

## Systematizing MODIS, TOMS and MISR satellite datasets with HYSPLIT model for monitoring regional pattern of aerosol and its seasonal variability in Pakistan

Khan Alam<sup>1</sup>, Salman Qureshi<sup>1,2</sup>

<sup>1</sup>Department of Geography & Geology, University of Salzburg, Hellbrunnerstrasse 34, Salzburg 5020, Austria.

<sup>2</sup>Department of Geography, University of Karachi, University Road, Karachi 75270, Pakistan

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Atmospheric aerosols play an important role in the energy balance of earth-atmosphere system. Aerosols vary in time in space and can lead to variations in cloud microphysics. The aerosol concentration is increasing day-by-day because of growing population, urbanization, and industrialization. In this paper we used Total Ozone Mapping Spectrometer (TOMS), Moderate Resolution Imaging Spectroradiometer (MODIS), and Multi-angle Imaging Spectroradiometer (MISR) aerosol data in order to understand the spatial and temporal variations of aerosols in the different cities of Pakistan.

Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model has been used for trajectory analysis to obtain origin of air masses in order to understand the variability of aerosol concentrations. We analyzed that the current MODIS aerosol data (2005-2008) and previous TOMS data (1981-1992) show increasing concentration of aerosol load in the vicinity of Pakistan.

We inter-compared MODIS and MISR aerosol optical depth (AOD) to validate satellite

retrievals and found that there is strong positive correlation between MODIS-MISR AOD (Table.1). Annual and seasonal variability of AOD has been assessed in industrial, urban, semi-urban, semi-arid and rural cities of Pakistan. Our analysis shows that maximum value of AOD is found in summer season over all study areas (See Fig.1 for Karachi only). Furthermore, with the back trajectory analysis, we analyzed that winter air masses reaching to the localities of Pakistan have traveled long distance, whereas the summer air masses traveled short distances. Therefore the air masses spent more time over land during summer time than winter, which legitimately explains the higher concentration aerosol observed during summer as compared to winter.

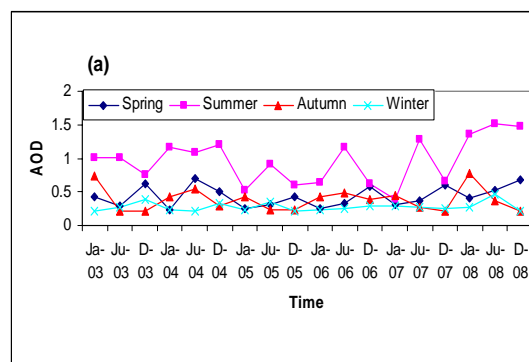


Figure.1 Seasonal variation of AOD for Karachi.

Table.1 Pearson Correlation for MODIS-MISR AOD for the period 2001-2005.

Name of Cities	Pearson Correlation
Karachi	0.845
Rohri	0.862
DG Khan	0.871
Multan	0.746
Lahore	0.676
Faisal Abad	0.716
Rawalpindi	0.818
Peshawar	0.892
Swabi	0.768
Zhob	0.675

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