Compact Raman Lidar (CRL) Data During PECAN- a brief Summary

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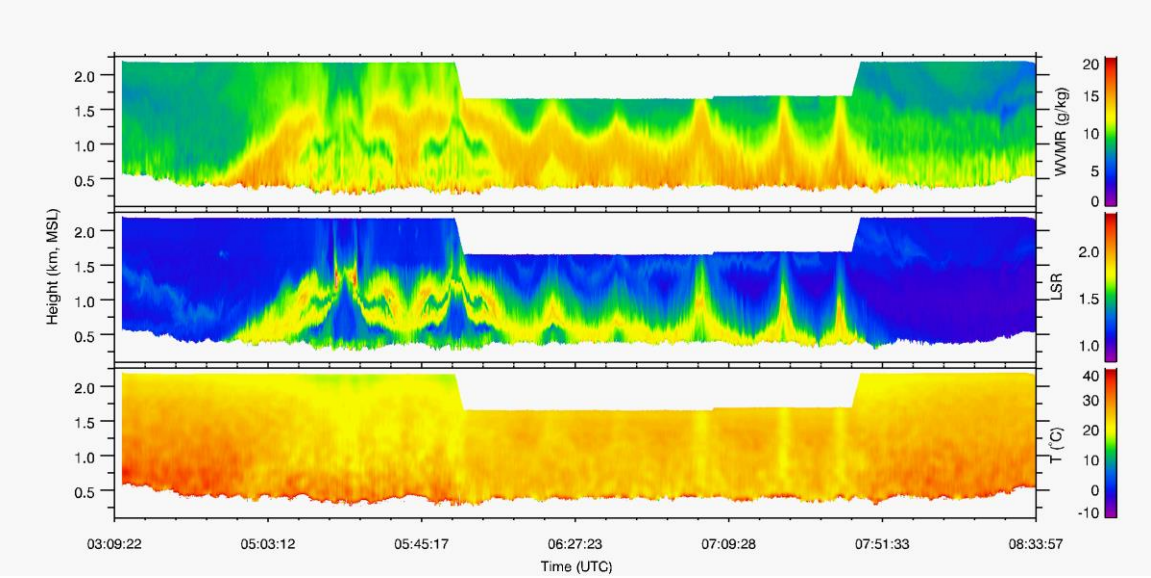
1. General

Compact Raman Lidar (CRL) system was originally designed for water vapor and aerosol measurements (Wang et al. 2011; Liu et al. 2014). For PECAN, we re-designed the receiving box by adding two pure rotational Raman channels while eliminating the perpendicular elastic channel due to limited space (Wang et al. 2015; Wu et al. 2016). Thus, CRL is able to provide water vapor, temperature, and aerosol measurements during PECAN. CRL has a small 355nm laser with 50mJ pulse running at 30Hz, which limits its measurement ranges.

Data for each flight is saved into a NETCDF file by mapping CRL data into the same height bin (MSL). Due to different signal-to-noise ratio (SNR) for different Raman channels, different scales of spatial averaging/smoothing are applied to water vapor, aerosol, and temperature data. But all data are saved in the same temporal and vertical resolution.

In general the SNRs of data decrease with range increase from aircraft. Near surface water vapor and temperature data may be contaminated by surface return due to uncertainties in detecting surface height. Please keeping these in mind when you explore CRL data

IDL code is provided to read and plot the data. An example of plot for July 1st is given below.



2. Aerosol

Aerosol distribution is provided as lidar scattering ratio (LSR), which is defined as the ratio of total backscattering to molecular backscattering. LSR of 1 indicates pure molecular atmosphere without any aerosols. One calibration is applied to the whole campaign. Thus, you may notice some small calibration biases among different flights. However, the data should be able to show the spatial variations of aerosols reliably.

LSR also can be used to identify cloud locations. In general, you can use LSR larger than 5 to identify cloud top boundary.

3. Water vapor

Water vapor is provided as mixing ratio (g/kg, validated data range of 0-25 g/kg). Water vapor is simply calibrated using flight level in situ measurements and CRL measurements at 180 m. However, the same calibration is applied to all flight with the same PMT gains. Thus, you may notice some small calibration biases among different flights. Due to short-range measurements, the atmospheric attenuation difference between 387 and 407nm is neglected in the current data processing.

For data before June 15, there are range-dependent biases due to PMT noise.

4. Temperature

Temperature is provided as °C with validated data range of -30 to 45 °C. Flight level in situ measurements are used to correct mean biases for each flight. Due to PMT noise, no temperature data before June 15 are provided. But if you are interested in any case before June 15, we could explore whether we could recover the data.

Also in or near cloud temperature measurements could be contaminated by leaked elastic signals.

5. Question or reprocessing request

If you have a specific interested time period, especially for publication, please contact me for possibilities to improve data qualities. To improve SNR, we can increase horizontal average in many cases. Improved short-range overlap correction for temperature and water vapor also could be done.

6. Acknowledgments

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7. References

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