National Aeronautics and Space Administration

NASA's Contributions to the 2021 Aeolus Field Campaign: NASA Headquarters

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vEGU 29 April 2021

https://espo.nasa.gov/cpex-aw
https://cpex.jpl.nasa.gov/cpex-aw/





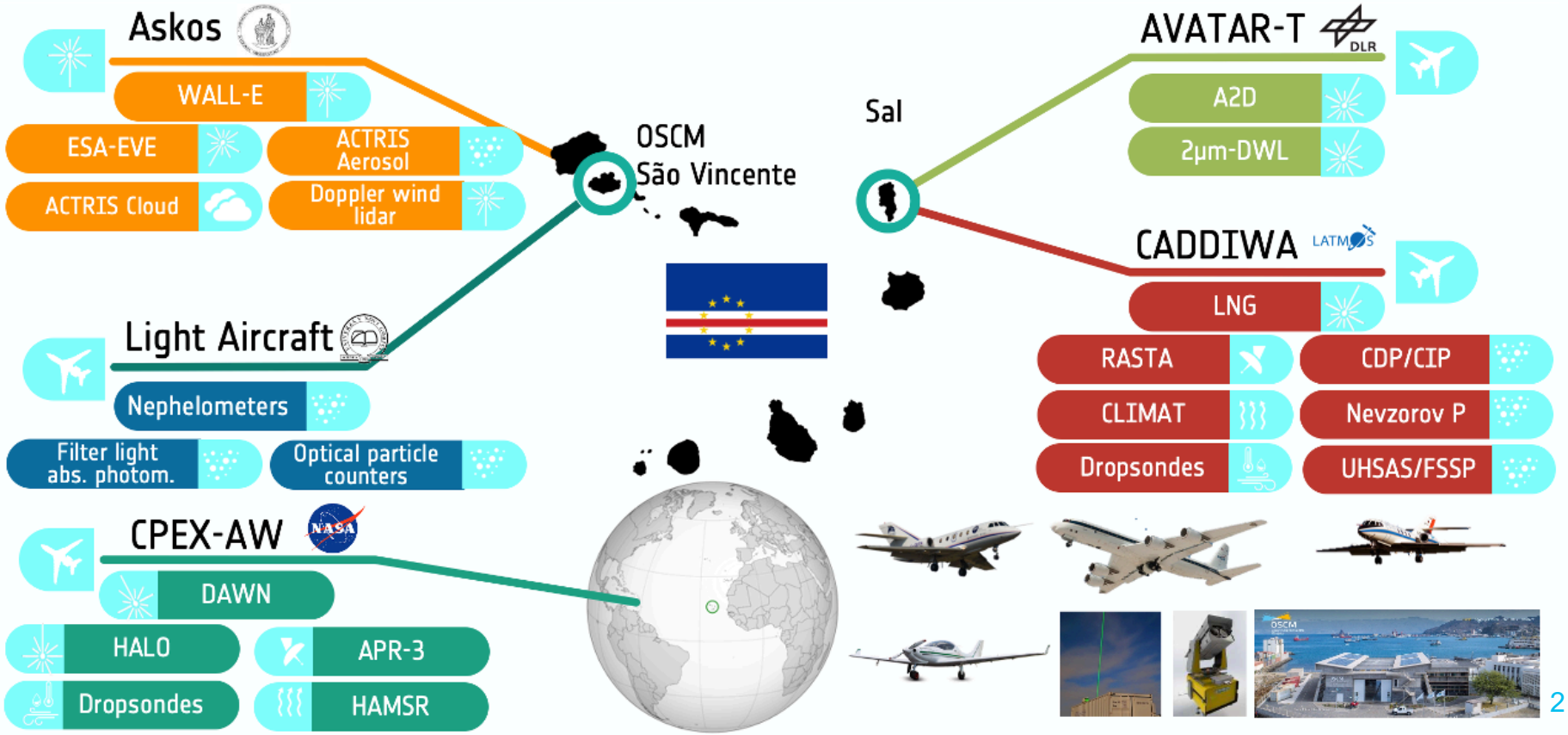


Tropical Campaign: Multiple Teams for Aeolus Cal/Val and Science Observations

NASA: Convective Processes Experiment – Aerosols and Winds (CPEX-AW)

- NASA moved to St. Croix due to international COVID complexities at Cabo Verde
- Operations were Summer 2020, rescheduled for July-Aug 2021; NASA considering matching new proposed dates of our European partners (~Mid-Aug to Late Sept)

Aeolus not expected to have enough signal to postpone to summer of 2022



CPEX-AW Aeolus Cal/Val ~~2020~~ 2021 with ESA



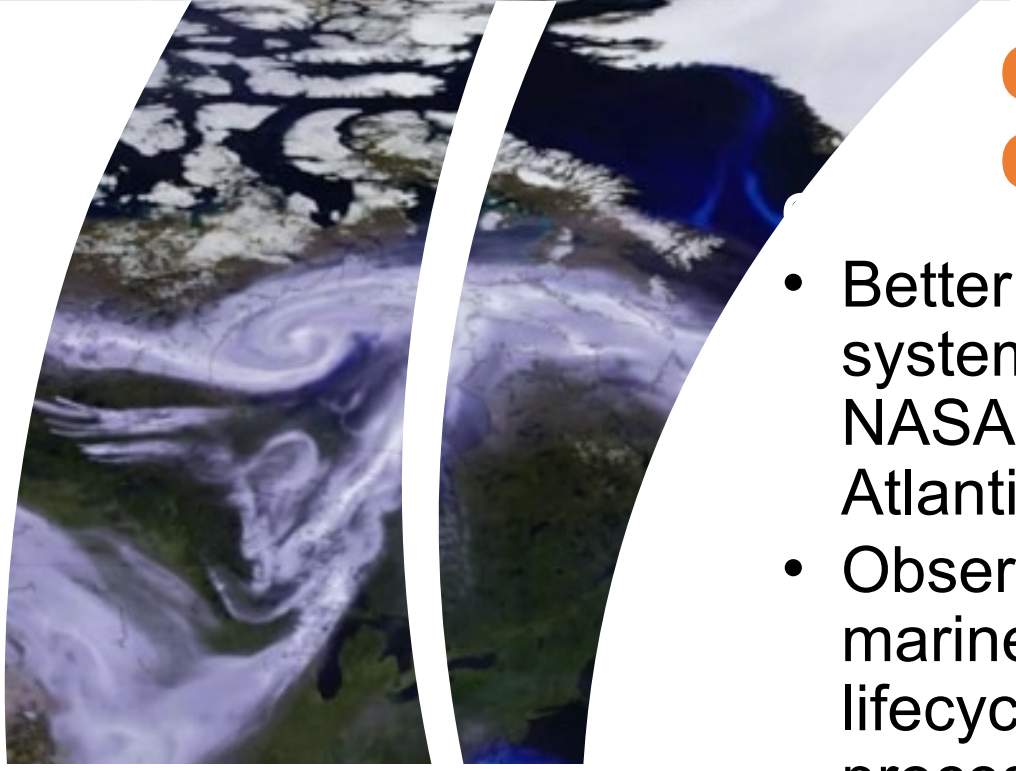
Confirmed Instruments on NASA's DC-8 Aircraft:

- **DAWN: (Doppler Aerosol WiNd lidar)** to provide vertical profiles of u and v components of 3-D wind below the aircraft.
- **HALO**: **(High Altitude Lidar Observatory)** to measure atmospheric H2O mixing ratios & aerosol/cloud/ocean optical properties.
- **Dropsondes** (from the DC-8)
- **APR-3: (Airborne Precipitation and Cloud Radar 3rd Generation)** to provide 3-frequency Doppler radar obs of clouds & precip
- **HAMSR**: **(High Altitude Monolithic Microwave integrated Circuit (MMIC) Sounding Radiometer)** infers the 3-D distribution temperature, water vapor, and cloud liquid water in the atmosphere in the presence of clouds.

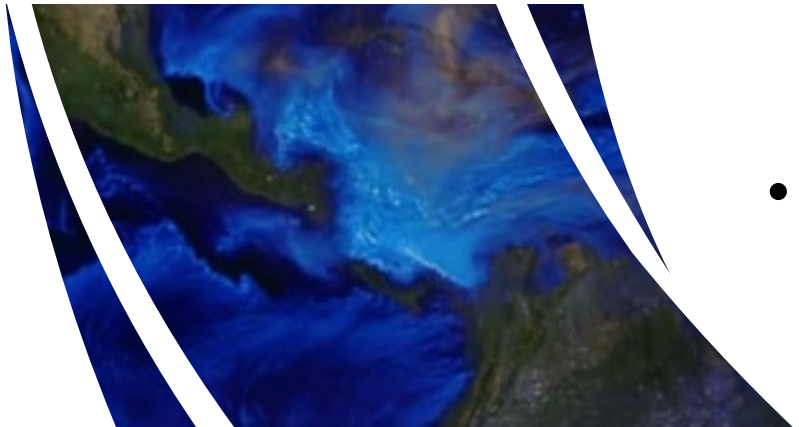




- **Possible inclusion: AIRO**: (**Aircraft In-situ Radio Occultation**) remote sensing payload that processes the aircraft's GNSS signals into GNSS radio occultation (GNSS-RO) data
- **Location: St. Croix; DC-8 Flight hours: 100-150; Dates: Early July-mid-August OR Mid-Aug-Late Sept 2021; Data will be freely available**
- **Hoping to coordinate with NOAA aircraft for research flights**
- **CPEX-AW includes** soundings, NRT modeling, and data assimilation



Some adjustments to science objectives will be necessary due to change in location from East to West Atlantic



CPEX-AW/Aeolus Cal Val Science Objectives

- Better understanding interactions of convective cloud systems and tropospheric winds as part of the joint NASA-ESA Aeolus Cal/Val effort over the tropical Atlantic;
- Observing the vertical structure and variability of the marine boundary layer in relation to initiation and lifecycle of the convective cloud systems, convective processes (e.g., cold pools), and environmental conditions within & across the ITCZ;
- Investigating how the African easterly waves and dry air and dust associated with Sahara Air Layer control the convectively suppressed and active periods of the ITCZ;
- Investigating interactions of wind, aerosol, clouds, and precipitation and effects on long range dust transport and air quality over the western Atlantic.

Funded Selections for CPEX-AW Science Team

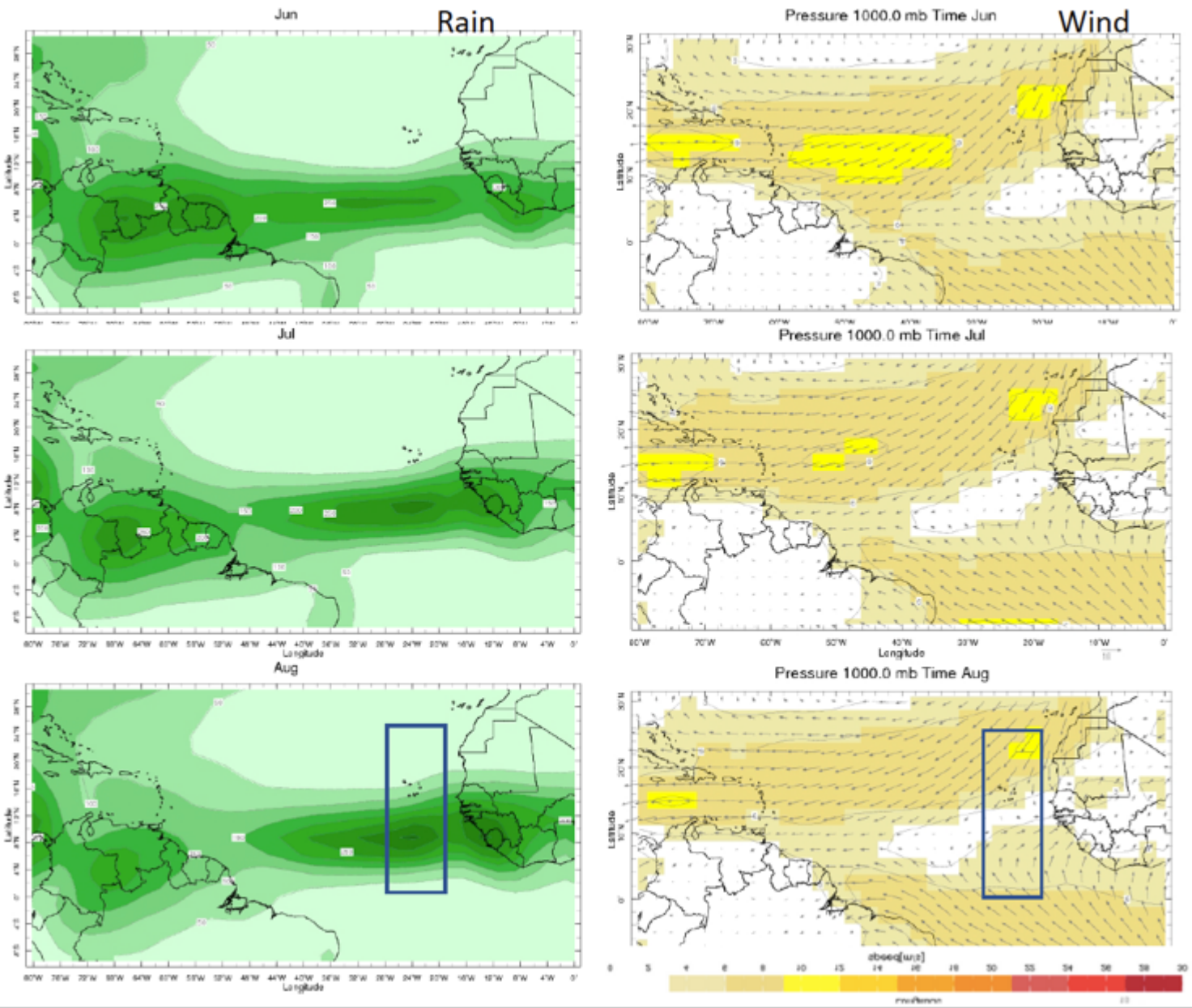
Principal Investigator and Team Members	Proposal Titles
PI: Shu-Hua Chen (U California, Davis); Team Members: Nathan, Kavaya, Yang	Improving Prediction and Advancing Understanding of Weather Systems over North Africa and the Tropical Atlantic Using Lidar Wind Observations
PI: Shuyi Chen (U. Washington, Seattle); Team Members: Su; Bedka, Durden, Emmitt, Hristova-Veleva, Z Pu, Rowe, Tanelli, Turk, Zipser	Interactions of Convection, Boundary Layer, and Wind (CBWind) in the Tropics: A NASA Field Campaign
PI: Hristova-Veleva (JPL)	An End-to-End Portal System for support of the 2020 Nasa Airborne Field Campaign
PI: Lambrightsen (JPL)	Tropical convection and thermodynamics (HAMSR)
PI: Nowottnick* (NASA Goddard); Team Members: Yorks, Colarco, Reid, LeBlanc	Untangling interactions between Tropical North Atlantic dynamics and Saharan dust using observations from the joint NASA-ESA Aeolus Validation Campaign
PI: Z. Pu (U. Utah); Team Members: Emmitt, Shuyi Chen	The Properties of Convective Systems in the Tropics and Their Relationships to the Tropospheric Environment and Surface Winds: A Study Using Advanced Data Assimilation with NASA Field Campaign and Satellite Observations
PI: Rowe (U Wisconsin, Madison); Team Members: Shuyi Chen, Durden, Sy, Tanelli, Turk	Linking Convective Cloud Processes and Air Motion through Airborne Datasets
PI: Sakaeda* (U. of Oklahoma); Team members: Elinor Martin*, Rios-Berrios, Redemann	Understanding the Coastal-to-Maritime Transition of Propagating Convective Systems over the West African Coastal Region
PI: Zawislak (U. Miami); Team Members: Dunion, Majumdar, Brammer, Bucci, Hardesty	Using Aircraft and Satellite Observations to Characterize African Easterly Wave Variability and Environmental Factors Associated with Downstream Tropical Cyclogenesis
PI: Zipser (U. Utah); Team Members: Russell, Veals, Huffman, C. Liu	The Upscale Growth of Mesoscale Convective Systems: A NASA Field Campaign in the Eastern Tropical Atlantic

***US Team Members specifically recommended to work toward joint ESA science goals by Cyrille Flamant and Malcolm Davison**

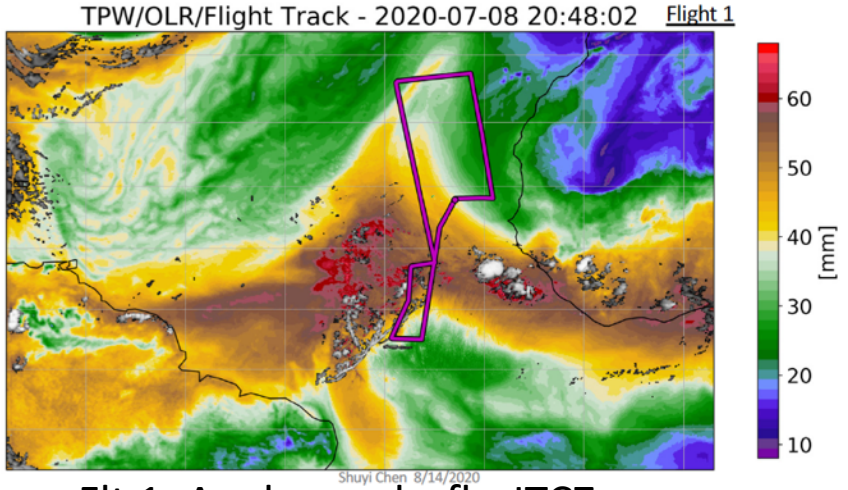
Climatology June. July, August

Figure: Climatology of rainfall (left panels) and wind (right panels) for June, July, and August (credit: IRI).

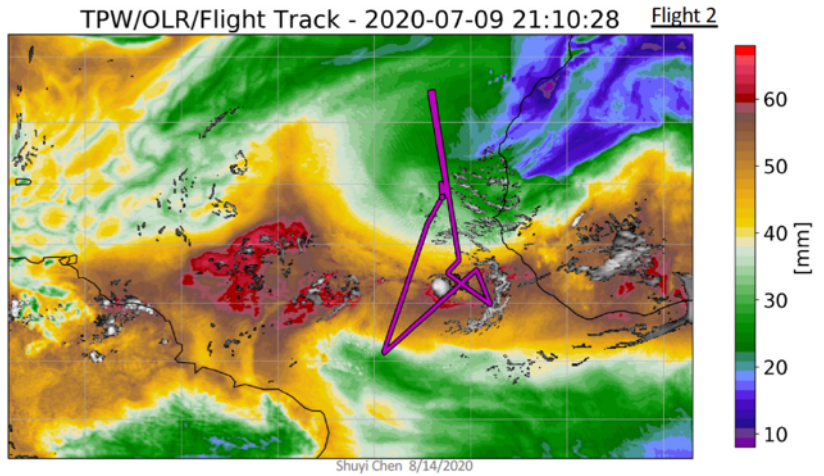
Blue box indicates the domain for DC-8 flights (if we were able to operate out of Cabo Verde).



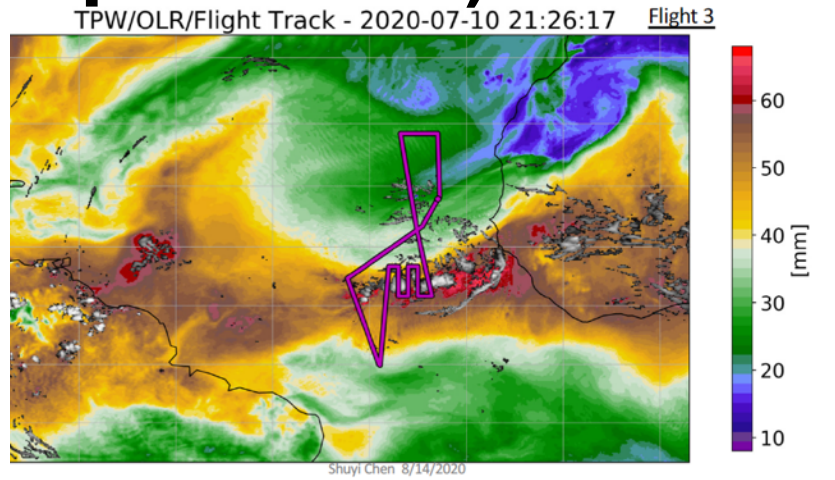
CPEX-AW Summary of Virtual Flights tested summer of 2020 (assumed Cabo Verde based operations)



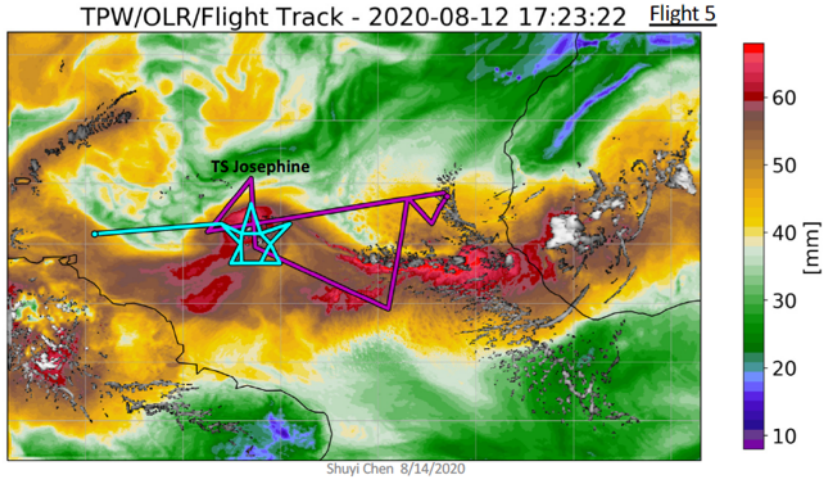
Flt 1: Aeolus underfly, ITCZ



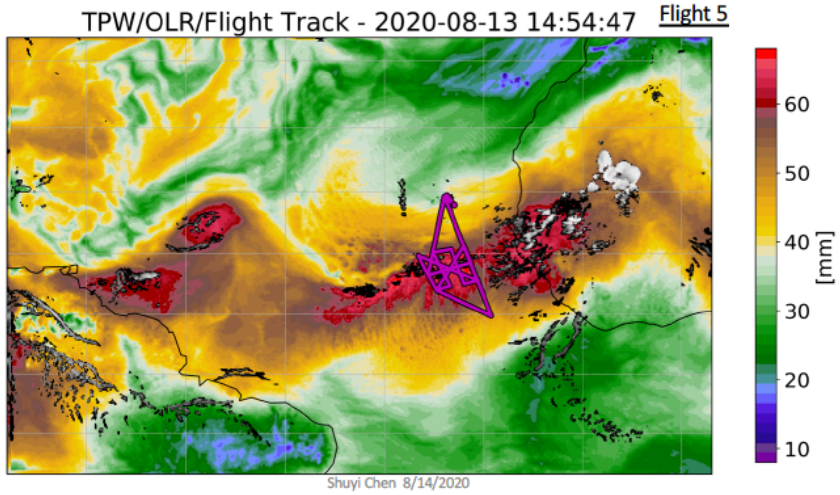
Flt 2: Joint with DLR & SAFIRE Falcon



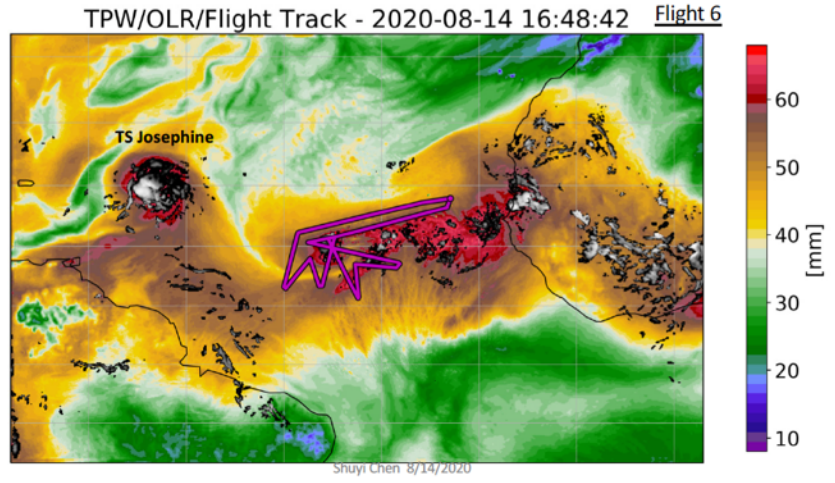
Flt 3: Dry air, ITCZ, Aeolus underfly



Flt 4: Joint w NOAA G-IV, TS Josephine



Flt 5: ITCS Convection, underfly Aeolus

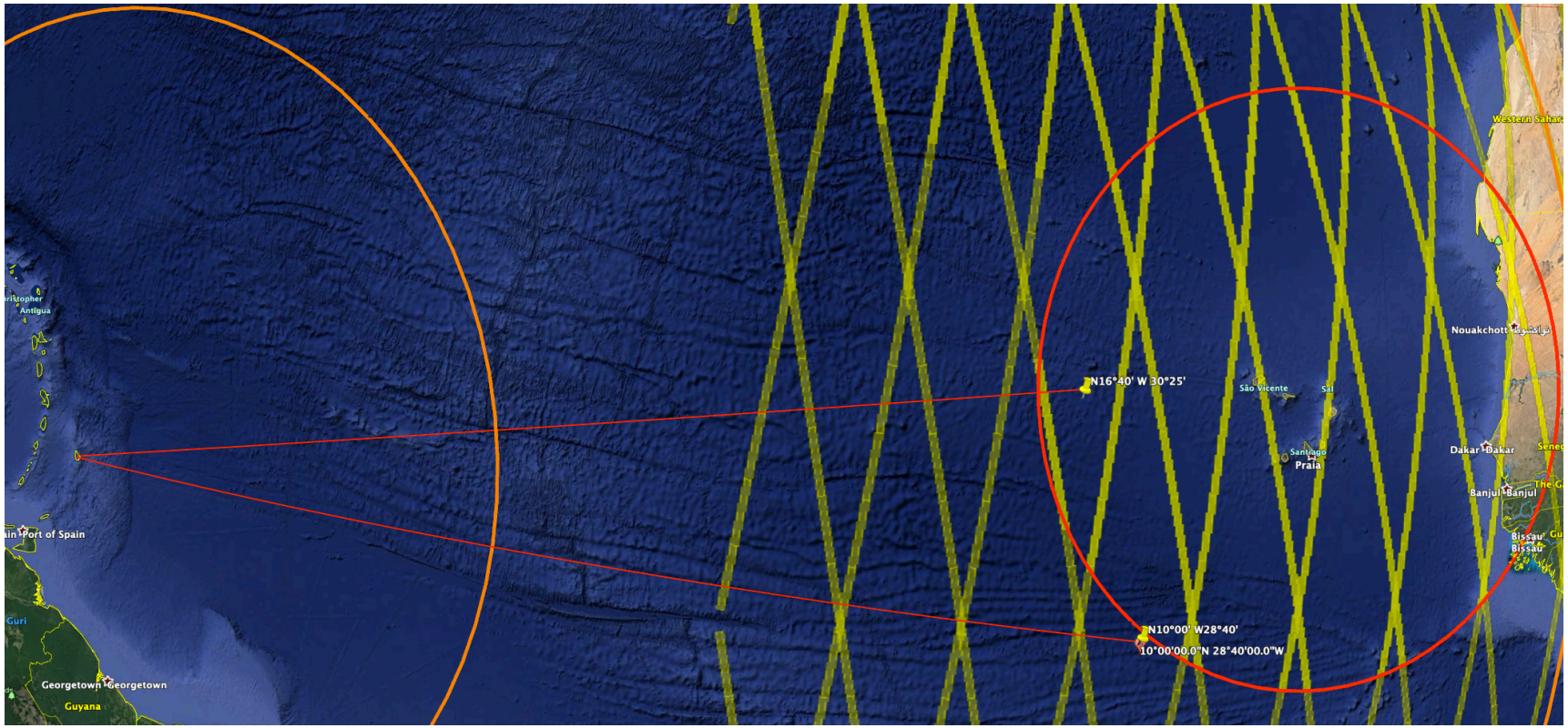


Flt 6: Dry air intrusion, ITCZ convection

UWIN-CM coupled atmosphere-ocean model forecast (initial and lateral BC from ECMWF) is used for all virtual flights.

DC-8 Aircraft & Coordinated flights with European Falcons

DC-8 has about 10.5 hours flight time meaning that the DC-8 could loiter near Cabo Verde (at yellow dots) for approximately 45 min to 1 hr 45 min for coordinated flights with the French and German aircraft. This would be a long round trip flight from St. Croix. Yellow lines indicate Aeolus track.



Flight planning will be further evaluated and coordinated upon confirmation among the partners

NASA CPEX-AW **2021 Preparations**

1. All instrument teams have access to their equipment and are preparing for ops summer 2021
2. Sea shipments start May 1 (for a July start of operations) due to the shipping delays with the pandemic
3. Refine with DC-8 crew coordinated flight options
4. Plan science (and coordinated) flight plans to address as much PI science as possible within flight hours available, Include coordination with French and German Falcons
5. Armstrong medical clearance for DC-8 on-board participants
6. Logistics: airport/hanger, hotel, transport, high-speed internet need to be secured for St. Croix
7. We are estimating 60+ in-field participants even with reduced numbers due to COVID
8. COVID Operations Safety plan being developed (CDC guidelines)
9. Caveats and potential changes are always possible

NASA CPEX-AW Status

- Funding rephased for operations in 2021
- NASA received approval for our return to on-site work plan so that individual instrument teams can perform maintenance and upgrades necessary for the summer 2021 flights
  - It is expected that this on-site/in-field operations plan can be leveraged by university participants.
- DC-8 Maintenance (engine and other repairs) due to be completed nearly on-time with CPEX-AW instrument upload not affected and starting May 2021
- Operations will be periodically be evaluated based on COVID status.

ALL SEEMS A GO FOR JULY-MID AUGUST **OR** MID-AUGUST-END OF SEPTEMBER OPERATIONS

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