Part 5 Questions & Answers 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 Carl Malings (carl.a.malings@nasa.gov), Melanie Follette-Cook (melanie.cook@nasa.gov), or Judd Welton (ellsworth.j.welton@nasa.gov).

Question 1: What is the depolarization ratio? How do you calculate depolarisation ratio?
Answer 1: The depolarization ratio is discussed in more detail in the appendix slides. It is the ratio of the signal measured between the co and cross polarization states of the emitted signal. It is a measure of the particle sphericity. Lower depolarization ratio indicates more spherical particles, higher ratios indicate the presence of non-spherical particles.

Question 2: What are the purposes/applications for the aerosol depolarization ratio measures? I cannot understand the concept of the depolarization ratio. Could you please explain again what it represents?
Answer 2: The depolarization ratio can be used to determine the presence of dust or ice clouds as compared to more spherical particles such as sulfate, marine aerosols, and water clouds. Smoke depolarization ratios can vary depending on the size and age, but tend to be between sulfate and dust ratios.

Question 3: How many MPLNET stations exist at the AERONET stations?
Answer 3: Approximately 98% of MPLNET is co-located with AERONET.

Question 4: How do we implement the AERONET AOD measures into the LIDAR Equation? Is it decomposed in separated terms? Asking because it appears as an integral in the Lidar context.
Answer 4: This is discussed in the presentation, slides 39-51.

Question 5: How is molecular attenuated backscatter signal (km sr)-1 obtained?
Answer 5: This is discussed later in the presentation, and also in the appendix slides.

Question 6: Will this molecular attenuated backscatter signal vary every day?
Answer 6: Molecular scattering is dependent on pressure and temperature and can change based on location and day/time. MPLNET uses the NASA GEOS-5 meteorological model to calculate our molecular terms.

Question 7: What is the optical depth(dense) of MPL to be eye-safe? Is it operated at high repetition rate (frequency)?
Answer 7: Optical depth and eye-safety are not the same. The MPL is eyesafe at the exit aperture of the instrument. It achieves eye safety by emitting low energy pulses (< 10 microjoules), and expanding the beam to the full diameter of the transceiver telescope. Good signal to noise is obtained by using a high repetition rate (2500 Hz) laser.

Question 8: How do you distinguish depolarization by non-sphericity from depolarization by multiple-scattering?
Answer 8: The MPL (and miniMPL) use a narrow field of view receiver to reduce solar background noise. This removes multiple scattering impacts, except maybe in very thick layers but these tend to attenuate the MPL signal enough that we cannot penetrate far enough into the layer to be affected by multiple scattering.

Question 9: How do you introduce the polarization property to the laser source? Do you measure signals at both parallel and perpendicular polarizations? How?
Answer 9: The MPL uses a more complicated polarization configuration than other polarized backscatter lidars due to its transceiver design. But the basic concept is the same, and uses measurements of co and cross polarization. For the MPL this is a ratio of linear and elliptical polarization. The details of the MPL polarization were beyond the scope of this presentation, but you can find more information on our website.

Question 10: How do you maintain all the time beam alignments for both TX and RX?
Answer 10: The MPL data system controls the timing between emission of the laser pulse and reception of the return signals using a photon counting detector. We do a final small range correction during calibration.

Question 11: We have Aeronet Ethiopia now. Any plan to co-locate? I did see Ethiopia in the planned list.

Answer 11: Not at this time, due to the cost of the lidar vs sunphotometer, MPLNET cannot deploy as many sites as AERONET. But we maintain a list of planned deployments based on funding. If you are interested in the MPL you can also contact the company directly about purchasing one.

Question 12: Can we measure stratospheric aerosol with MPLNET?
Answer 12: Yes, but this may require longer time averaging to retrieve aerosol properties for weaker stratospheric layers. We can detect stratospheric layers more easily, especially at night. Our signal data are acquired up to 30 km amsl.

Question 13: Are MPLNET vertical profiles all zenith sky measurements? Does it have a different footprint with AERONET, since AERONET may do direct-sun scan?
Answer 13: Yes, all MPLNET data are essentially nadir. We use a small angle tilt to avoid specular reflection from ice clouds. The MPL instrument can be scanned with additional equipment, but we do not do this for MPLNET observations.

Question 14: Is the aerosol extinction calculated using the classical Klett inversion technique, and what was the lidar ratio used?
Answer 14: This is discussed in the section on the aerosol product. We used a constrained Fernald/Klett approach with the AERONET AOD to avoid problems setting an a priori lidar ratio.

Question 15: How can I download the MPLNET data for an Indian site?
Answer 15: This is covered later in the presentation; data can be accessed via the MPLNET website.

Question 16: Please let us know how we can join the MPL NETWORK, both for data sharing and also operate a mini aerosol-cloud lidar at our station in synchronous with the existing NASA-AERONET sun-sky-moon-polarimetric multi-spectral Radiometer and other systems such as 24x7 Air quality monitoring system, Multi-spectral Aethalometer, Nephelometer etc. for synchronous measurements complement to satellite observations.
Answer 16: At this time, MPLNET only supports the MPL product line. Not other commercial or custom built lidars. We use standardized instrumentation, calibration, and data processing like AERONET. If you are interested in the MPL you can contact

the company directly about purchasing one. If you have your own MPL or miniMPL and are interested in joining MPLNET please contact us on the website (or judd.welton@nasa.gov).

Question 17: How is the range corrected backscatter signal normalized? With what value the normalization is done for the range corrected backscatter signal is obtained?
Answer 17: This is discussed more in the appendix slides. The NRB signal is normalized to the range squared and the emitted energy. MPLNET does not provide an attenuated backscatter (absolutely calibrated) signal. But we do provide the lidar efficiency parameter (or lidar constant) in our aerosol product, so one can calculate the attenuated backscatter.

Question 18: Do we need to perform background correction?
Answer 18: MPLNET provides all the calibrations and data processing. Our Level 1 signal already accounts for this.

Question 19: Does MPLNET collaborate with CALIPSO lidar data product? What could be the agreement between MPL and CALIPSO during biomass burning and cloud occasions?
Answer 19: We discuss some collaboration with CALIPSO later in the presentation. However, it is often difficult to do direct comparisons between fixed ground lidar and satellite lidar such as CALIPSO since the swaths of each are narrow. It is better to combine the data from both since the satellite lidar provides a lot of spatial convergence, and the ground lidar provides temporal information (the LEO satellite lidars only provide limited temporal snapshots).

Question 20: Will the C values will eventually be used for completing AERONET LV2 data in order to avoid the problem of not being able to measure when clouds are present? Could this C factor could be used to complete data when technical problems in the instrument are found?
Answer 20: Level 2 MPLNET aerosol processing is the same, the only difference is that we use Level 2 AERONET AOD as a constraint (vs Level 1.5 AERONET AOD for Level 1 and 1.5 MPLNET processing). The C values are used to track instrument health, along with the instrument diagnostics.

Question 21: What is the agreement between the PBLs computed from MPL and Radiosondes?
Answer 21: This was discussed briefly on the PBL product slide. There have been some comparisons to radiosonde data, as well as to model PBL heights. A larger more comprehensive comparison of MPLNET PBL height to radiosonde PBL heights has not been done but would be great to see.

Question 22: How is cloud screening done in the MPL signal?
Answer 22: Any minute of data containing a cloud base below the aerosol top height is screened from the 20 minute signal average used for aerosol processing. If a cloud is detected above the aerosol top it is flagged in our aerosol data product.

Question 23: How different are the minimpl to a cl51/cl61 ceilometer?
Answer 23: The MPL uses a green wavelength (532 nm) vs near infrared in most ceilometers. The MPL has a better signal to noise than typical ceilometers and also a longer range (to 30 km). The MPL is also polarized, as is the new CL61. Intercomparisons between the miniMPL and CL61 are ongoing and more planned.

Question 24: Are there plans to expand the network or is the size of the infrastructure enough to continue the team's research?
Answer 24: MPLNET size cannot grow too large due to the cost of the lidar compared to the sunphotometer used in MPLNET. But we are planning to add more sites over the next few years.

Question 25: Can we discriminate between the aerosol types? Which one is more accurate, CALIPSO or LIDAR ?
Answer 25: It is more difficult to discriminate between aerosol types with only MPLNET, mostly because we have only one wavelength. CALIPSO lidar has two wavelengths which provides some information about particle size. But use of multi wavelength raman or HSRL lidars would be better for examining aerosol types. For MPLNET, we can infer dust or smoke vs other aerosols, but that is the limit.

Question 26: What's the estimated cost for the MiniMPL?
Answer 26: Please contact the MPL company for pricing information.

Question 27: Should the AERONET AOD be available at the same site? How can the MPLNET be far from an AERONET site?
Answer 27: yes we require colocation with AERONET except for sites at extreme polar latitudes such as our site at the South Pole. We limit the distance between MPLNET and AERONET to less than 1 km, ideally much closer especially if near an aerosol source.

Question 28: Can you please explain again the relationship of polarization with cloud, Ice, water, aerosol? What is the role of backscatter and extinction parameters in differentiating between these objects?
Answer 28: I believe the question relates to differentiating between clouds and aerosols, and then aerosol typing. There can be a large range of depolarization ratio values, from near zero to 50%. Water clouds, sulfate, and humidified marine aerosols typically have a low depolarization ratio since the particles are more spherical. Ice clouds and dust have higher depolarization ratios, 30-50% and 25-40% respectively. Smoke aerosols can have larger ranges depending on age and size, but typically might be 15 - 25%. These are very broad ranges and should not be interpreted as absolute values. However, one cannot type aerosols based solely on depolarization. Retrieval of other properties such as size and absorption (index of refraction) are required. Such retrievals need extinction profiles at different wavelengths and the polarization information, which is beyond the capabilities of MPLNET.

Question 29: Can you please refer to the paper detailing how to identify the contribution of PBL aerosols to column integrated AOD? You said that 0.5 of AOD is usually above the PBL. How do we infer that?
Answer 29: I am not sure which particular paper you are referring to. There have been many studies examining the use of column AOD to infer aerosol concentration at the surface, but not all specific to MPLNET/AERONET. The problem with this approach is that the column AOD includes aerosol above the PBL, which are not influencing surface concentrations. Using MPLNET mixed layer height (PBL proxy) and the aerosol extinction profile, we can calculate the AOD in only the mixed layer. This mixed layer AOD will correlate better with surface concentration measurements, in particular when the PBL is well mixed (like during mid-day). The example shown on slide 54 was a 10 year climatology from only one site, GSFC in Maryland USA. The data show that on average there is about 0.05 AOD contribution from above the mixed layer. This does not apply to all sites, only this particular example.

Question 30: Is the AOD at MPL wavelength obtained by simple interpolation from aeronet AODs?
Answer 30: We use a 2 order polynomial fit to the AERONET AOD.

Question 31: Has MPLNET been used for observing large-scale aerosol transport (such as Volcanic eruptions)?
Answer 31: Yes, see our webpage for publications related to analysis of volcanic eruptions. MPLNET observations were combined with data from other lidar networks to observe the plume transport and evolution.

Question 32: What prevents the network from expanding to other countries in South America? Is it that the hosting country needs to purchase the instrument?
Answer 32: Our colleagues in LALINET (another GALION network) operate lidars in South America, and I coordinate with them. We have one MPLNET site in Brazil and discussions for another in future. If you are interested in lidar observations in South America I would recommend contacting LALINET.

Question 33: How effective is MPLNET in detecting the extent of Saharan sand storms and their characteristics?
Answer 33: MPLNET instruments can detect the presence of dust compared to other aerosol types, even for sites far from the Saharan region.

Question 34: What are the smallest size aerosols that can be reliably detected?
Answer 34: We can detect scattering from normal aerosol size ranges, but not CCN.

Question 35: Is there any possibility to reactivate the inactive station?
Answer 35: Yes, this has happened in the past and more are planned.

Question 36: Are you aware of any environmental agency using this data to demonstrate 'exceptional events' within the context of the Clean Air Act?
Answer 36: The data has not been used in an official capacity. Outside of the US, some groups have been working with their local EPA (example: Taiwan Ministry of Environment).

Question 37: What is the advantage of MPL over a ceilometer? I wonder if the Vaisala CL61 is comparable since it can provide depolarization. Is the Unified Ceilometer Network going to potentially be included in GALION?
Answer 37: This has been previously addressed, see the response to Question 23.

Question 38: What is the minimum laser pulse frequency so we can get good Lidar retrievals?
Answer 38: For MPLNET, the pulse frequency is 2500 Hz. The controlling factor to get good lidar retrievals is the signal to noise ratio, and this will depend on a variety of factors.