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

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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

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

**MJJ2020**

**ASO2020**

**NDJ2020/21**

**FMA2021**

Soil Moisture Departure (%)
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

Colorado, USA: Plague

Southeast Region, Brazil: Chikungunya

Mauritania: Rift Valley fever

Cambodia, Southeast Asia: Dengue.
Daily Soil Moisture anomalies and Disease Outbreaks

- Colorado, USA: Plague
- Southeast Region, Brazil: Chikungunya
- Mauritania: Rift Valley fever
- Cambodia, Southeast Asia: Dengue
Cumulative Disease Profiles

Colorado, USA: Plague

Southeast Region, Brazil: Chikungunya

Mauritania: Rift Valley fever

Cambodia, Southeast Asia: Dengue.
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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