An Overview of NASA TROPICS Applications and Early Adopter Activities

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TROPICS Mission Overview

- Earth Venture Instrument proposal selection by NASA to measure tropical cyclone structure and demonstrate SmallSat technology

- Design
  - 6 CubeSats with 12-channel passive microwave radiometer (MicroMAS-2)
  - Provide rapid-refresh observations of temperature and moisture soundings and precipitation over the tropics with <60 minute revisit time
  - Meet requirements for temporal refresh needed to study storm evolution with ability to see into clouds

TROPICS = Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats
TROPICS Early Adopter Program

• **What is an Early Adopter:** Groups or individuals who have an interest in utilizing TROPICS data

• **Goal:** Build capacity to accelerate the integration of TROPICS in research and application quickly after launch

• **Objectives:**
  1. Identify applied research and applications areas
  2. Use current sensors and proxy data to demonstrate TROPICS capabilities and values
  3. Foster interaction between the Science Team and community

• **Value:** identify advantages and limitations that can be exploited or addressed prior to launch
• Meeting Objectives
  – Introduce a broad community of potential end-users to the expected value of TROPICS by reviewing mission specifications and status
  – Review TROPICS data applications through presentations and breakout discussions
  – Provide a forum for applied researchers and operational decision makers to share insight into how observations from TROPICS can be used in their organizations and challenges to their application
  – Begin establishment of a user community that can be used to highlight potential TROPICS applications and accelerate post-launch applications
  – Hard copy of the report available upon request (see me at the meeting) or go to Workshop website: http://tropics.ccs.miami.edu/workshop-summary/
Four application areas were identified and reported on:

- **Terrestrial:** high-temporal resolution precipitation data can supplement tropical regions that lack ground-based radar coverage.
- **TC Analysis and Nowcasting:** providing mission observations and imagery to operational hurricane forecasters who rely on satellite data to diagnose storm structure.
- **TC Modeling and Data Assimilation:** increased temporal frequency when used with 4DVAR techniques may aid in improving intensity forecasts.
- **Tropical Dynamics:** applied research to determine convective extremes and trends in precipitation and severe storms not resolved well enough with current temporal frequency of observations.

End-users want temporal refresh of 30 – 60 minutes to address research and forecasting challenges related to tropical cyclones; more than 3 hours doesn’t add to current datasets.

Most users want data latency of < 1 hour; > 3 hours makes data difficult to use for operations.

Mission data need to be provided in data formats compatible with user modeling and decision support systems.
Application Focus Areas

Terrestrial / Disasters
- Disaster risk management
- Flash Flooding
- Landslides
- Land surface classification
- Drought

Tropical Cyclone Analysis and Forecasting
- Formation
- Structure & Intensity
- Position estimates
- Rapid Intensification
- Tropical convective lifecycle

Tropical Cyclone Modeling and Data Assimilation
- Global and mesoscale models
- Assimilation approaches
- OSSE studies
- Intensity models
- Radiative transfer models

Tropical Cyclone and Tropical Dynamics
- Tropical Cyclone Structure
- Madden-Julian Oscillation
- Tropical Cyclone Diurnal Cycle
- Mesoscale Systems
- Rapid Intensification
Meteo France developed a data assimilation method for Megha-Tropiques SAPHIR and plan to follow the method to assimilate TROPICS observations.

Use ATMS to develop a Bayesian Monte Carlo Integration technique to retrieve atmospheric variables and assimilate in GSI+GEOS system.
Early Adopter Examples

Assessing the ability of the HNR proxy data to resolve the Tropical cyclone Diurnal Cycle

Use of real-time NOAA-20 CrIS/ATMS profiles to support hurricane field campaigns during Dorian as a demonstration of a future TROPICS application

NUCAPS 596 mb water vapor

Dry air intrusion

601 UTC

748 UTC

NOAA-20
• Goal of proxy data is to accelerate the use of mission data in operational/decision-making environments

• Proxy data are being developed using modeled data from a Hurricane Nature Run and the FY-3C satellite
  – Simulated datasets that match the spatial, temporal, and spectral frequency of planned satellite architecture
  – Plan to make data available in multiple data formats for easier, earlier integration

• Science Team recently released a version consistent with post-launch format
Proxy data is currently available here: [https://www.nsstc.uah.edu/tropics/get_involved.html](https://www.nsstc.uah.edu/tropics/get_involved.html)

But will be moved to a new site by Feb. 1 2020 [https://weather.msfc.nasa.gov/tropics/products_proxy.html](https://weather.msfc.nasa.gov/tropics/products_proxy.html)
Get Involved

- 2nd TROPICS Applications Workshop 19-20 February 2020
  http://tropics.ccs.miami.edu/

- We would love to learn more about how your group uses satellite data to study or make decisions regarding tropical weather or climate
  - Become an EA!
  - Subscribe to our TROPICS Applications Mailing List
  - Participate in quarterly calls
  - Check out the proxy dataset

- Contact me at emily.b.berndt@nasa.gov if you have any questions or would like to get involved

- Our new website will be launched soon: https://weather.msfc.nasa.gov/tropics/