Spatial variability of MODIS and MISR derived atmospheric data products

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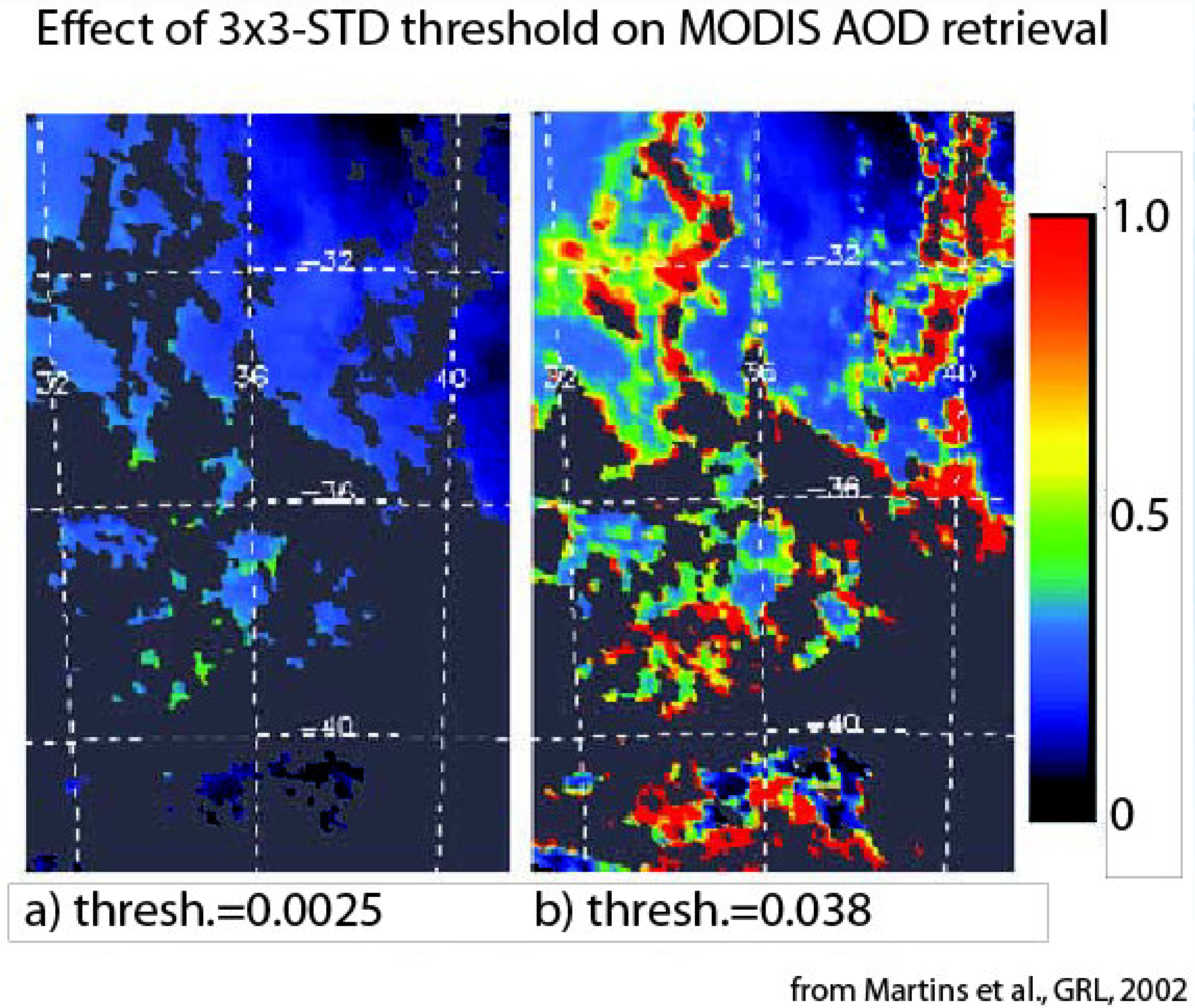
Executive summary of project goals:

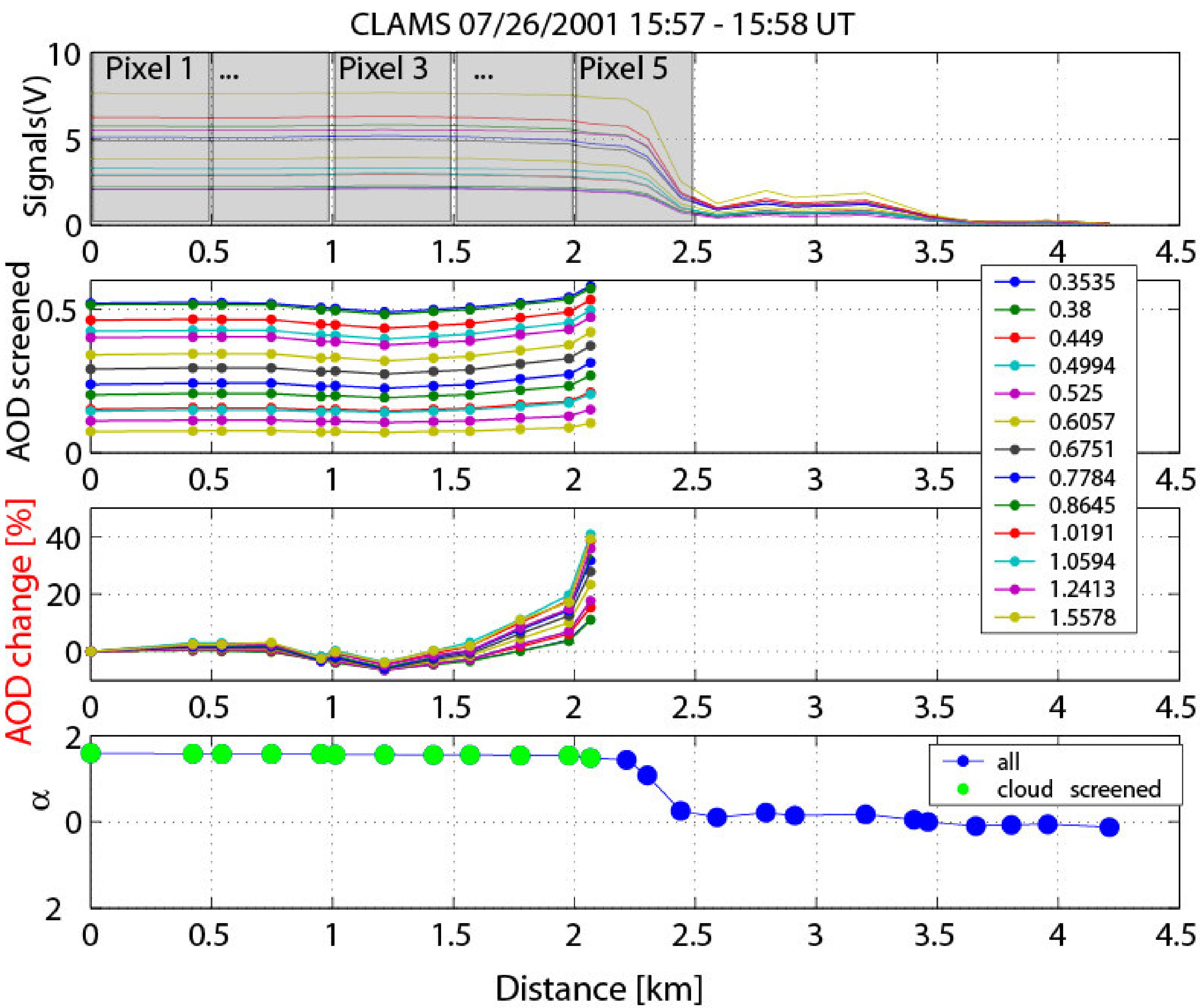
1. based on the combination of suborbital and satellite measurements, to determine the spatial variability of aerosol optical depth in the vicinity of clouds and assess how well current EOS satellite sensors capture or suppress such variability within their processing algorithms,
2. to determine what fraction of the direct aerosol radiative forcing of climate may be undetected because the aerosol optical depth in the vicinity of clouds is erroneously filtered out or masked as cloud by current EOS sensor retrievals,
3. to compare the spatial variability in aerosol optical depth and columnar water vapor in different geographical regions, thereby assessing the performance of current EOS sensor algorithms under a variety of regional and climatic conditions,
4. to make available the validation capabilities of the NASA Ames Airborne Sunphotometer group to the MODIS-Atmosphere science team in support of future refinements to AOD and water vapor algorithms and future developments of over-the-ocean (glint/off-glint) algorithms to derive aerosol absorption.

Spatial variability of AOD in the vicinity of clouds – cloud haloes or cloud contamination? -1-

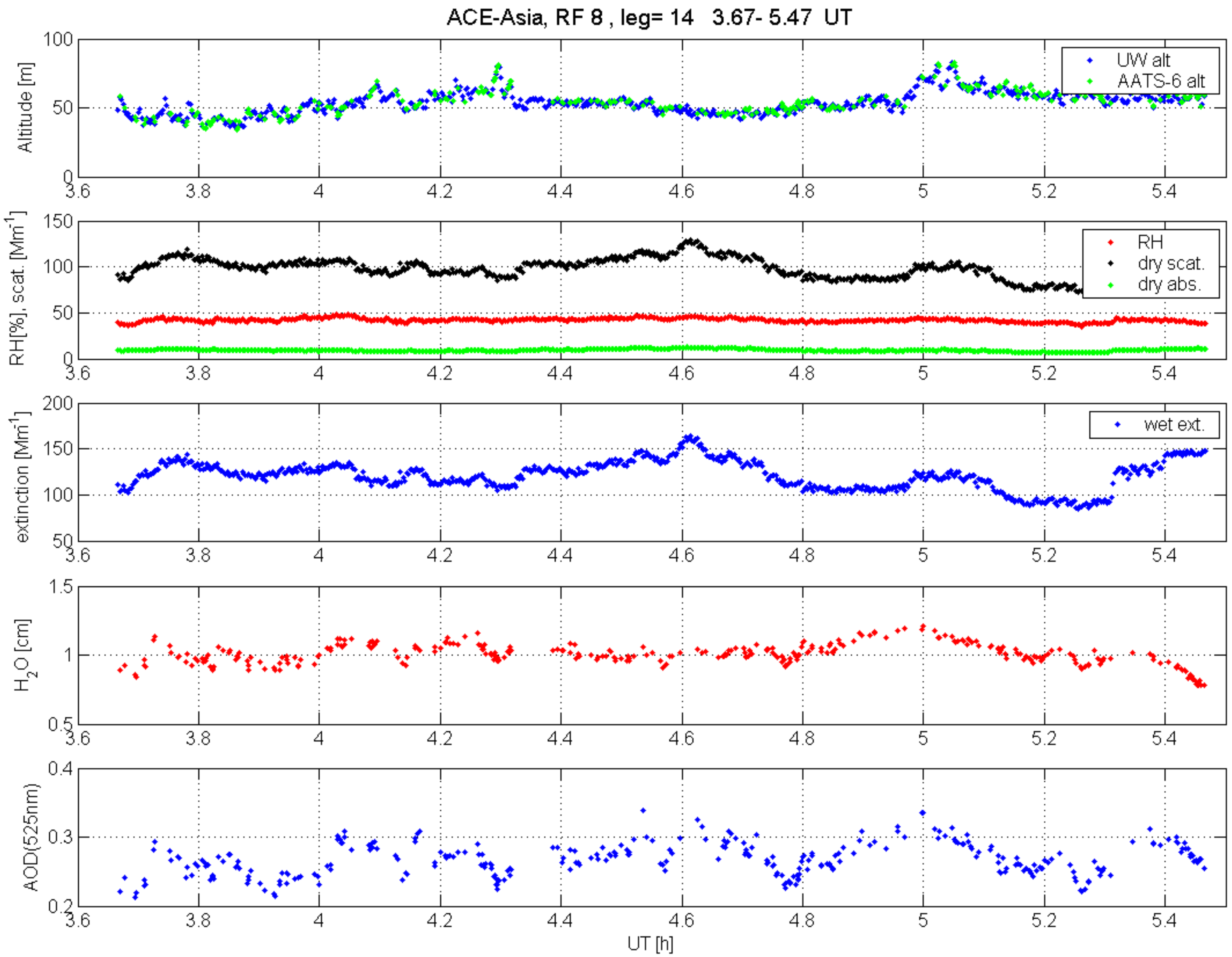


…but, what about cloud haloes?

Spatial variability of AOD in the vicinity of clouds – cloud haloes or cloud contamination? -2-

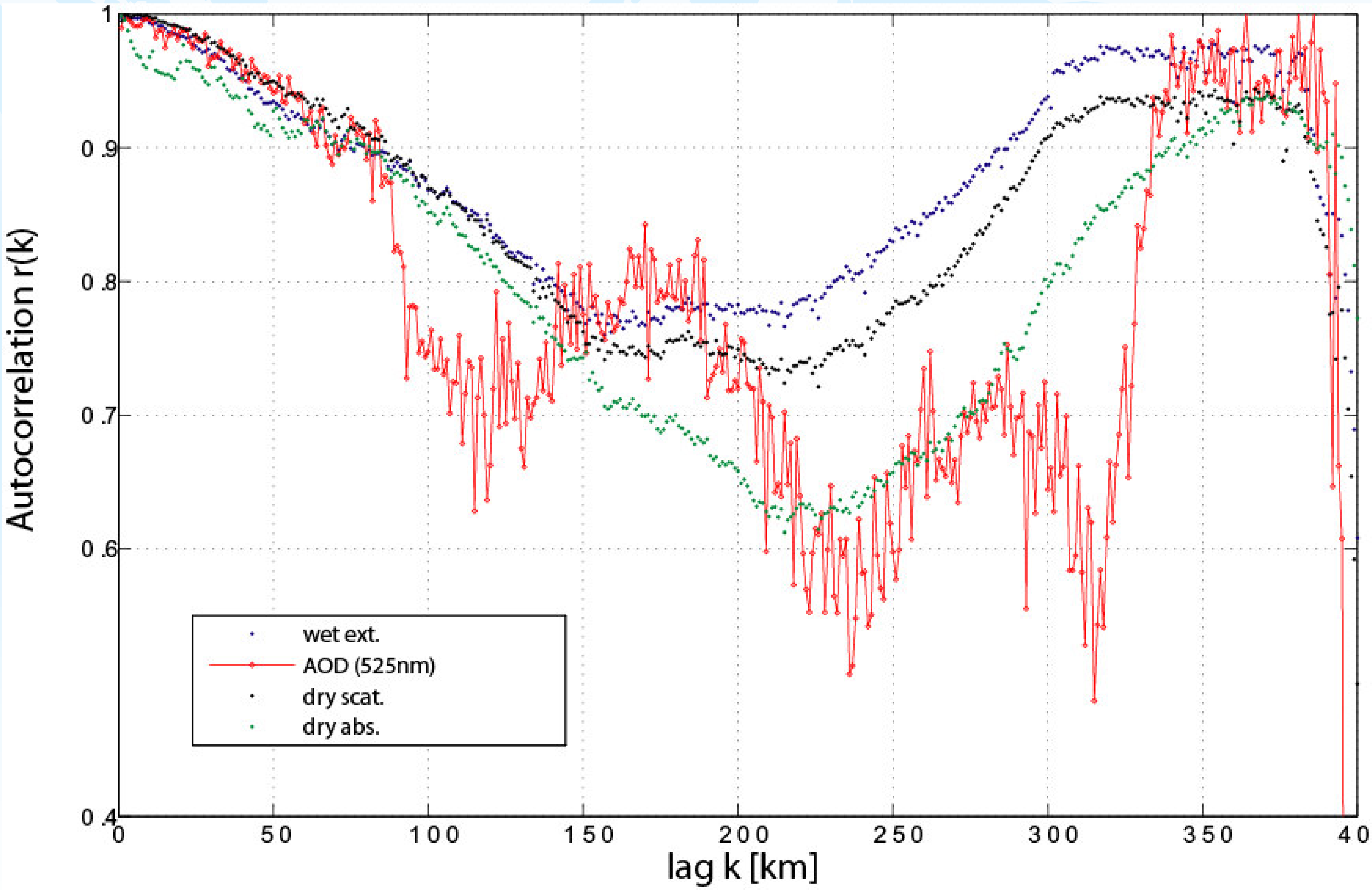


Over-ocean spatial variability of AOD and in situ aerosol properties (ACE-Asia, 2001) -1-



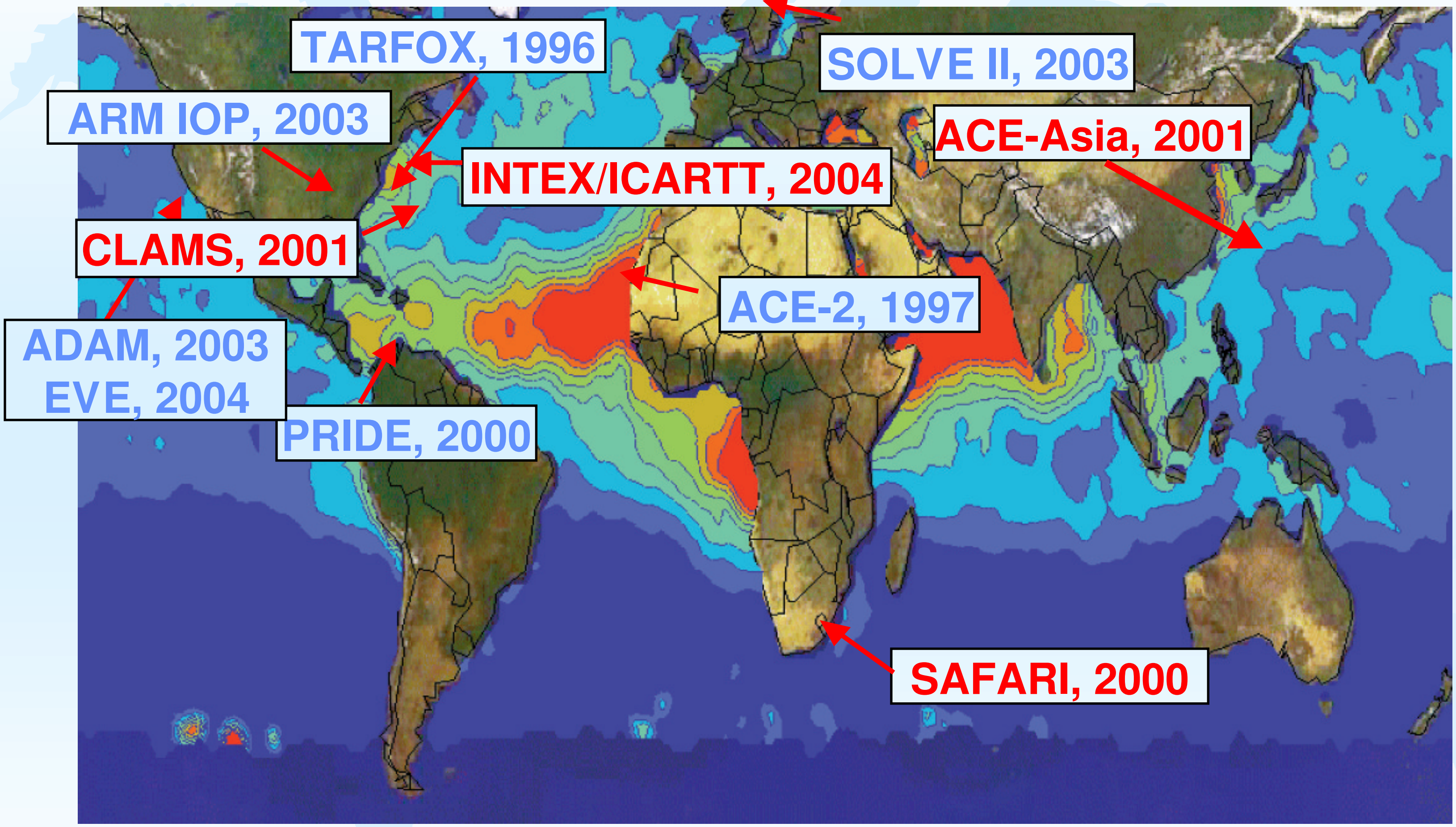
Autocorrelation:

$$r(k) = \frac{\sum_{i}^{N} \left[(x_i - m_1)(x_{i+k} - m_2) \right]}{(N-1) s_1 s_2}$$



NASA Ames Airborne Sunphotometer-Satellite Group

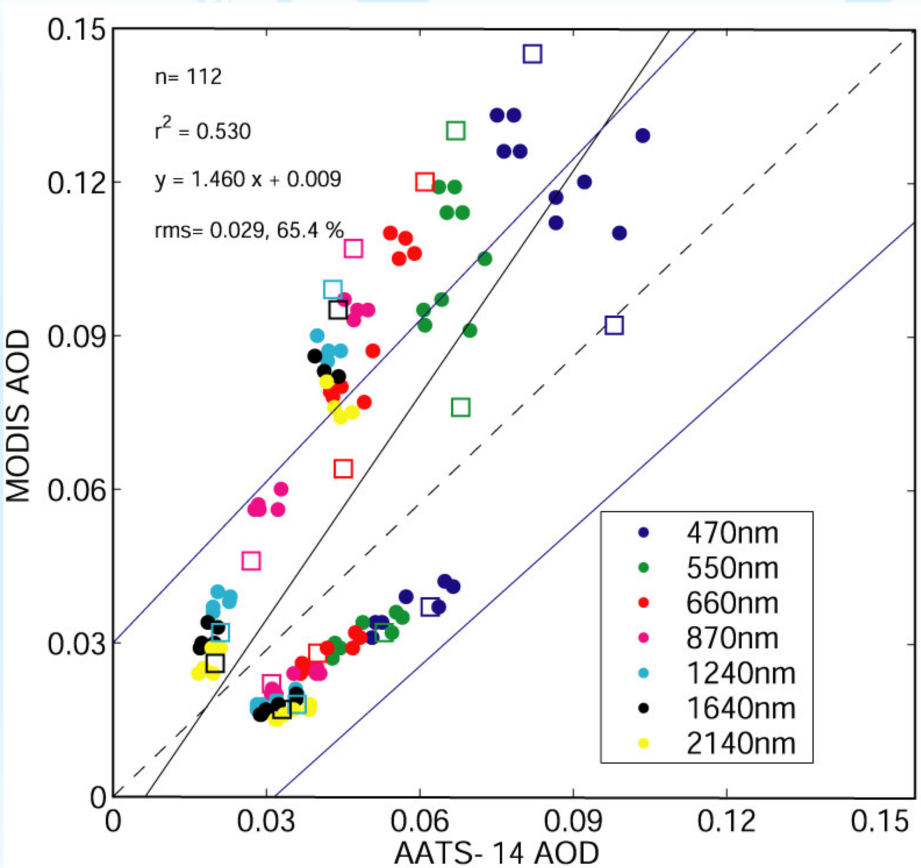
Major Aerosol Field Campaigns, 1996-2004

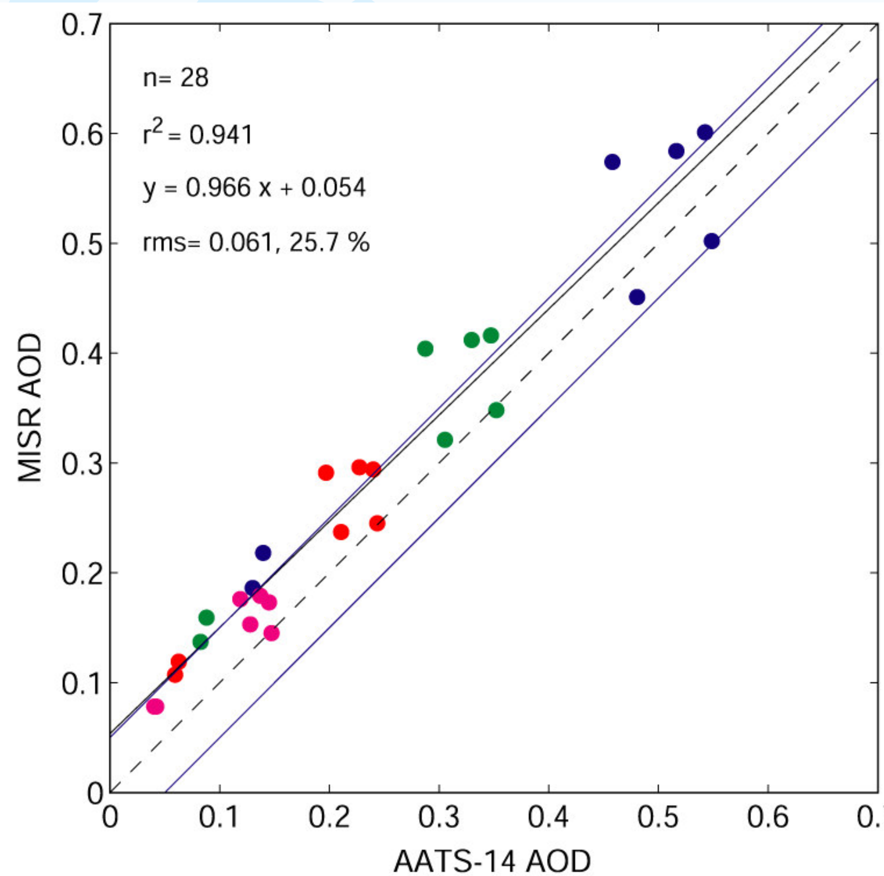


Aerosol Optical Depth Derived from Upward Scattered Solar Radiance

AVHRR/NOAA 11, June-Aug., Husar et al., *J. Geophys. Res., 102,* 16,889, 1997.

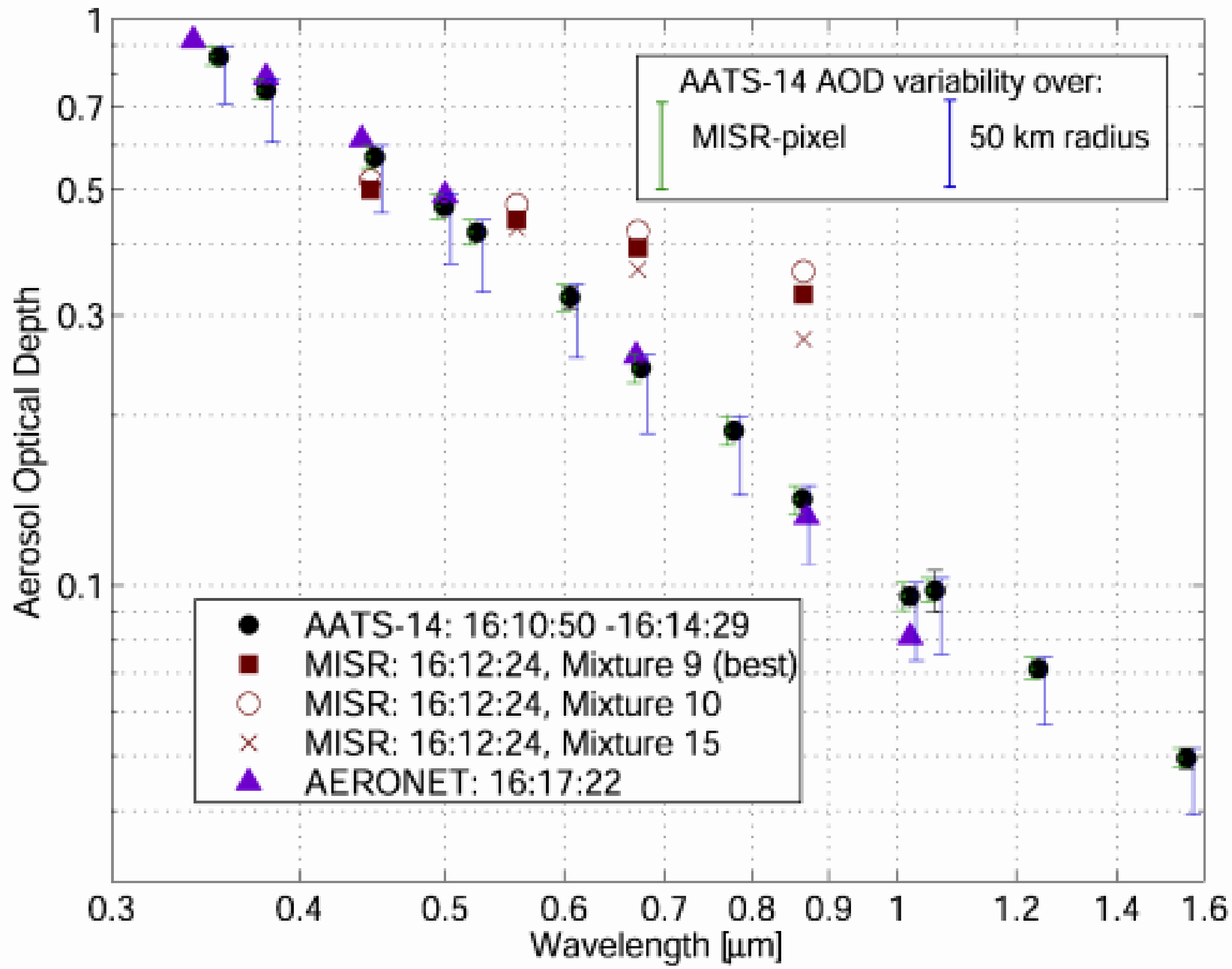
Over-ocean AOD validation work -1-





Scatter plot of AATS-14 with MISR AOD (standard algorithm) and MODIS level 2 AOD (10x10km, nadir) from Redemann et al., 2004

Over-ocean AOD validation work -2-



Summary / Approach

1. Find MODIS/MISR data granules with coincident suborbital data in the vicinity of clouds, determine the spatial variability of aerosol optical depth in the vicinity of clouds from both methods and compare, assess how well the satellite sensors capture or suppress such variability within their processing algorithms.
2. Determine what fraction of the direct aerosol radiative forcing of climate may be undetected because the aerosol optical depth in the vicinity of clouds is erroneously filtered out or masked as cloud.
3. Compare the spatial variability in aerosol optical depth and columnar water vapor in different geographical regions, thereby assessing the performance of the satellite sensor algorithms under a variety of regional and climatic conditions.
4. Support new algorithm developments (e.g., glint/off-glint, absorption) and validation studies aimed at future refinements to AOD and water vapor algorithms.