National Aeronautics and Space Administration

Soil Moisture Active Passive Mission

SMAP

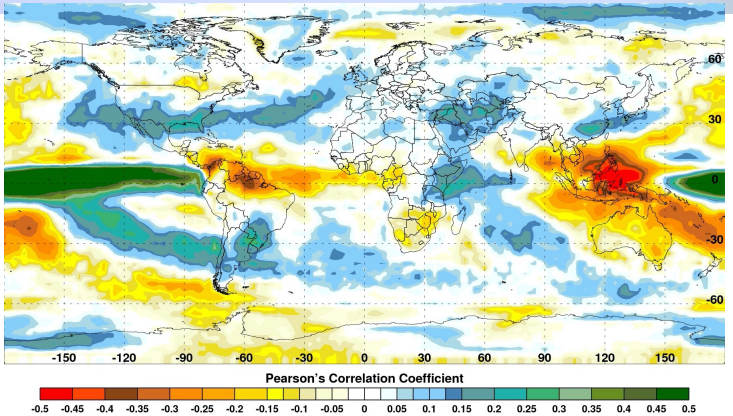
SMAP Soil Moisture anomalies associated with recent Vector-borne Disease (VBD) Outbreaks

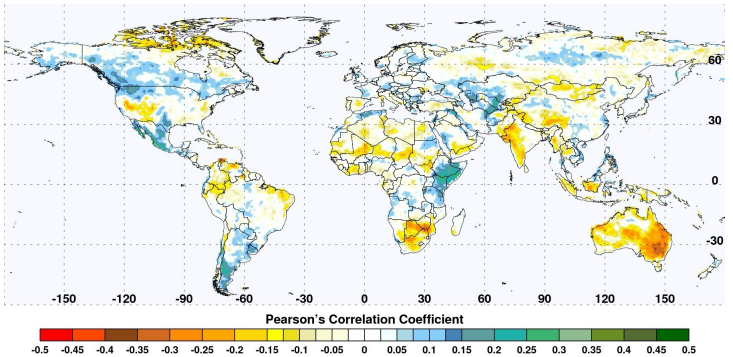
Assaf Anyamba, Natalie Thomas, Heidi Tubbs, Bhaskar Bishnoi
Universities Space Research Association
& NASA Goddard Space Flight Center

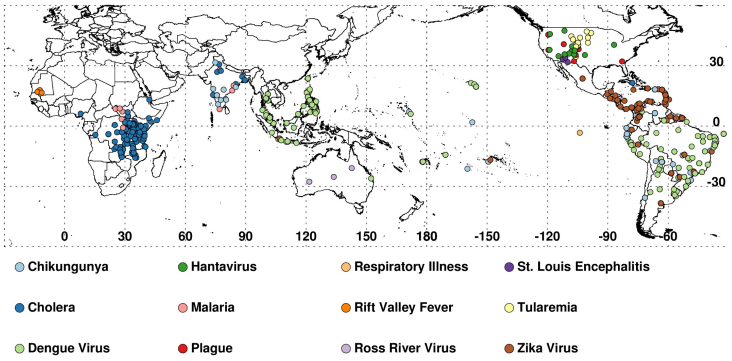
SMAP DAART/ST Meeting
Wednesday, July 21, 2021, 09:00 Pacific, 12:00 Eastern)

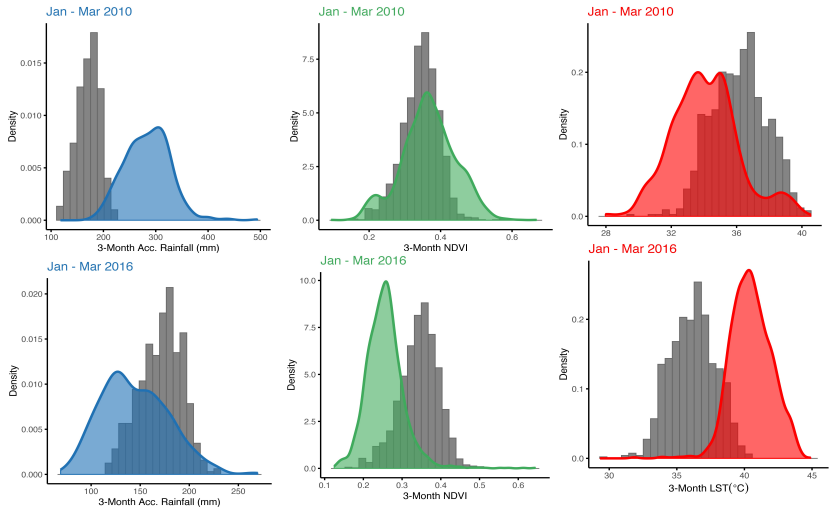
Background: VBD Outbreaks and Teleconnections

- Most VBD outbreaks driven by variability in Climate/weather conditions esp. ENSO
- Previously used Rainfall, **NDVI** and **LST** to examine the variations in climate, however **Soil Moisture (SM)** observations are the missing component
- SM - Critical role in interplay between host, pathogen and environment "**disease triangle**"
- Preliminary results from the SMAP special issue paper



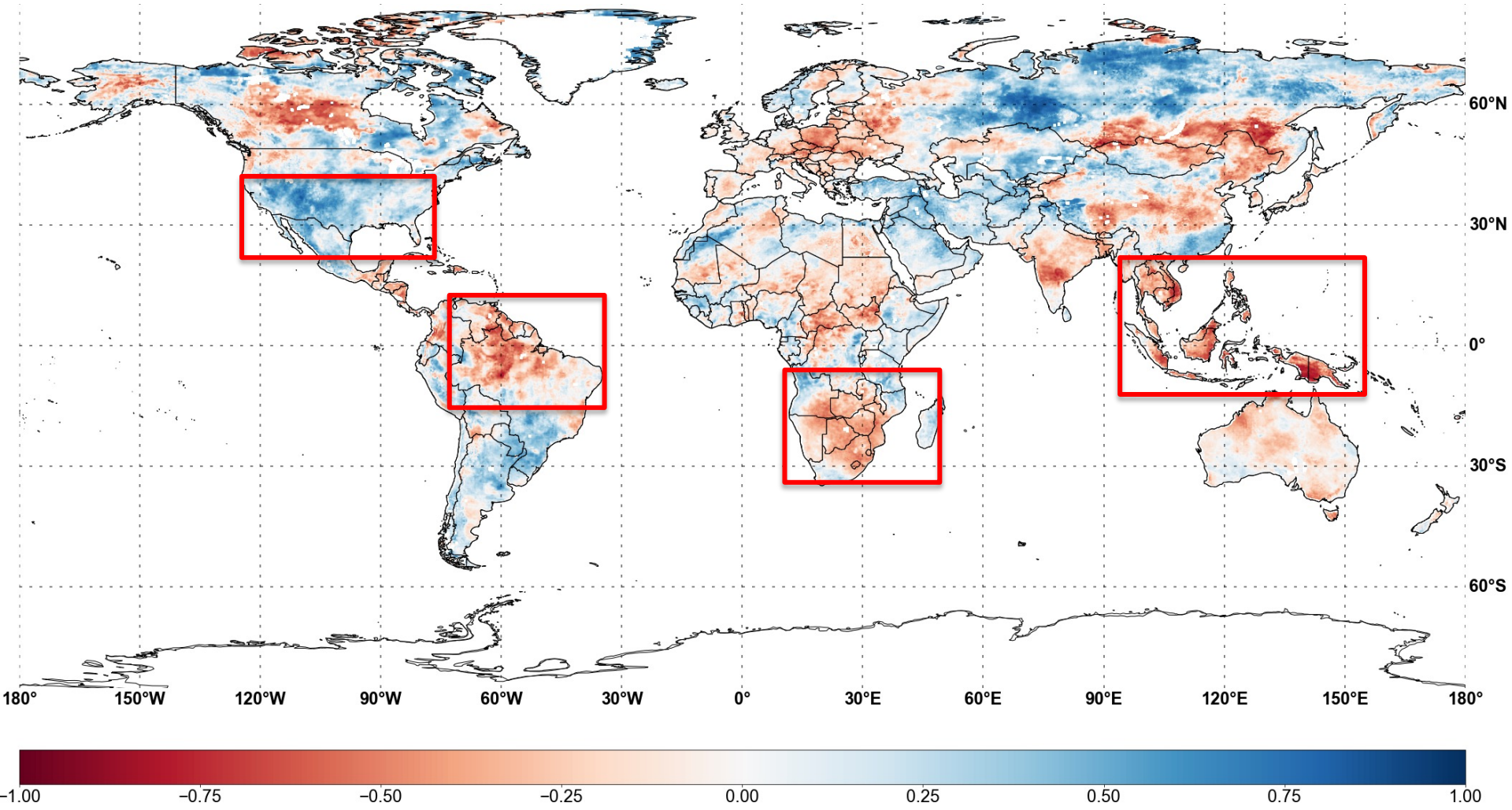






Anyamba et al, Nat. Sci. Rep. 2019

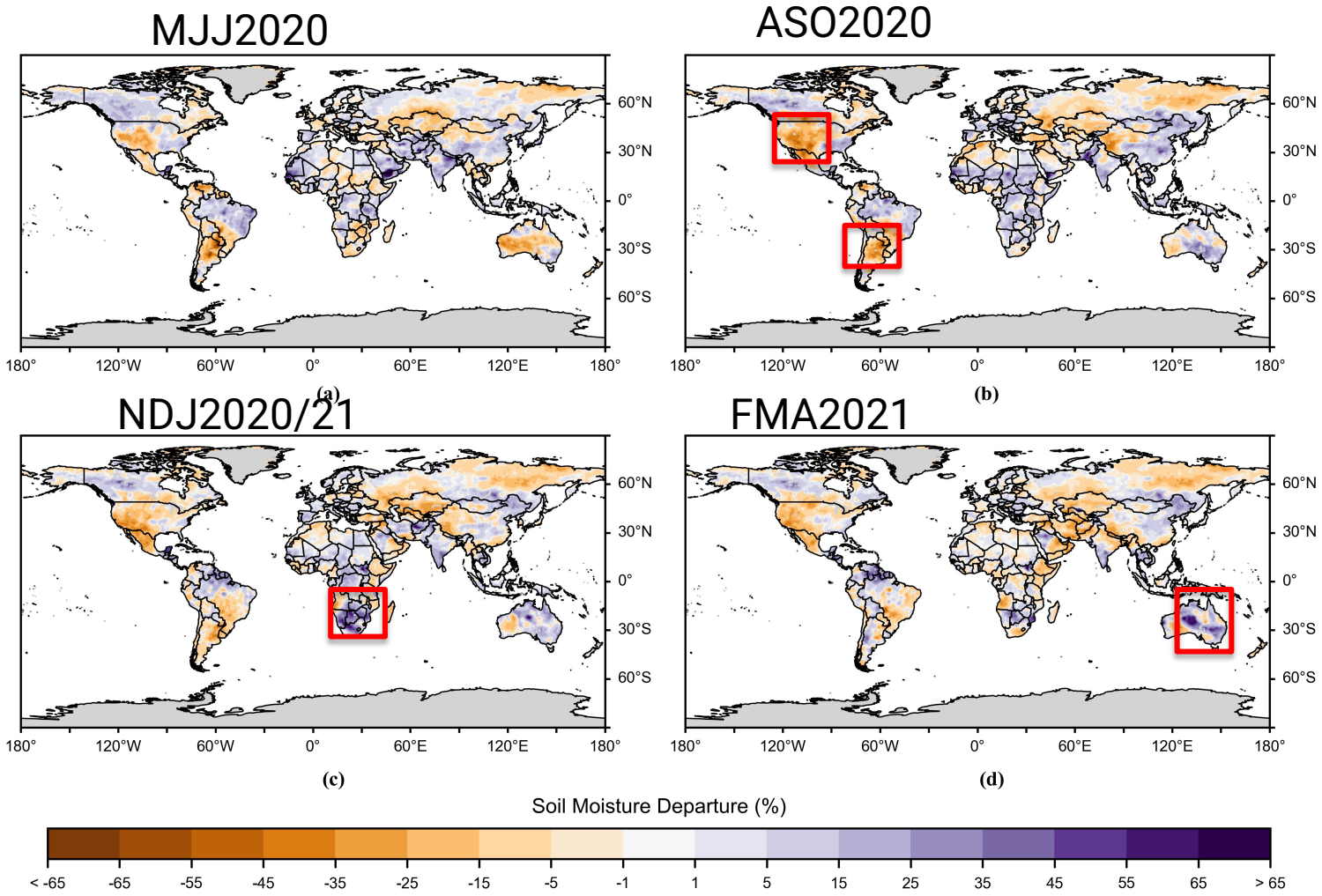
SMAP Level 4 (0-5cm) – NINO3.4 Index Correlation



SMAP Soil Moisture - improved characterization of teleconnection patterns especially in most cloud prone tropical regions: SE Asia, Congo Basin and Amazon where there is often missing data from optical observations

Soil Moisture anomalies: 2020/2021 La Niña Event

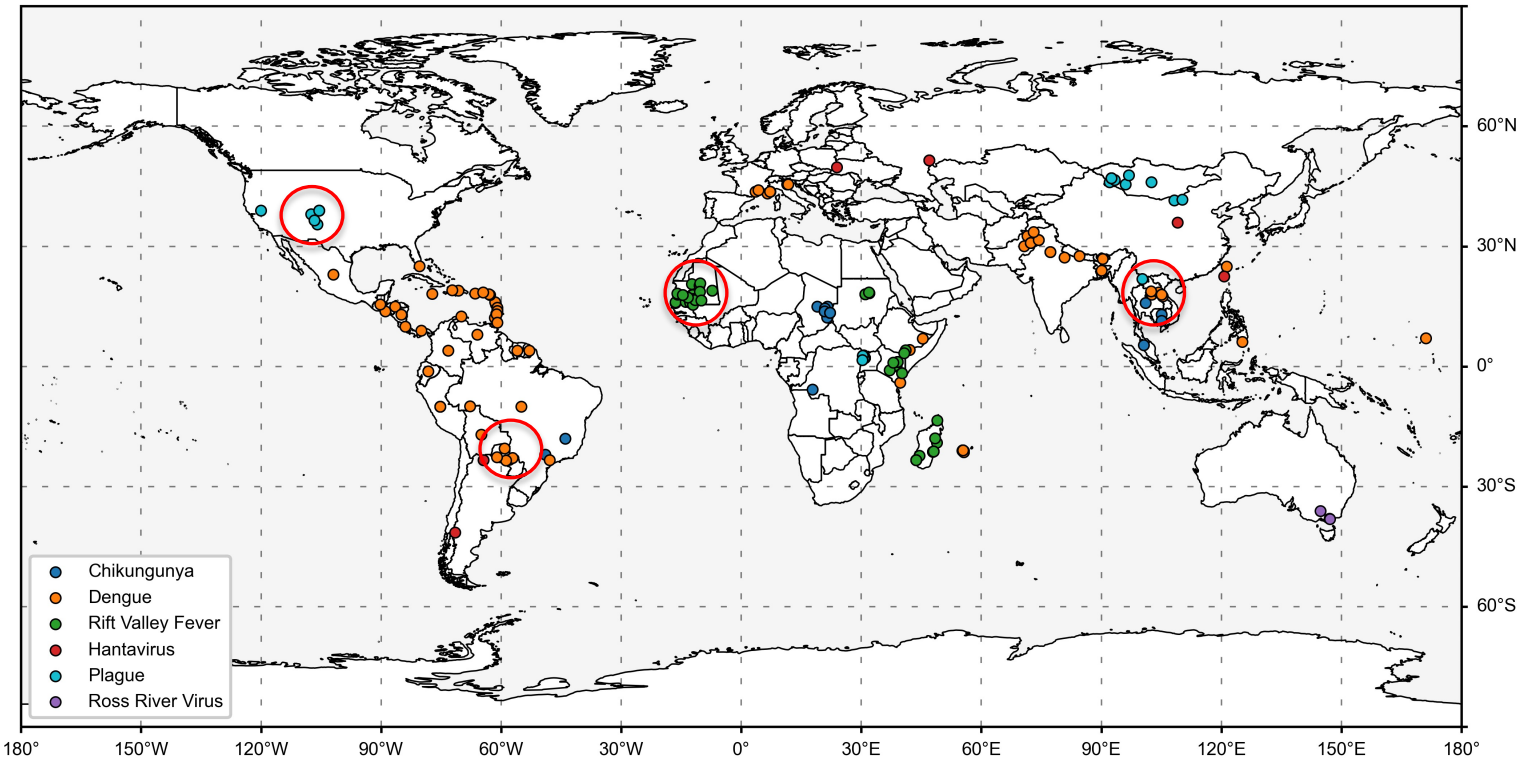
- SMAP Level-4 Soil Moisture surface layer product (0-5cm)
- Seasonal Composite anomalies



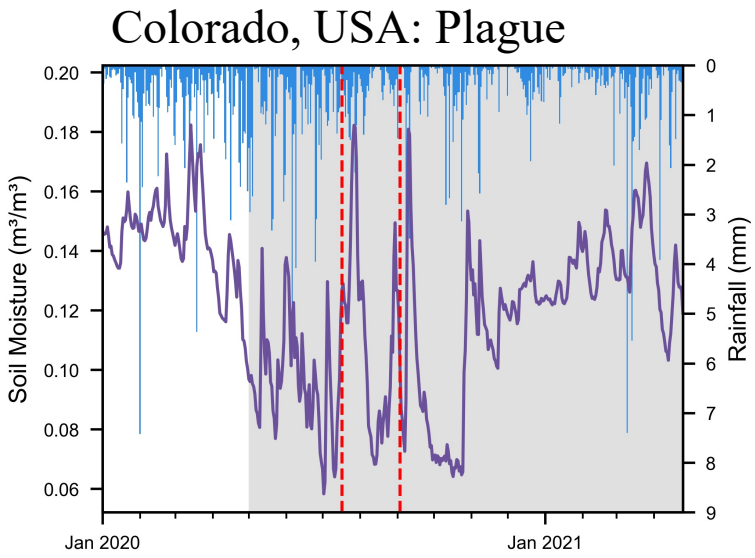
Disease Data Collection

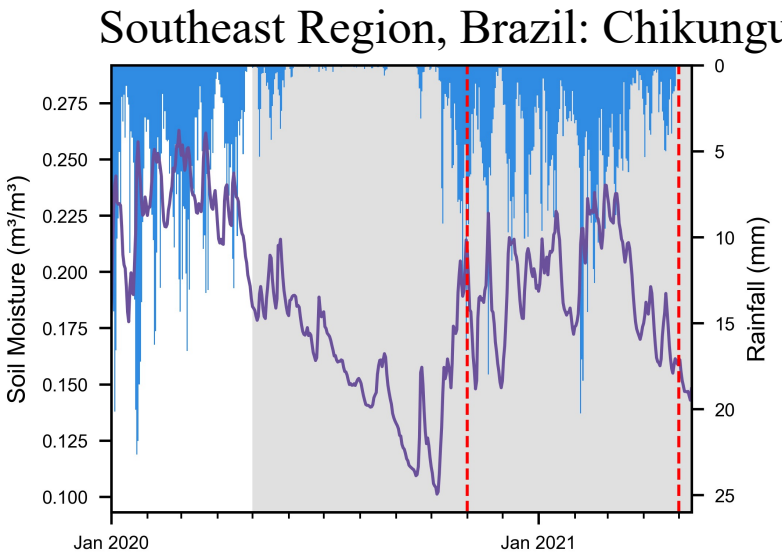
- Focus on the 2020-2021 La Niña event
- Disease Data:
  - Program for Monitoring Emerging Diseases (ProMED)
  - Department of Defense Armed Forces Health Surveillance Branch – weekly surveillance updates
  - Food and Agricultural Organization of the United Nations – Animal Health Updates Threat Updates (AHTU) reports.

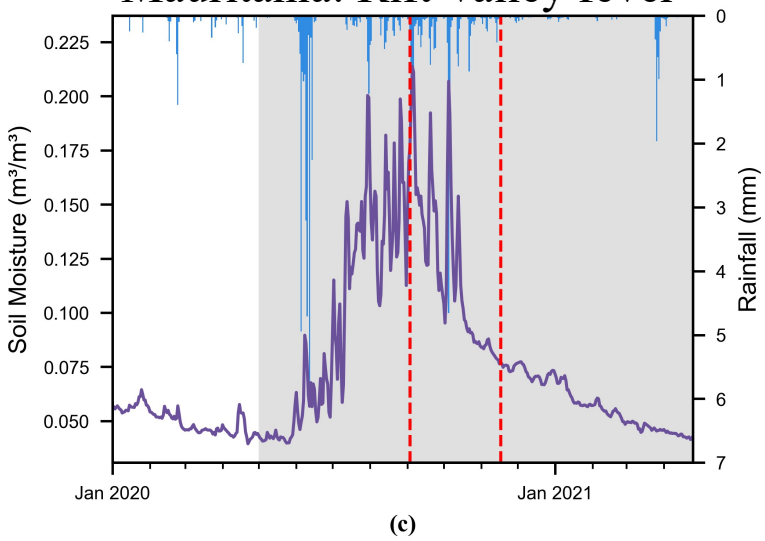
VBD Outbreaks May 2020 – April 2021

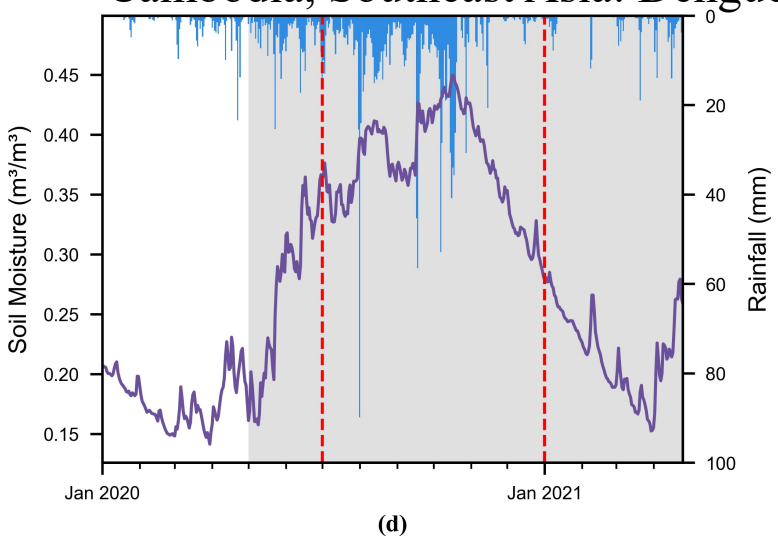


Daily Soil Moisture, Rainfall and Disease Outbreaks

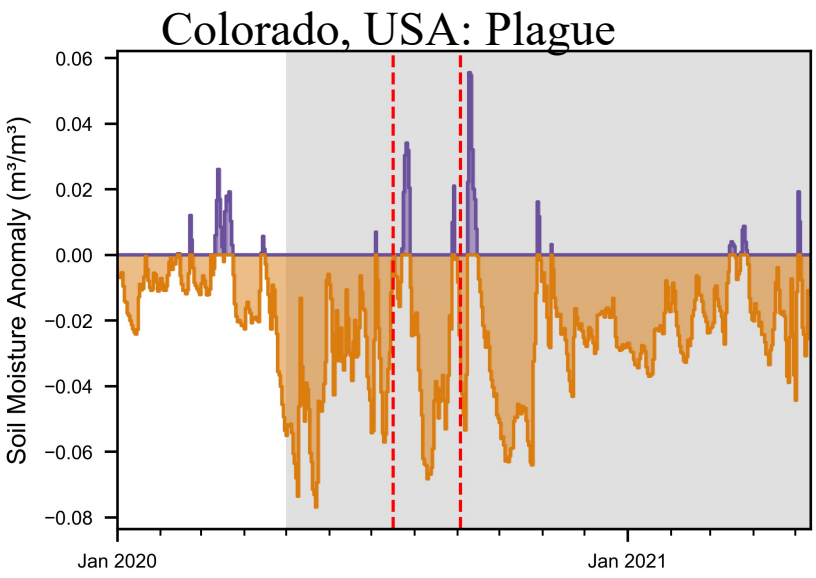


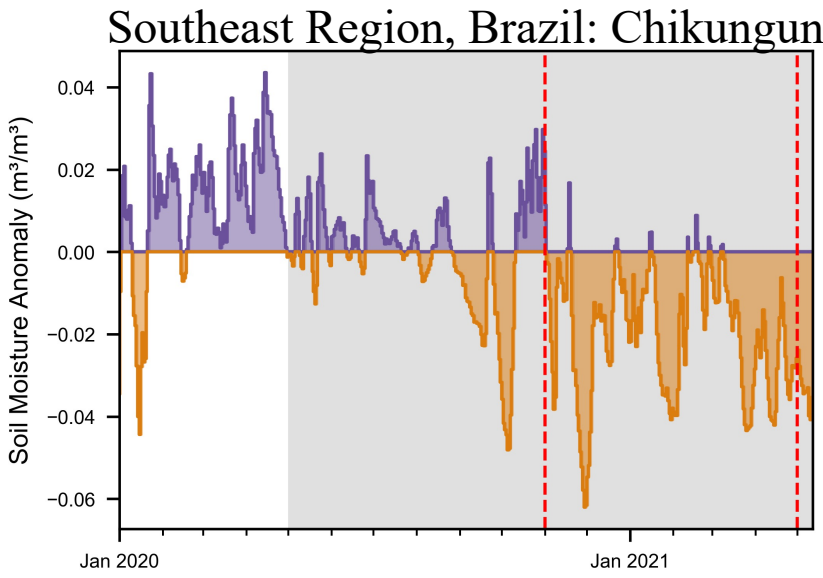


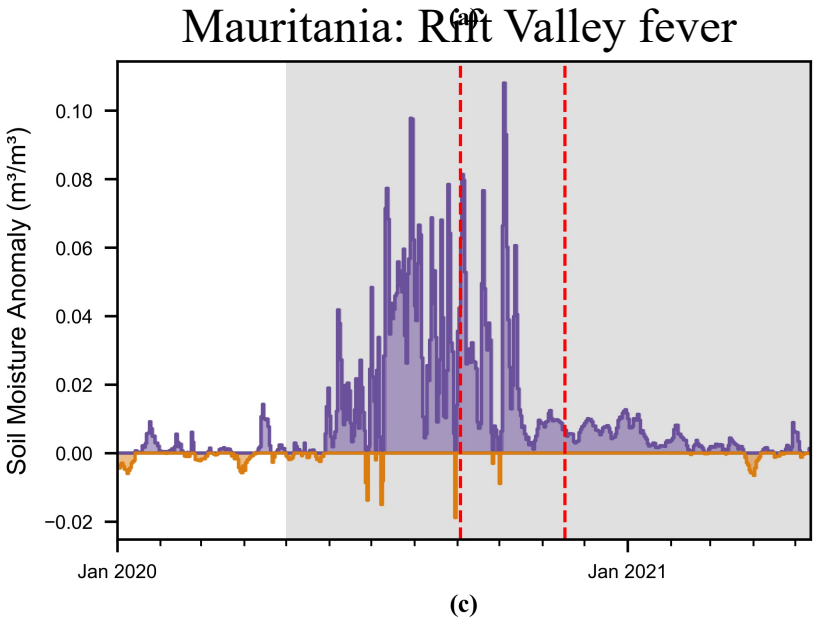


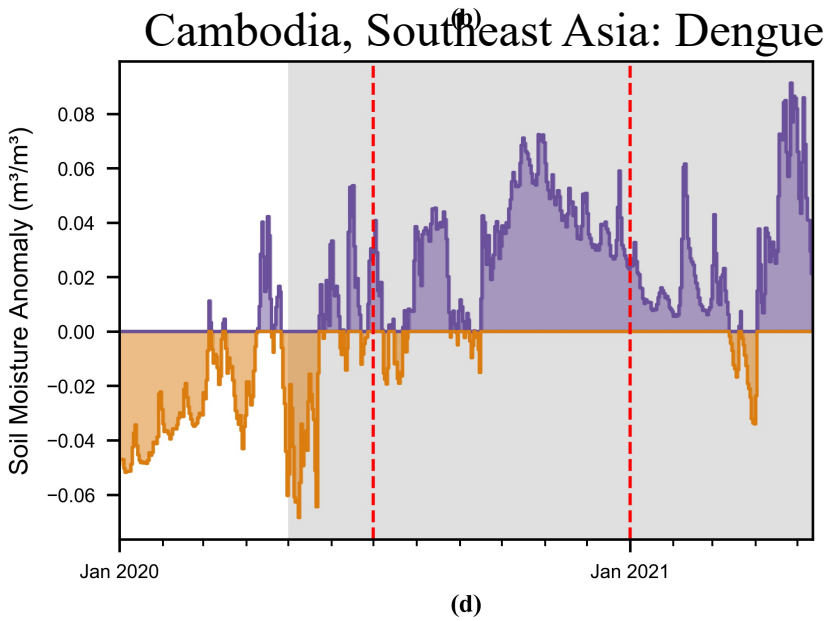


Daily Soil Moisture anomalies and Disease Outbreaks



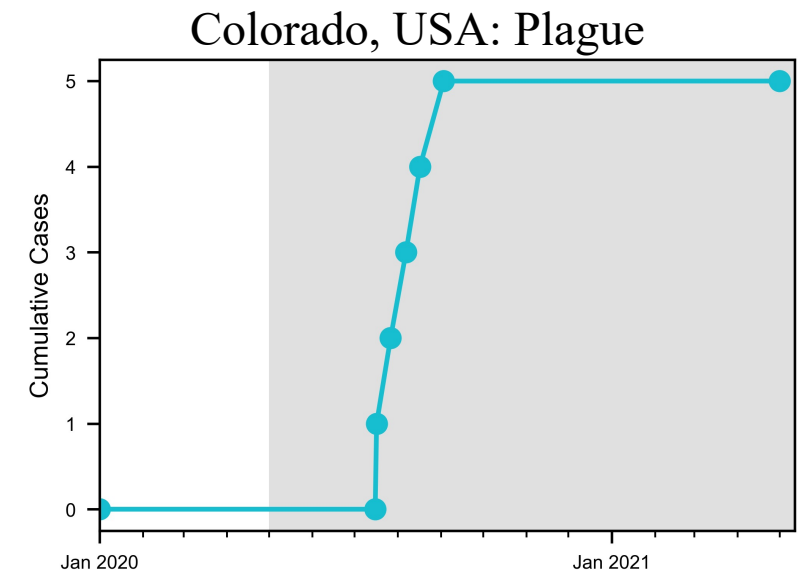


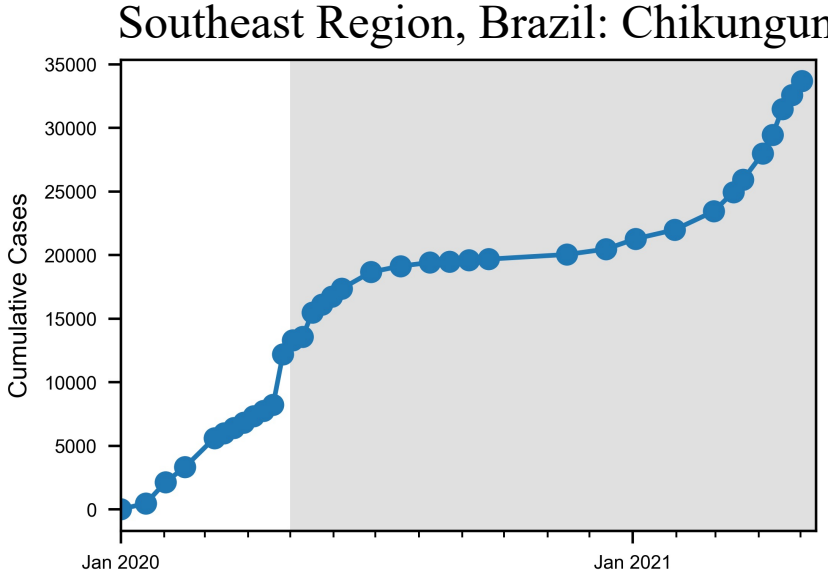


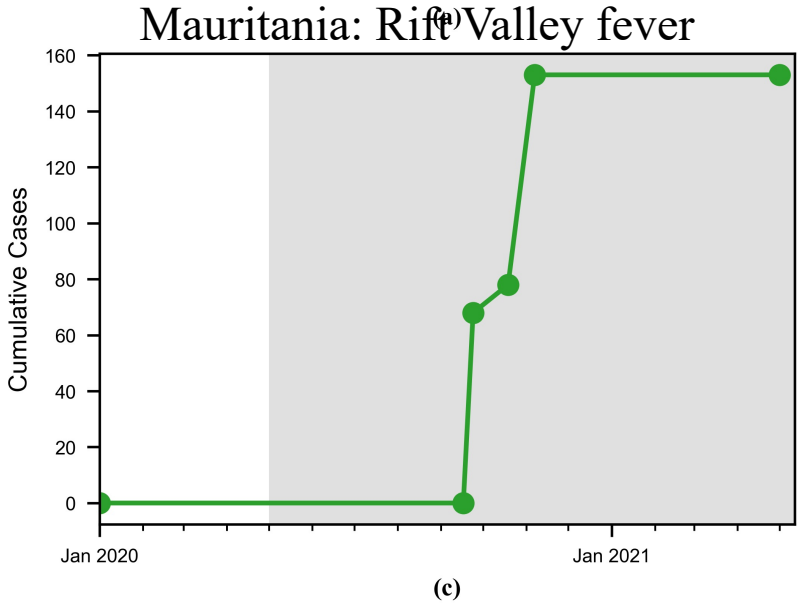


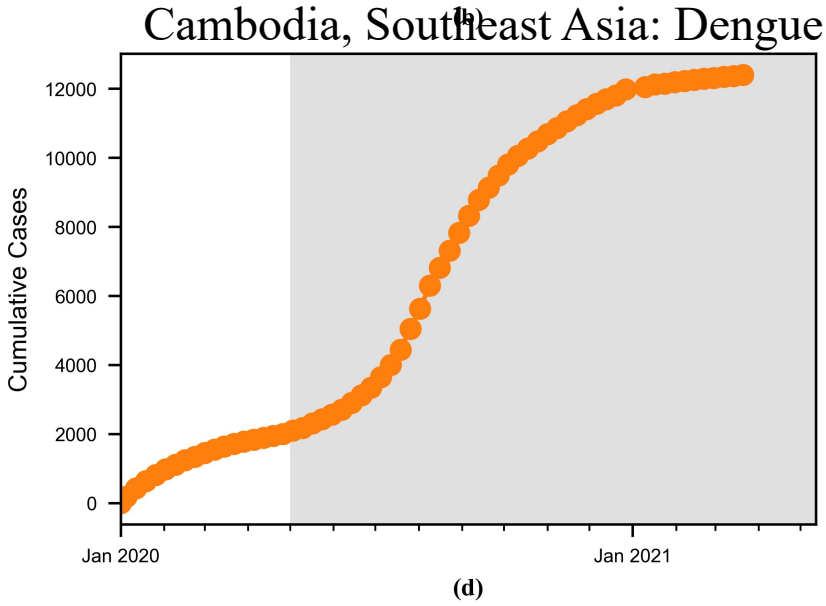
Cumulative Disease Profiles

SOIL MOISITURE TRIGGER





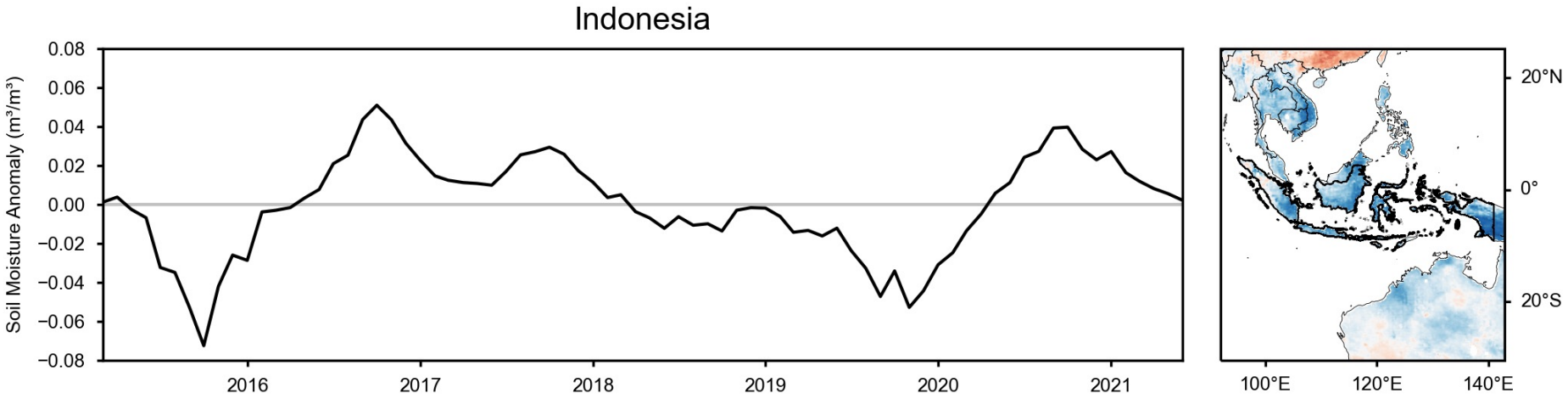




SOIL MOISTUTE AMPLIFIER

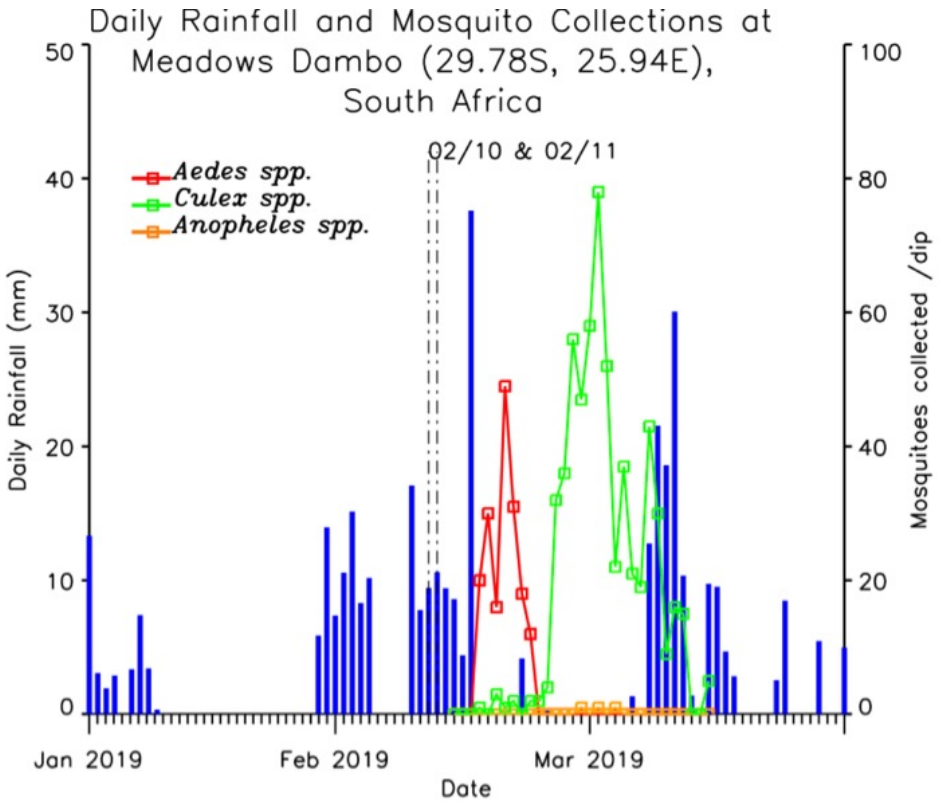
Observations

- SMAP Soil moisture – advantage – observations over cloud prone areas
- soil moisture signal amplified during the growing season in areas of disease occurrence (esp. Rift Valley fever, Plague)
- Importance of soil moisture “memory” of climate and weather events
- Unknown: Impact of COVID19 on disease surveillance and reporting during this period



Next Steps

- Evaluate “extreme” events in the SMAP soil moisture record determine relationship with longer disease records since 2015; East Africa, 2018, SE Australia 2020, Sahel 2020
- Characterize daily SMAP soil moisture in relation to vector populations
- Input SMAP soil moisture data into forthcoming disease models: RVF, Chikungunya, Dengue



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