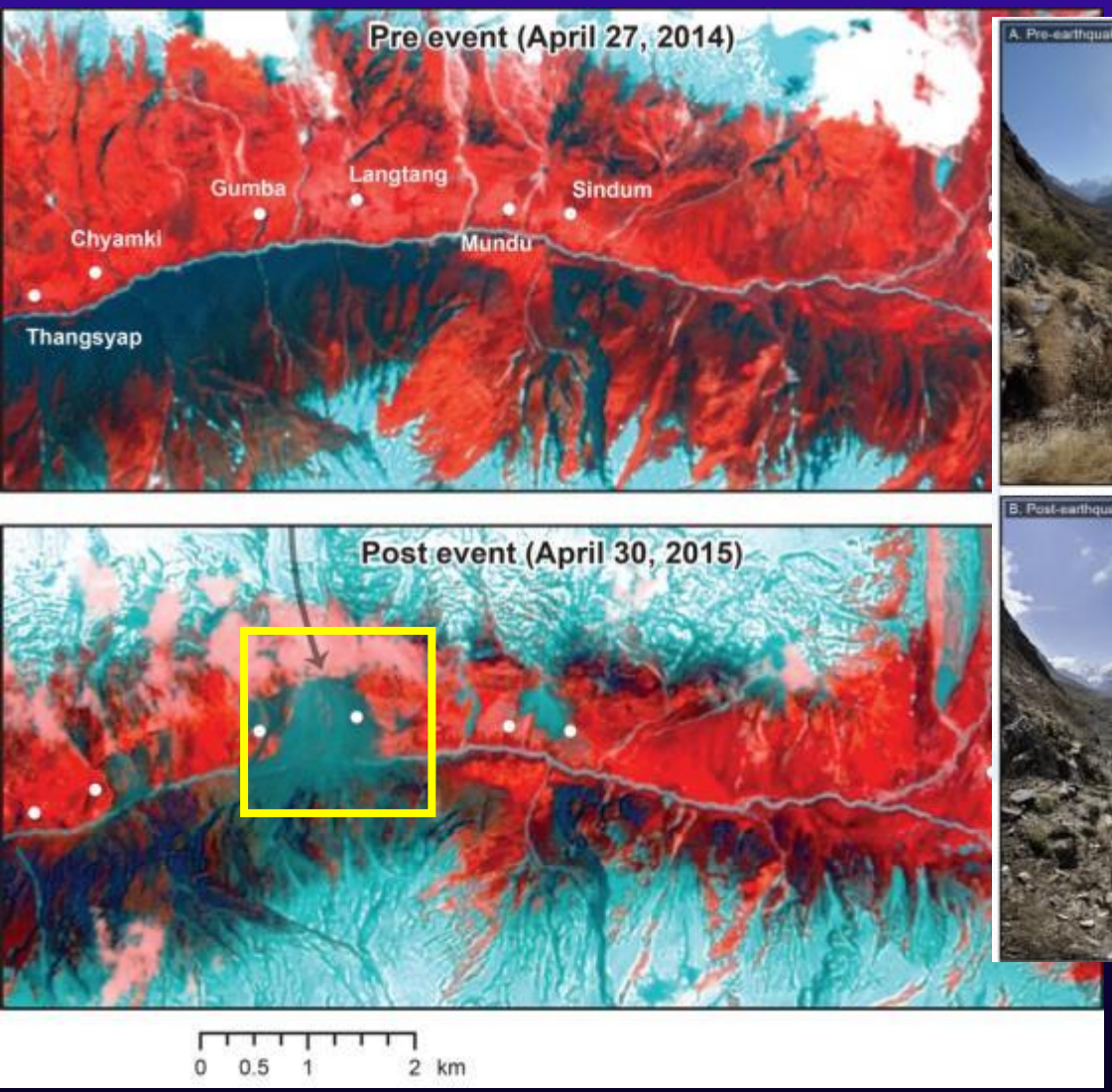
Nighttime images from NASA's Suomi-NPP satellite provide spatially detailed maps to study the effects of, and human response to, natural hazards. NASA scientists are teaming up with FEMA responders to contribute near-real time power outage maps.




Comparing Suomi-NPP images before and during Hurricane Matthew's landfall on the Carolina coast (left) helped identify areas without power. These images were in good agreement with the region's electricity providers (above).

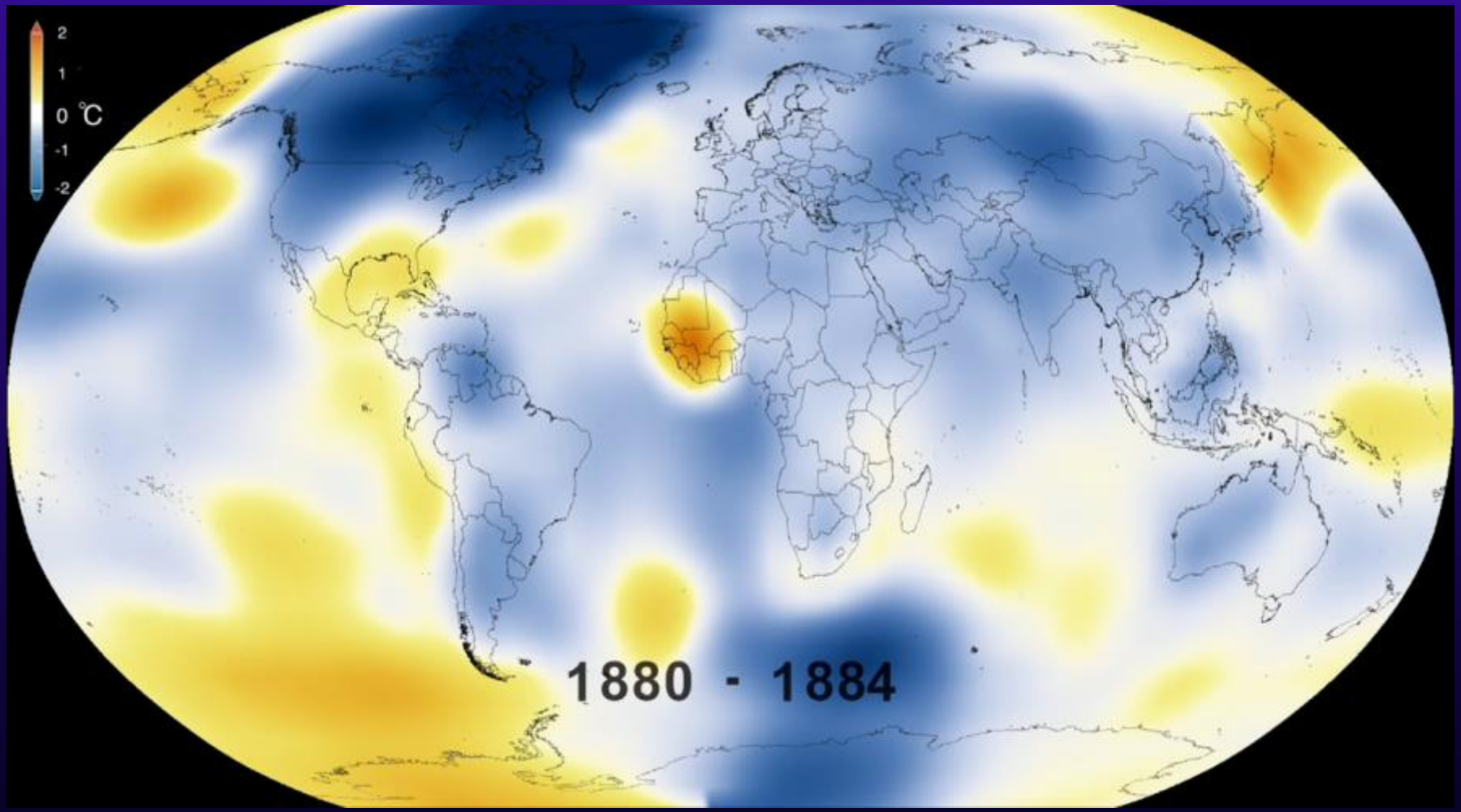
# Gorkha Earthquake: Langtang Valley landslides, Nepal



Landsat 8 false color image of Langang Valley (2014 and 2015)

# Landslides blocking lakes in Nepal

# At NASA, we can also do things like this…




https://svs.gsfc.nasa.gov/4419

# Parting thoughts…

- NASA Earth Science has been making pioneering discoveries of our Earth for 60 years
- By combining data from multiple satellites and relating that to what we see from the ground, we can get a much better understanding of how natural hazards are shaping our landscape and affecting us
- Having the vantage point of space is invaluable for observing how are Earth is changing, but observations from the ground are CRITICAL to improving these measurements