Health & AQ Applications as Part of the Aerosols & Cloud-Convection Precipitation (A-CCP) Study

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July 12th, 2019; HAQAST Meeting, Pasadena

2017 NAS Decadal Survey

"shape science priorities and guide agency investments into the next decade"

2017 NAS Decadal Survey

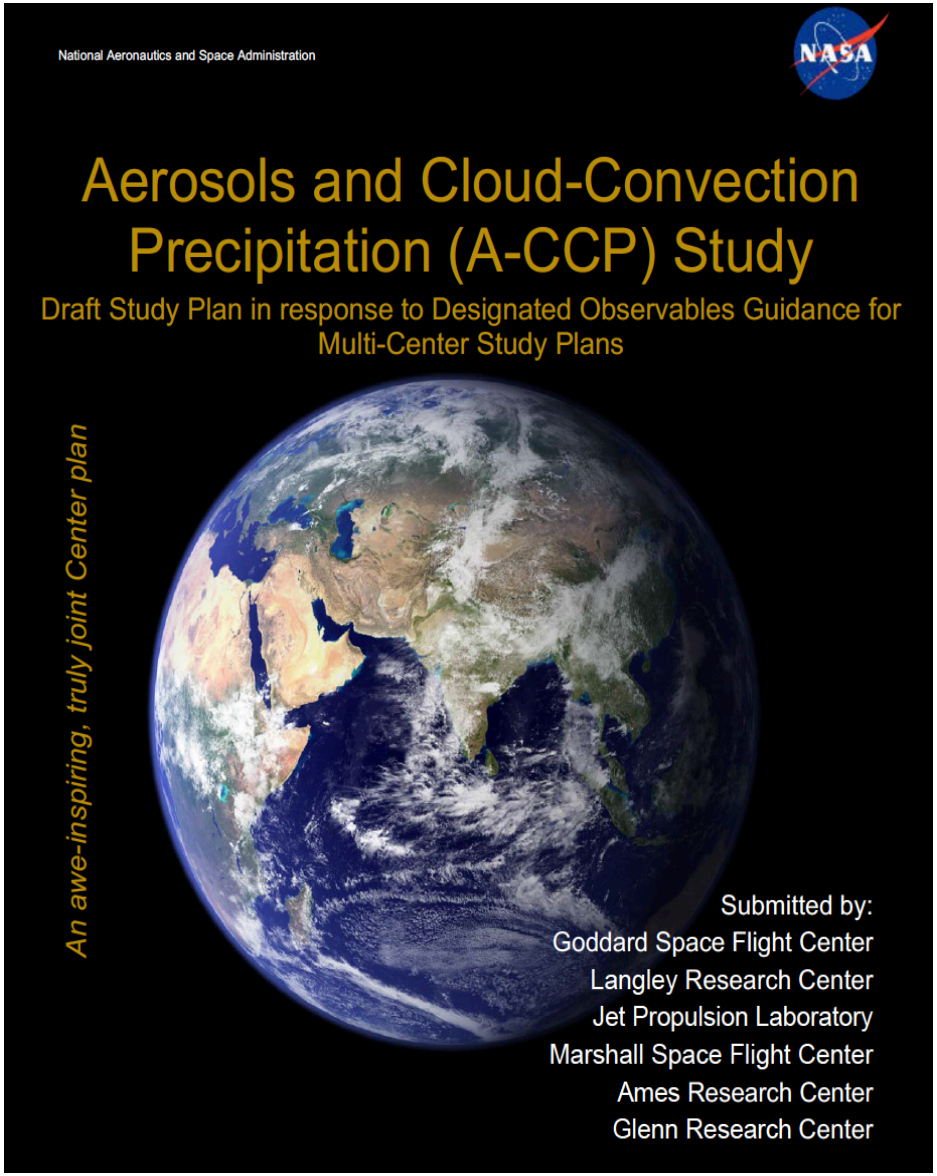
Both science and applied sciences were highlighted in the report.

NASA Study Plans

NASA initiated four "study plans", including A-CCP, based on the Decadal Survey recommendations.

*Two new NASA flight program elements: a committed group of observations termed *Designated*, along with a competed group termed *Earth System Explorer*.

Targeted Observable	Science/Applications Summary	Candidate Measurement Approach	Designated	Explorer	Incubation
Aerosols	**Aerosol properties, aerosol vertical profiles, and cloud properties** to understand their effects on climate and air quality	Backscatter lidar and multi-channel/multi-angle/polarization imaging radiometer flown together on the same platform	X		
Clouds, Convection, and Precipitation	**Coupled cloud-precipitation state and dynamics** for monitoring global hydrological cycle and understanding contributing processes including cloud feedback	Radar(s), with multi-frequency passive microwave and sub-mm radiometer	X		
Mass Change	**Large-scale Earth dynamics** measured by the changing mass distribution within and between the Earth's atmosphere, oceans, ground water, and ice sheets	Spacecraft ranging measurement of gravity anomaly	X		
Surface Biology and Geology	**Earth surface geology and biology,** ground/water temperature, snow reflectivity, active geologic processes, vegetation traits and algal biomass	Hyperspectral imagery in the visible and shortwave infrared, multi- or hyperspectral imagery in the thermal IR	X		
Surface Deformation and Change	**Earth surface dynamics** from earthquakes and landslides to ice sheets and permafrost	Interferometric Synthetic Aperture Radar (InSAR) with ionospheric correction	X		



What will A+CCP observe?

A-CCP is a combined Aerosols and CCP process-oriented Earth Observing System

- Payload may consist of:
  - a) Active sensors (lidars and radars) are the cornerstones of the payload, complemented by
  - b) Several passive radiometers (multi-angle, multi/hyper-spectral, with some polarized channels, from UV to sub-mm)

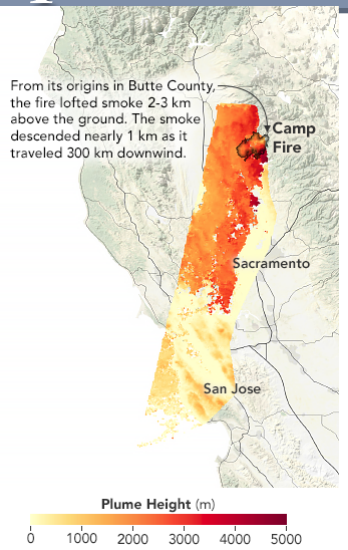
- Being a process-oriented mission, some of the instruments may have a narrow swath needed to provide context to the measurements (as opposed to wide swath needed for mapping)

- A-CCP is an Earth Observing System potentially consisting of
  - a) A space-based mission (payload, spacecraft, launch vehicle)
  - b) A fully integrated, sustained sub-orbital component
  - c) Models, data assimilation and synergistic algorithms needed to extract maximum benefits from the A-CCP measurements

Objective 6: Aerosol Attribution
Potential Enabled Application Example

- **AQ Forecasting & Decision-Making:** Observations of speciated aerosol enable initial conditions, plume tracking (e.g., volcanoes, forest fires), and estimation of emissions for AQ forecasting, as well as, for AQ decision-making, such as State Implementation Plan development and Exceptional Event support.
- **Relevant Geophysical Properties:** AOD, Aerosol Extinction Profiles, Aerosol Speciation, Aerosol layer height

- **Partners**: NOAA, EPA, state AQ agencies, National Forest Service, FAA, VAACs

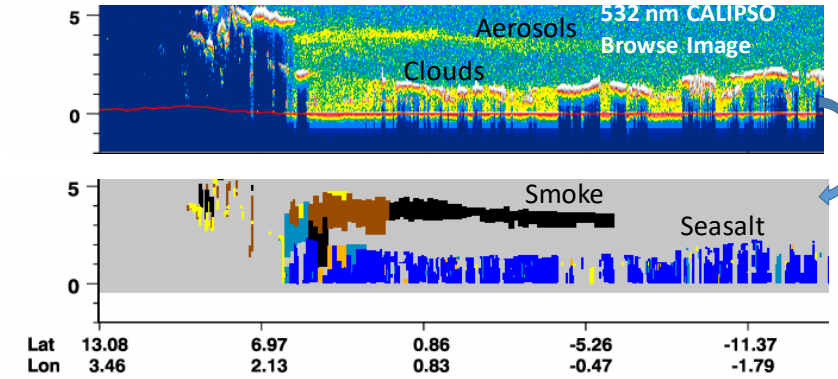


A+CCP has the potential to provide more and better information to characterize the 3-D structure of speciated aerosols within the boundary layer and to quantify emission sources

Objective 8: Absorbing Aerosols
Potential Enabled Application Example

- **Wildfire Operations & Management :** Observations of the horizontal and vertical extent of absorbing aerosol enable estimation of the impact on air quality at the nose level of biomass burning and at larger scales, the impact on radiation of smoke aerosols above clouds
- **Relevant Geophysical Properties:** AOD, AAOD, Aerosol Extinction Profiles, Aerosol Speciation, Aerosol layer height,
- **Potential Partners**: EPA, NOAA, United States Forest Service, state agencies

A+CCP will enable measurements of absorbing aerosol, particularly smoke from wildfires and biomass burning that will allow more accurate estimates of plume injection heights and transport



CALIPSO images of aerosols above clouds and absorbing (smoke) and scattering (seasalt) aerosol subtypes

Stakeholder Community Input

- Tell us how you use aerosol satellite data and how you would like to see it improved.
  - If your interest is piqued, please contact us.
- NASA Weather and Air Quality Forecasting Applications Workshop (July 22-23, 2019)