Part 2 Question & Answer Session

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Ed Nowottnick (edward.p.nowottnick@nasa.gov) or Melanie Follette-Cook (melanie.cook@nasa.gov).

Question 1: But how can you tell that the cloud is ice and not water?
Answer 1: We tend to refer to liquid water as water, of course ice is water as well. When we refer to water in the presentation, we are referring to liquid water clouds. Ice clouds are differentiated from liquid water clouds using the depolarization ratio, as ice clouds contain non-spherical particles and therefore have a perpendicular polarization return.

Question 2: Which LiDAR product has available data for South America?
Answer 2: Space-based (polar orbiting) instruments will cover South America. There are NASA ground based systems such as MPLNET in parts of South America. Other space agencies likely have some as well.

ARSET Training that includes MPLNET: NASA Atmospheric Composition Ground Networks Supporting Air Quality and Climate Applications

Question 3: Why does EarthCARE use 355 nm?
Answer 3: 355 nm is chosen because there is more backscattering from molecules in the atmosphere, allowing the instrument to separate molecular and particulate (aerosols & clouds) returned signal for the HSRL technique.

Question 4: Is there a way to find data based on location instead of time event?
Answer 4: Try NASA Earthdata: https://search.earthdata.nasa.gov/search. Using worldview orbit tracks as demonstrated during the training is also a method.

Question 5: Can we access and analyze the data in (Google Earth Engine) GEE? And is there any data available to Ethiopia?
Answer 5: Through the quick look websites we covered in Part 2 as well as NASA DAACS will have data over Ethiopia. Google Earth Engine has several lidar datasets available, however, these all appear to provide information on land surface, not atmospheric composition.

Question 6: Is there a hyperspectral future for lidar or will it continue to focus on mono-spectral lasers?
Answer 6: There is near term technology maturation occurring for hyperspectral lidar is being tested via airborne platforms. That is the usual progression before spaceborne implementation.

Question 7: Is it possible to use these satellites to measure gas emissions in a specific area? Have any gas emission measurements or environmental alerts related to air quality been created?
Answer 7: Ground based trace gas systems for NO_2, ozone, CH_4 have been developed. ESA is developing a space based lidar called MERLIN.

ARSET Training on the remote sensing of methane emissions: Methane Observations for Large Emission Event Detection and Monitoring

Question 8: Can you do laser polarimetry? LIDAR from multiple angles?
Answer 8: U of Wisconsin has a ground-based lidar system that scans horizontally. Multi-angle lidar systems (like CATS) have been demonstrated from space.

Question 9: Is it possible to obtain data for a specific cloud type?
Answer 9: Yes. Download the data file (Level 2) and use the feature classification flag to subset your target (e.g. ice cloud).

Question 10: Different studies use various space-time collocation strategies. What is the most widely recommended approach for space-time collocation when comparing CALIPSO data with AERONET observations?
Answer 10: This is typically target dependent. Aerosol related targets that do not evolve as quickly as convective targets often use a 3 hour and ~50-100 km range ring for collocations. Convections will tend to be tighter temporally (~30 minutes) and spatially (~few kms).

Question 11: Can you talk about LiDAR applications for wildfire fighting?
Answer 11: CATS demonstrated near-real time smoke plume measurements from space. NASA has had several field campaigns focused on sources and downwind evolution of smoke. UAV technology is currently being developed that can deploy small scale lidar in wildfire environments to measure smoke plume evolution.

Question 12: How can it be considered as high resolution when it measures above the 15 km altitude (top of troposphere)?
Answer 12: High resolution will refer to vertical resolution. Those are typically divided in bin sizes of 30m-60m.

Question 13: What kind of aerosols are detected by this technique? Can they be identified by the wavelength, like NO_2 or SO_2?
Answer 13: Elastic backscatter and HSRL lidar systems are primarily designed to observe aerosols (e.g. dust, seasalt) and clouds.

Question 14:Can coal fly ash be detected using lidar data?
Answer 14: Yes. The issue from space is the plumes tend to be narrow. For this application, airborne measurements or ground based are better.

Question 15: Has CALIPSO stopped its data?
Answer 15: Yes, in 2023. The team is working on final data reprocessing.

Question 16: What will be the replacement for CALIPSO? Does it cover the Southeast region?
Answer 16: Right now, NASA has ICESat-2 that can also provide atmospheric measurements. Additionally ESA has EarthCARE in space that also covers this region.

Question 17: Is there a way to link the lidar observation data with the ionospheric behavior?
Answer 17: This is beyond the scope of this training, but a quick search revealed there is precedence for studying the ionosphere using lidar.

Question 18: I wonder if it is possible to measure volcanic ash plume height from lidar data.
Answer 18: Yes. This is one of the highlights of using lidar data from space and has been done previously multiple times.

Question 19: Can we use LiDAR technology for disaster management and threat prevention? And how?
Answer 19: We can use it for disaster management like wildfires and volcanic ash. One application would be to deploy via drone in environments that are too dangerous for humans.

Question 20: What do you think is the best way to compare the on-earth observations (measured by sensors) with the satellite data?
Answer 20: This has been a popular question. Typically what we do depends on application. See response to question 10.

Question 21: Could you please share what is the temporal resolution of lidar data acquisition if we aim for near real time volcanic ash forecast modelling?
Answer 21: Earthcare is more or less 3 hours. As we move forward, the goal is to get data as soon as possible.