Atmospheric Radiation Science Workshop, Boulder, Colorado
March 8-11, 2016

Workshop Topics


Category 1: Radiation Science – Current Directions

- How can airborne science bridge the gap between global or regional scale satellite observations and modeling of clouds and aerosols on one side, and process-level modeling and detailed case studies on the other?
- What can experiment and flight planners learn from modelers, the satellite remote sensing community, and from ground-based experiments?
- Summarize radiation science problems and questions that were or will be addressed with specific experiments, for example, SEAC^{4}RS, TC^4, CSET, ORACLES, INTEX, ARISE, ARCTAS.
- Review specific goals and "score cards" and compare the different experiment approaches for addressing science questions
- Review the different challenges in determining cloud-aerosol radiative effects, heating rates and photochemistry parameters from airborne vs. ground-based vs. satellite observations. For example: What are the uncertainties of observables such as aerosol absorption and heating rate above or between clouds? What do we need to reduce these uncertainties? Which measurement, sampling, or analysis strategies are most promising in this regard?
- What kind of information do specific observations contain, and how do they reduce the observational uncertainties? How can we quantify information content? How do we reduce observational artifacts?
- Are there new potentially important observables (for example, diffuse radiation) that are only rarely measured on aircraft?
- Review different kinds of "closure studies", and discuss the collective role of satellite, in-situ and ground-based radiation observations in this context.

- What are the lessons learned from ground-based observations (for example, in terms of redundant measurements, stability)?
- How can disparate data sets acquired from the ground, aircraft, and satellites be used effectively? What are the synergies between these observational vantage points?
- **Focus area clouds, aerosols and three-dimensional effects**: Discuss approaches for determining the radiative effects, actinic fluxes and heating rates in spatially complex scenes. How can the observations be "scaled" from the local perspective of airborne observations to be useful for global modeling?
- **Focus area polar latitudes**: Establish the most pressing needs for airborne science in these data-sparse regions. Do we need direct measurements of the radiative effects of mixed-phase clouds above bright surfaces, the dark ocean, and the marginal zone? Do we need to better constraining the polar surface radiative energy budget? Do we need to improve cloud remote sensing using new remote sensing approaches or by in-situ validation? All of these? Regardless of the priorities, it is necessary to discuss how airborne observations can effectively fill gaps in the satellite and ground-based observational system, given their limited spatial and temporal spatial sampling capabilities.

Category 2: Instrumentation, Technology, and Requirements

- Summary of current technologies: Discuss performance parameters (instrument requirements) such as accuracy, precision, temporal and spectral resolution, stability of the various different kinds of radiometers that are used throughout the community
- Calibration aspects
    - Discussion of quantities: irradiance, actinic flux, radiance, and how accurately they can be determined
    - Angular response, wavelength assignment, temperature sensitivity
    - Shortwave calibration topics (FEL bulbs, LEDs, tuneable laser, solar techniques (Langley)
    - Longwave calibration topics (heat bath vs. transfer vs. others), field calibration techniques and challenges
    - Should facilities be shared in the community?
- Discuss advantages and drawbacks of simplified/miniaturized, custom-built state-of-the-art instrumentation, and standardized/COTS-based instrumentation. Outline domains of application for each of those
- Stabilization and Pointing (irradiance/radiance, almucantar, solar tracking, AMAX-DOAS)
- Strategies for improving performance parameters (for example, through fiber technology, cooling, new calibration approaches, leveling platforms)
- Emerging technology and new insights about the performance of commonly used components such as calibration equipment, spectrometers, pyranometers, optical fibers
- Developments in spectral imaging and sunphotometer systems for remote sensing
- What can we learn from ground-based measurements (e.g., redundancy)
- What are additional potentially important observables (for example, diffuse radiation) that are only rarely measured on aircraft?
- Global vs. diffuse vs. direct separation techniques (SPN1 vs. rotating shadowband)

Category 3: Platforms, Regulations, and Flight Planning

- Discuss typical flight planning approaches given the range of current science questions, especially when they require satellite coordination, multi-level flights, profiles, aircraft collocation, low-altitude or in-cloud legs.
- Can multiple requirements, e.g., for radiation science, air quality/chemistry, in-situ plume/cloud sampling be harmonized in a single framework?
- What are the benefits and drawbacks of the various different aircraft that have been used for radiation and remote sensing observations?
- How can non-traditional platforms (helicopters, towed payloads, tethered balloons, drones) contribute to radiation science? Is it possible to make radiation observations on such platforms, and what are the tradeoffs compared to traditional, more stable platforms?
- How can we address the "collocation problem" in radiation science – i.e., the need to sample above, within, and below a layer of interest? How do we get closer to the surface?
- For multi-platform measurements (especially involving drones and manned aircraft), what constraints are imposed by current regulations? Are there strategies to cope with such restrictions (for example, by creating dedicated flight zones)?
- What can experiment and flight planners learn from modelers, from the satellite remote sensing community, and from ground-based experiments?

Category 4: Programmatic Concerns and Directions

- How is radiation science represented at NASA, NSF, DOE, NOAA, National Laboratories, and Universities? What are the programmatic overlaps? Are there any perceived gaps?
- What is the direction that our observing system is taking? What will be the roles of surface, aircraft and satellite observations?
- Which airborne platforms are currently employed? What can we expect in the future? Can the radiation science community help in defining science and platform requirements (e.g., UAVs, South/North Pole transit aircraft, NOAA/NASA follow-on aircraft, commercial flights)?
- Strategies for enhanced data use: New developments in data dissemination, visualization, exchange between experimenters and data users.