Reflectance-based method – The atmosphere

Measurement approaches
Goal of atmospheric measurement

Results of atmospheric characterization are to provide data representative over the test site at sensor overpass

- Frequency of sampling depends on the variability of the atmospheric conditions
  - Clouds
  - Windblown dust
  - Diurnal events – land and sea breeze
- Temporal sampling of atmospheric conditions give indications of spatial homogeneity
- Manual versus automated
  - Difficult to collect high frequency data for manual systems and requires dedicated person
  - Automated systems can fail at critical moments
  - Some automated systems require predetermined collection rates for other purposes
Compromise approach

One method is to collect high frequency temporal data only at critical moments

- Sampling early in the morning based on solar zenith intervals in order to obtain Langley data
- Lower frequency data later in morning when solar zenith is not changing dramatically
  - Allows evaluation for stability of the day
  - Collects enough data to evaluate whether instrument is operating properly
  - Gives sufficient data to use in case of later failure
- Increased sampling (30 s) starting 15 minutes prior to a sensor overpass and lasting 15 minutes after
  - Coincides with surface reflectance data collection
  - Allows for personnel to concentrate on reflectance
Example case
Optical Depth

PC Fair Grounds
June 29, 2008

519 nm

Time (UTC)
Angstrom/Junge parameter

PC Fair Grounds
June 29, 2008
Mean $\alpha = 0.84$
Overpass $\alpha = 1.22$
Inversion results

Process a 10-minute average of optical depth for input into aerosol inversion

- Standard deviation of average indicates stability of the instrument and atmosphere
- Oddly shaped result or poor agreement with fit also indicates stability of the atmosphere (or instrumental issues)
- Approach is more straightforward than doing inversion and averaging results

![Inversion results graph with data points and calculated parameters]

PC Fair Grounds  
June 29, 2008  
17:45:00 (UTC)

\[ \alpha = 1.22 \pm 0.01 \]

\[ \delta_{A_{550}} = 0.198 \pm 0.001 \]

\[ O_3 = 150 \text{ DU} \]

WV = 2.51 cm

Aerosol optical depth vs. Wavelength (\(\mu\text{m}\))
Line of sight data - multispectral

PC Fair Grounds
June 29, 2008
Overpass (17:43:00)

CH. 1
CH. 2
CH. 3
CH. 4

Pyrometer signal

Time (UTC)

16.5 17.0 17.5 18.0 18.5

ExoTech Signal

1725 1745 1800
Line of sight data – single band
For high reflectance, goal of atmospheric data is to obtain a best estimate for the day

- Essentially answering the following questions
  - Is today different than what I typically see?
  - Is the atmosphere changing?
  - What is the likelihood I have clouds in my satellite sensor view and or in front of the sun?
  - Do I have spatial homogeneity?
- Or equivalently – Will the atmosphere contribute larger errors today than what I expect from my error budget?
- Different philosophy than if we are atmospheric scientists attempting to understand the aerosol chemistry