A preliminary concept of a coordinated research program for the coming decade on cloud, precipitation aerosol processes

Three concepts all with emphasis on microphysics:

I) add cloud microphysics and aerosol capability to GPM constellation spacecraft (eg spectral polarimeter)

II) An aerosol element - profiling HSRL system and spectral polarimeter –

III) Atmospheric dynamics mission - dual frequency radar (35/94 GHZ), Doppler, scan TBD and microwave radiometry - emphasis on cloud and precipitation microphysics - fly with II) above - also recognized loss of EGPM

The NRC panel packaged this concept together with Ocean ecology (AKA ocean color) into the ‘ACE’ mission

Under study by both GSFC and JPL (directed by NASA HQ)
### Mission Science Objectives and Questions

- **Reduce the uncertainty in cloud-aerosol-precipitation interaction through simultaneous measurement of aerosol and cloud & precipitation properties.**
- **Estimate the carbon uptake by ocean ecosystems through global measurements of organic material in the surface ocean layers**
  - How do aerosols deposited on the ocean surface influence nutrient levels and stressors for ecosystems?
  - How do climate and habitat changes influence the productivity and elemental cycles of the global oceans?

### Instrument Requirements

- **Multi-beam cross-track dual wavelength lidar (cloud and aerosol profiles)**  
  - 30m vertical resolution; 532 & 1024 nm; Dual polarization  
  - ACE A
- **Dual frequency (94/34GHz) Cross-track scanning cloud radar (cloud profile and characterization)**  
  - <200m vertical resolution; <1km footprint; >-30dBze Sensitivity  
  - ACE B
- **Multi-angle Multi-spectral Polarimeter (cloud and aerosol properties and height)**  
  - 5 angles; 380-164 nm; >350km swath; 500m resolution  
  - ACE B
- **Multi-band cross-track visible/UV spectrometer (aerosols and ocean color)**  
  - 2nm ozone band (317nm); 5nm resolution 345-800nm; 58.3 cross-track scanning

### Mission Description

- **One or more spacecraft (flying in formation)** making simultaneous measurements of clouds, aerosols, and ocean biological processes
- **‘Four’ instruments** (see below, left)
- **LEO, Sun-Synchronous early afternoon orbit, to minimize sun glint and optimize passive instrument performance**
- **500-650km orbit to optimize coverage, and active instrument requirements**

### Mission Depictions

- **MISR on Terra: Heritage for Multi-Angle Polarimeter**
- **CloudSat: Heritage for Cloud Radar**
- **CALIPSO and the A-Train: Aerosol Lidar, constellation and formation flying heritage**