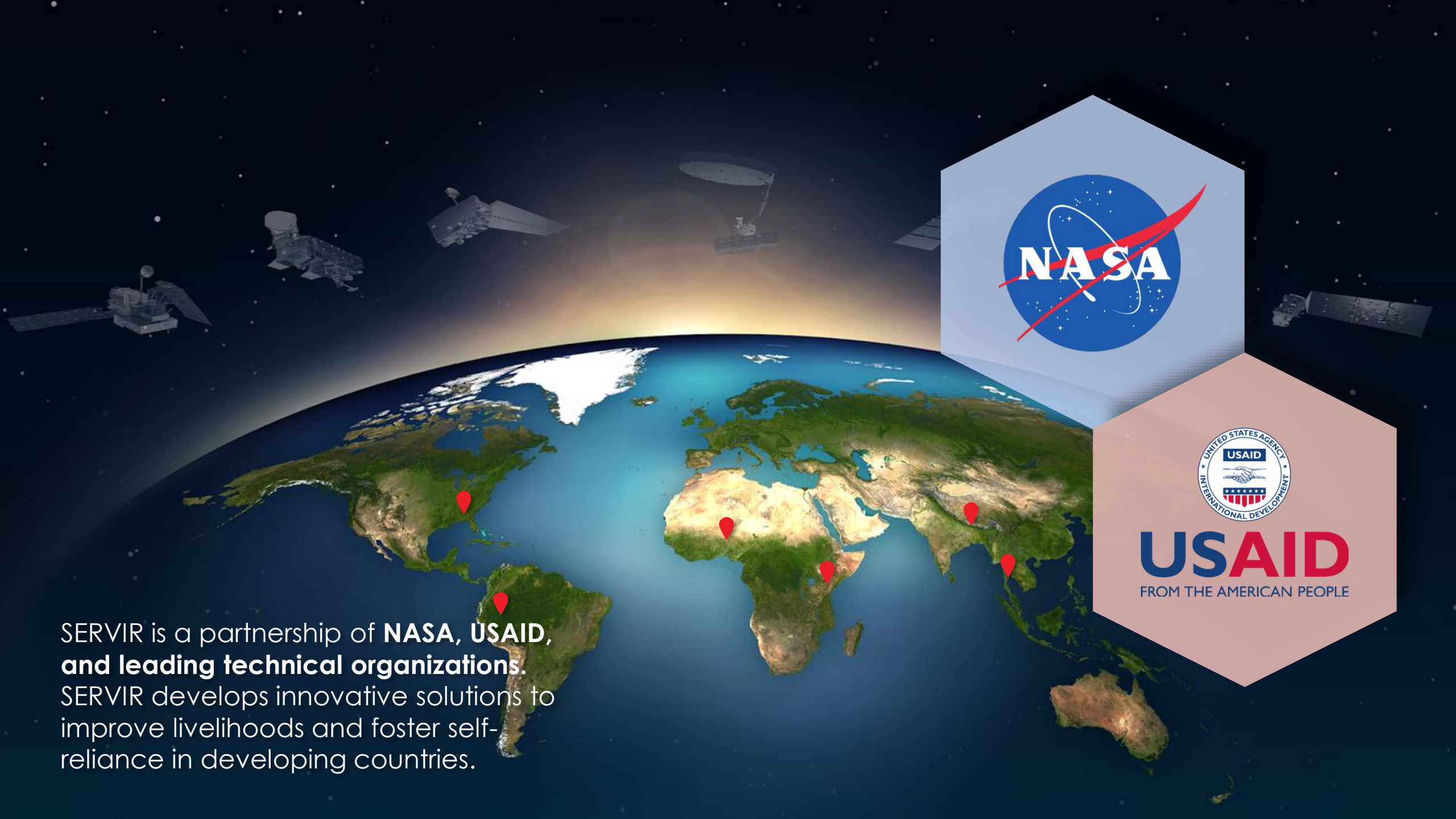


NASA SERVIR: Connecting Space to Village



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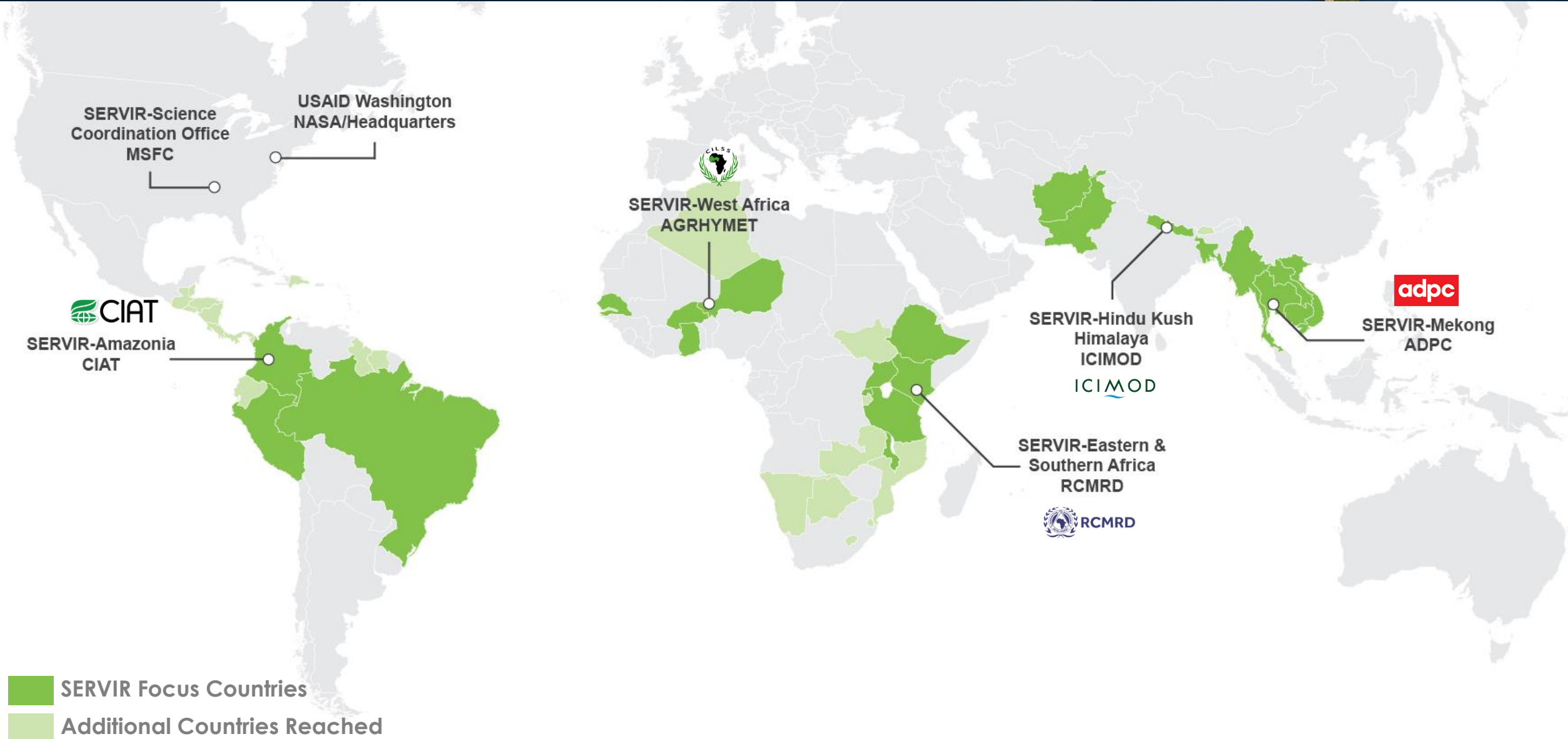




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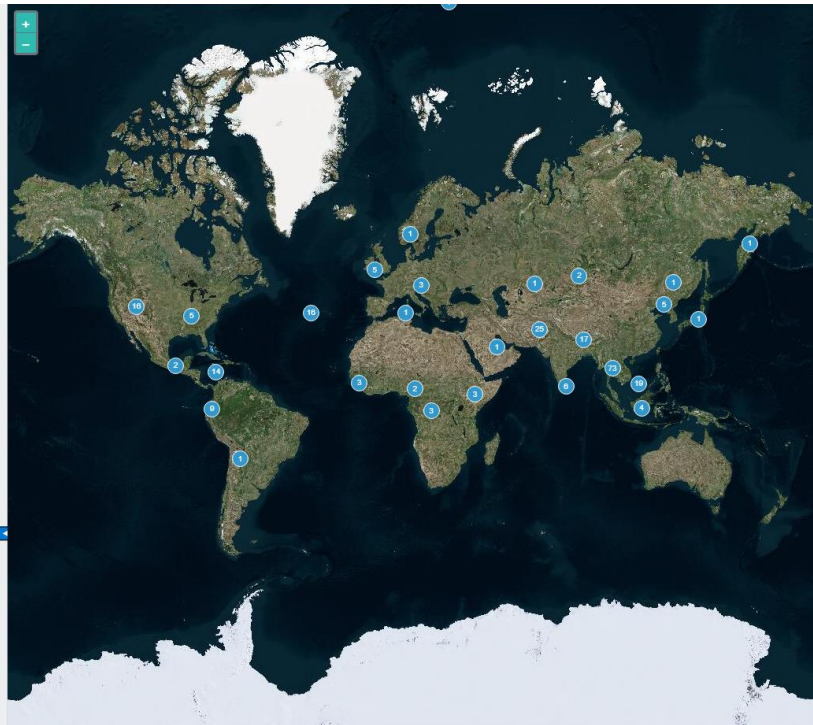




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- Cambodia Change Detection
- Collaborative Forest Landscape Restoration Program (CFLRP)
- Afghanistan_NLCS
- Ecuador Ministerio del Ambiente
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6.2 Radar Remote Sensing

A radar instrument generates its own electromagnetic signal by transmitting a microwave pulse that enables observation of Earth's surface (or other planets and moons) day and night. In order to generate an image, the pulse is focused in a direction away from radar (Fig. 6.3). When the pulse is transmitted at radio, the instrument is called a radar altimeter. The microwave pulse typically illuminates ground areas of tens of kilometers, and only the portion of energy reflected toward the radar is measured. The angular reflection pattern depends on the target properties such as roughness (differs greatly between plants, water surface, urban structures) and geometry. The geometry is determined by the look angle and the terrain slope. The former is the angle subtended by the line of sight between the radar and a target on the ground. This varies greatly across an image. The look angle and terrain slope can be combined into the incidence or projection angle. These angles are often used to perform terrain radiometric corrections, sometimes called "terrain flattening", which is intended to remove image artifacts due to geometry. In mangroves, topographic effects are generally neglected due to their unique setting of very flat areas.

6.2.1 MICROWAVE BANDS

Radar is an active instrument with a definite advantage over optical sensors: they can see through clouds, day and night. This is a particularly prized attribute along the tropical coastlines, and its free public availability is continuously rising. They transmit a microwave pulse and measure the portion of the energy that it reflects back. The measured return is called "backscatter" and is generally presented in decibels (10 log₁₀(intensity)). Some radar instruments come in several "modes" (i.e., wavelength bands) to analyze the bands: C, S, L, and P bands. These are denominations introduced during the development of radar during World War II, and they simply refer to a range of frequencies as defined by the Institute of Electrical and Electronics Engineers (IEEE). See Table 2.3 in Chapter 2 for details on the applications of SAR bands.

6.2.2 SCATTERING MECHANISMS IN MANGROVES

There are three types of scattering mechanisms: (1) direct (or single-bounce), (2) double-bounce, (3) volume scattering (see Fig. 6.4). In mangroves, the "double-bounce" term that strongly dominates the HH channel (see Chapter 2, Table 2.1) changes to volume scattering and double-bounce scattering, with ground and subsequent scatterer may be reduced by the presence of aerial roots as microwaves are scattered and re-scattered (Fig. 6.5). The double-bounce scattering mechanism in mangrove forest strongly depends on canopy height and structure. Trends in volume and double-bounce at L-band (e.g., level signatures vary much more than in other frequency bands). In particular, in mangroves, the volume scattering mechanism and double-bounce scattering increase in closed and open canopies, respectively (see following section on polarimetry, foundation SNAP and PUSAP) (see following section on polarimetry, foundation SNAP and PUSAP) (see following section on polarimetry, foundation SNAP and PUSAP).

6.2.3 POLARIMETRY

The radar measurement can also be characterized through polarimetry. Generally, radar instruments are enabled for several orthogonal polarizations: open and closed canopies, transmitting horizontal (H) or vertical (V) waves, receiving down-looking and receiving either H or V. For example, a fully polarimetric L-band radar instrument is called POLSAR (L-band active polarimetric SAR) (see following section on polarimetry, foundation SNAP and PUSAP) (see following section on polarimetry, foundation SNAP and PUSAP).

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Figure 6.4 Radar scattering mechanisms in mangrove forests with aerial roots (Rhizophora) and the microwave signal is transmitted, decreasing backscatter at high biomass.

Figure 6.5 Radar backscatter at L-HV, acquired by ALOS-2 over the Gabon Estuary, Gabon. Bright areas to the North-West result from strong double-bounce effect. In urban structures of the city of Libreville, large medium backscatter and grey backscatter (horizontal scattering) are observed. Urban was mostly masked based on double backscatter (in particular at LHV), interestingly, due to strong attenuation from roots. For mangrove forests with red mangrove trees reaching several tens of meters exhibit lower backscatter along the South-Eastern portion of the Estuary.

Figure 6.7 Polarimetric representation of mangrove forests in Akanda, Gabon. Top left image shows an ALOS color composite image of single, volume, and double-bounce scattering components based on the Freeman-Durden decomposition. The yellow polygons show the mangrove extent.

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Amazonia

Photo courtesy of USAID



International Center for Tropical Agriculture

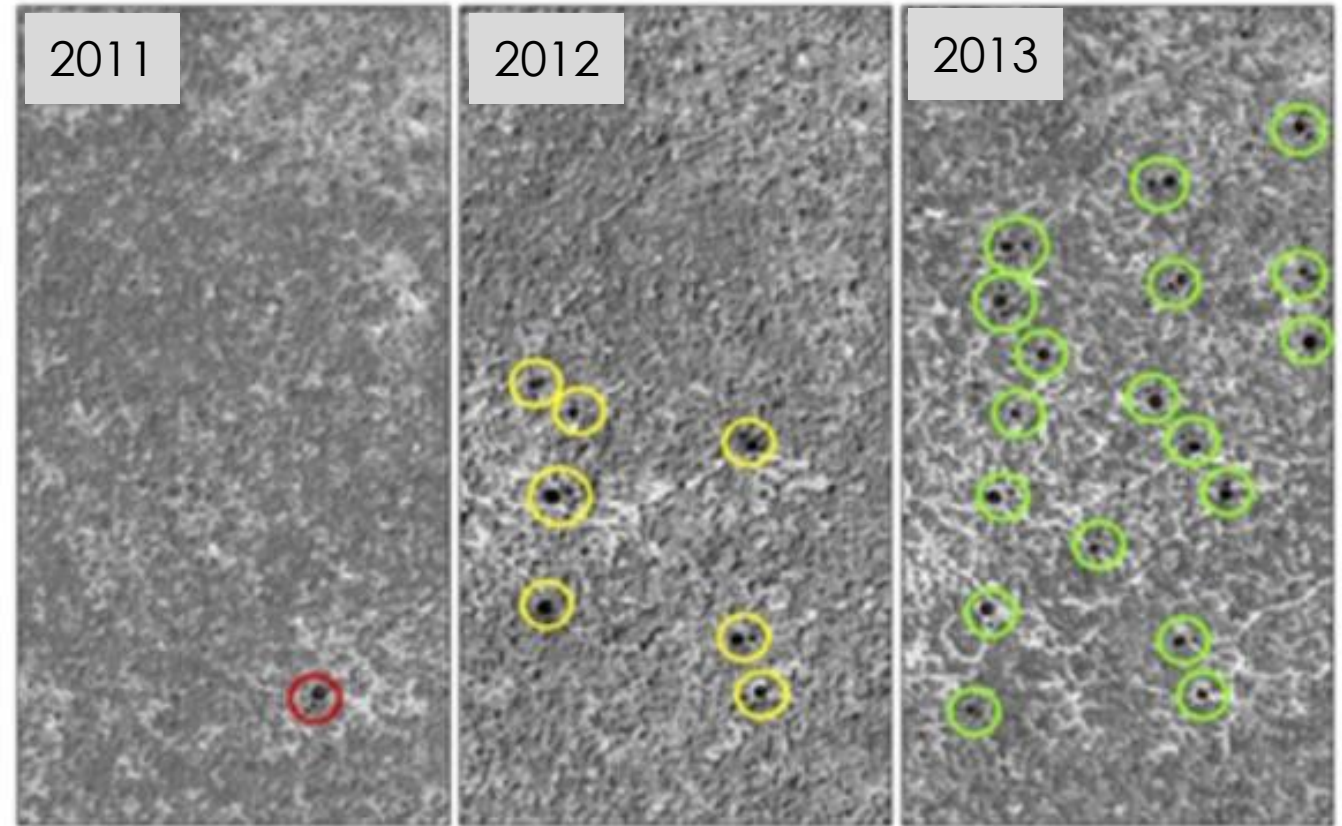


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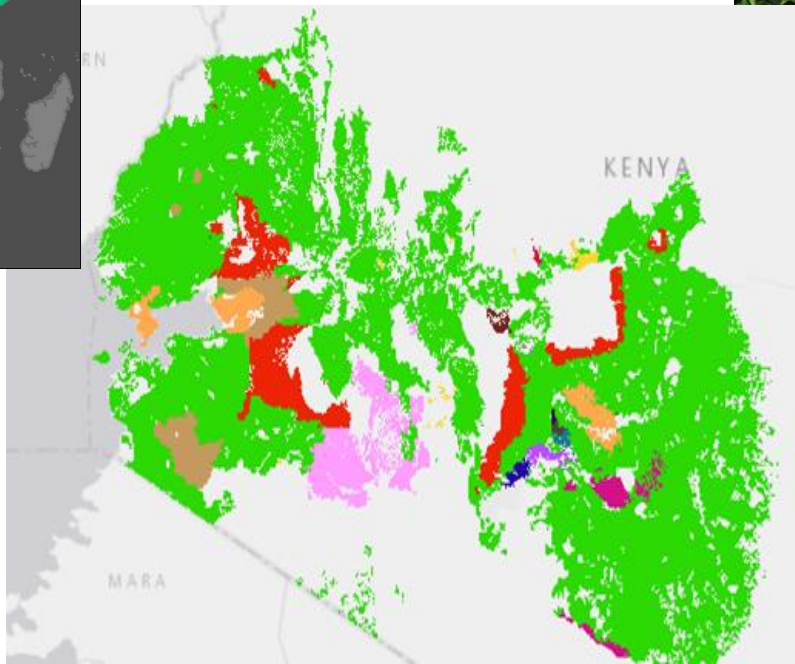
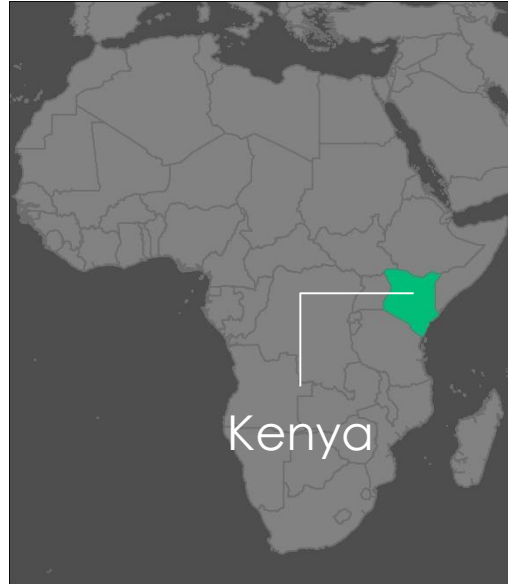
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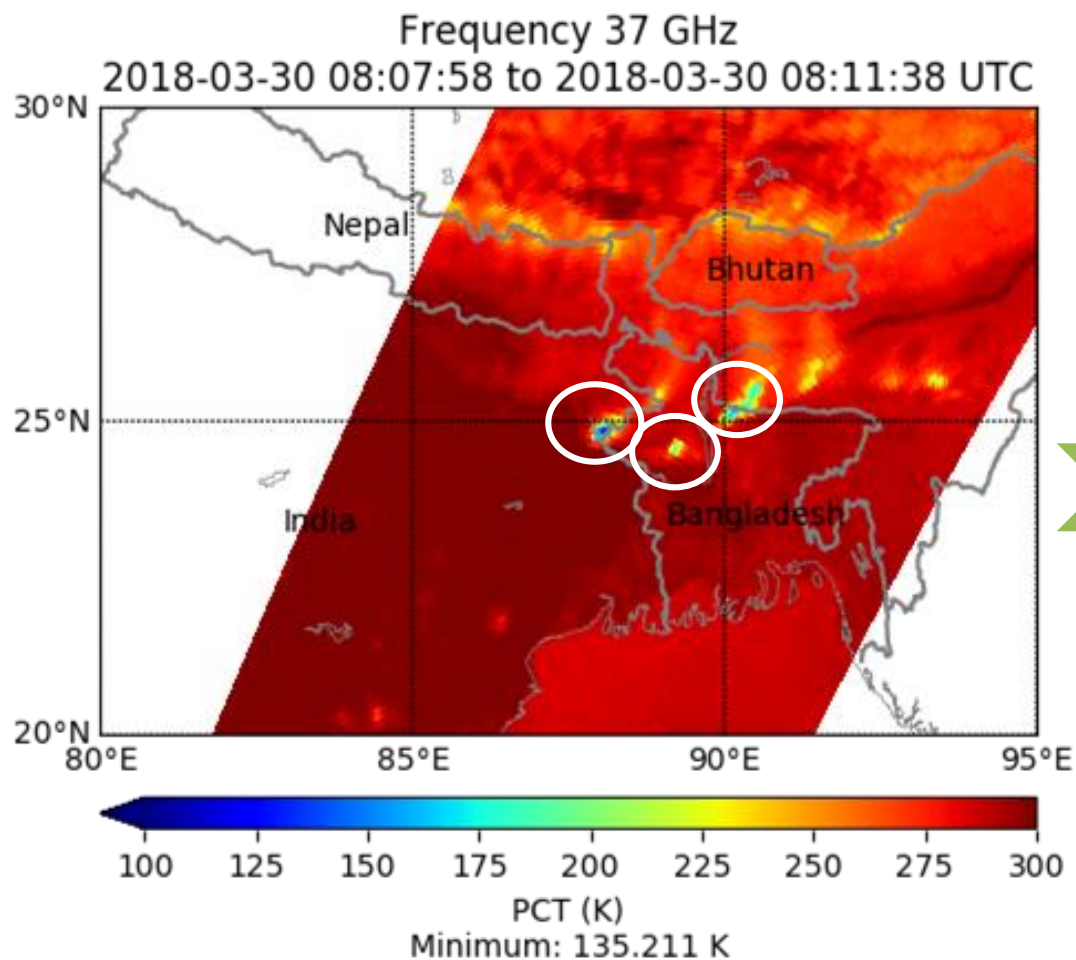
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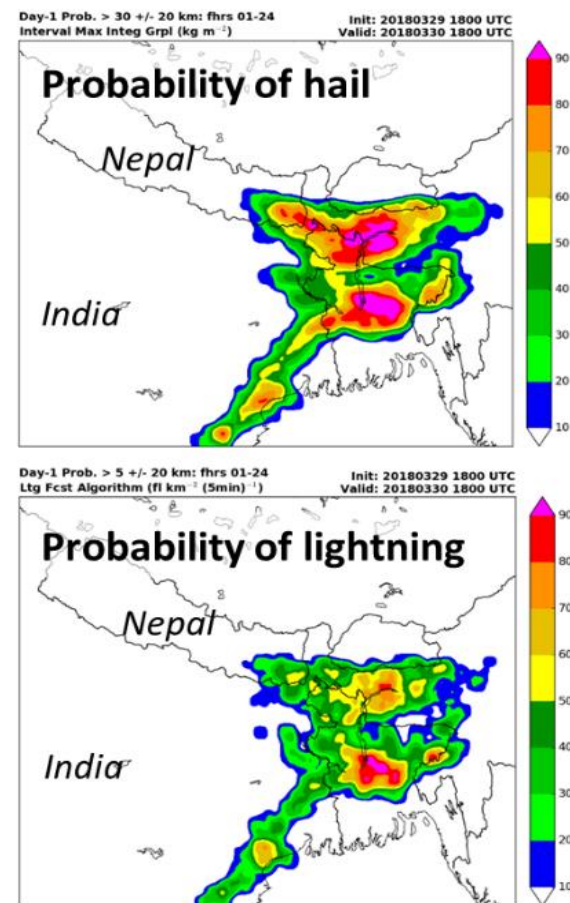
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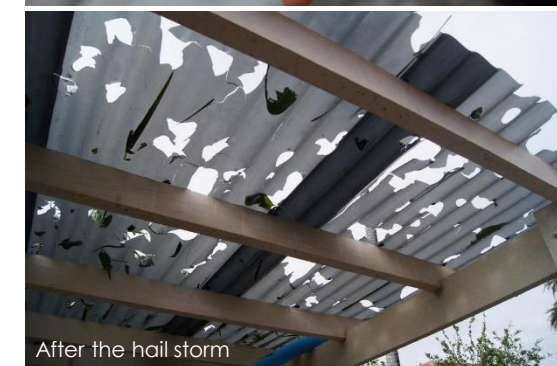
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HKH Model Prob.-Forecasts

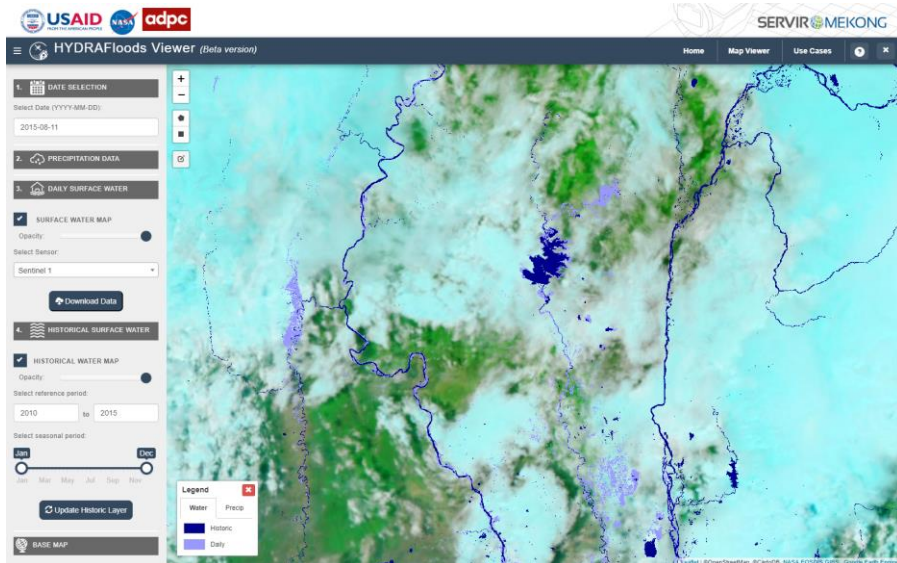
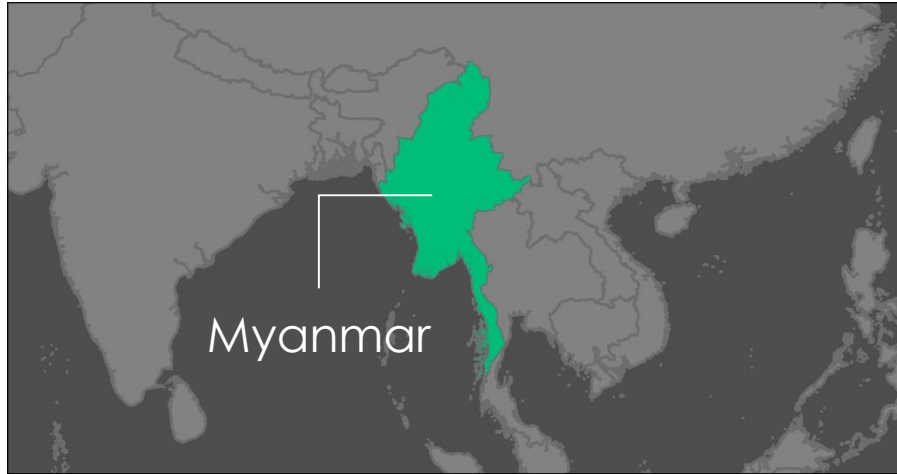


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Roof damage

Mekong: Supporting Early Flood Preparedness in Myanmar



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HYDRAFloods Viewer (Beta version)

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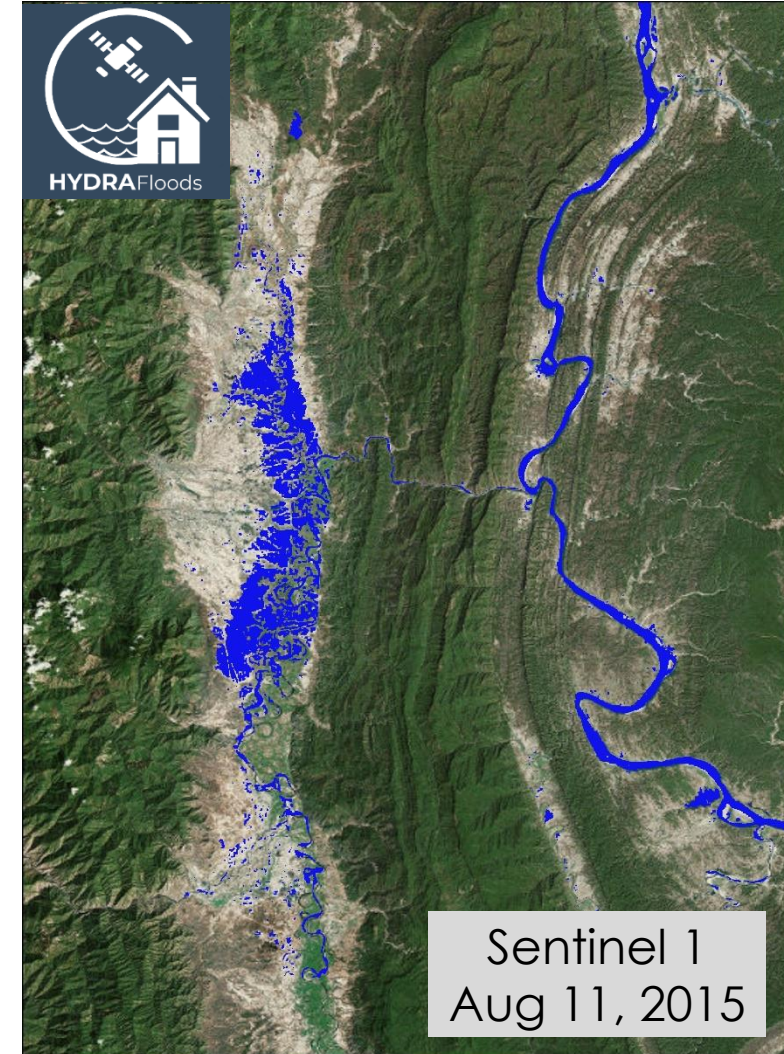
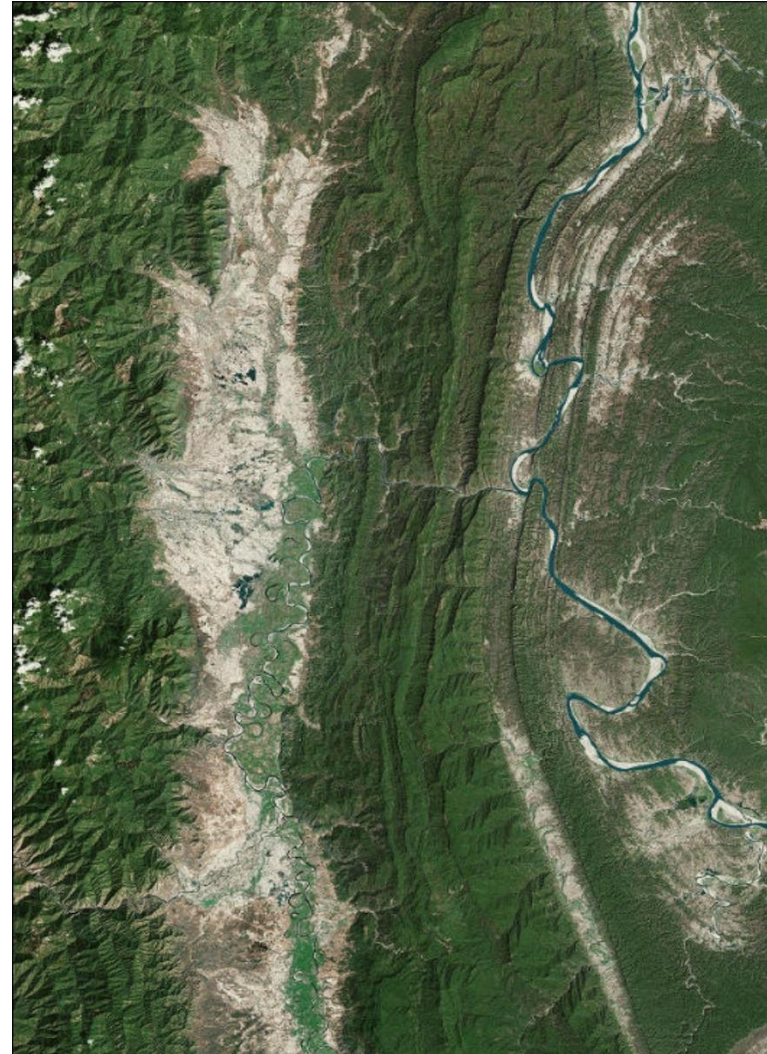
2. PRECIPITATION DATA

3. DAILY SURFACE WATER
 SURFACE WATER MAP
Opacity: [slider]
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4. HISTORICAL SURFACE WATER
 HISTORICAL WATER MAP
Opacity: [slider]
Select reference period: 2010 to 2015
Select seasonal period: [dropdown]
Update Historic Layer

BASE MAP

Legend
Water: [blue square] Precip: [purple square]
Historic: [dark blue square]
Daily: [light blue square]



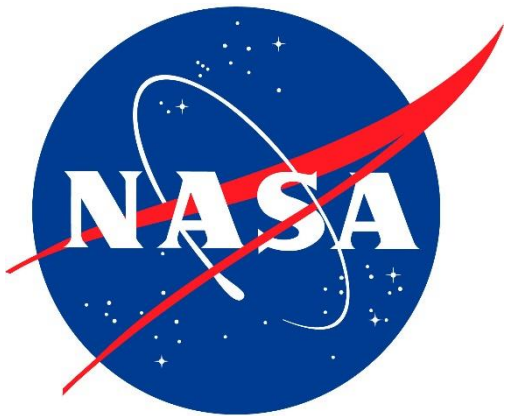
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