Assessment of the MODIS Data Ability in Quantitative and Qualitative Analysis of Air Quality in Urban Area

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Extended Abstract

Introduction

The aerosols present in the atmosphere that consist of suspended solid and liquid particles and have natural and human origin, are the main causes of air pollution and consequently are the basis for creation and/or exacerbation of heart cardiovascular and respiratory. In recent years, the need for monitoring and control of air pollutants in wide scale and with an acceptable speed and accuracy is felt. The most important advances in satellite remote sensing is the ability to retrieve characteristics of particulate matter's over the land through use of MODIS sensor on Terra and Aqua platforms. Due to the availability of at least one MODIS images per day from our country, it is possible to estimate the suspended particles' concentration in the atmosphere above each pixel.

Materials and methods

20 stations in citywide record pollutants such as Carbon Monoxide, Nitrogen Dioxide, Sulfur Dioxide, concentration of Aerosol less than 10 micron size and lead concentration on the hourly based intervals. In this research MODIS level1 and MODIS level2 images were used. These data contains radiance and reflectance at top of atmosphere all coordinated, calibrated and atmospherically corrected. These data are available under names MOD02QKM, MOD02HKM, and MOD021KM with spatial resolution of 250, 500 and 1000 meters respectively. Along with these images, pollutant data collected in pollution surveying stations were used for quantitative and qualitative analysis of suspended particles in wide scales.

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The atmospheric Aerosol Optical Depth (AOD) of the city of Tehran in each station was calculated using MODIS images. The calculated AODs were compared with pollution data collected at the station where a correlation coefficient of about 0.7 through a linear equation of (*PM10 (μgr/m^3) = 222.78*AOD - 65.091*) was achieved. This is shown in figure (1) below:

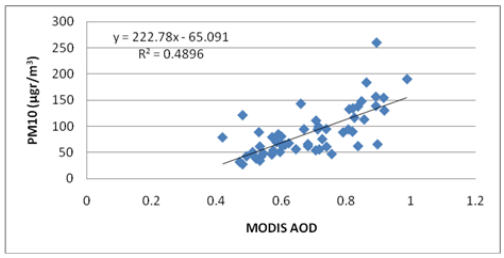

Fig. 1. A Model for extraction of PM10 from MODIS AOD

Results and Discussion

Generally it seems that this amount of correlation for low spatial resolution data such as MODIS is acceptable. It should be noted that the AOD's pixel size are usually 10*10 km^2 and therefore the ground underneath is covered only with a few of these pixels in each satellite passage, while the ground based measurement data are only valid in a limited distance around the station. This in many cases renders the accuracy of comparing satellite data and ground-based data difficult. One of the main sources of uncertainties was the MODIS AOD product low spatial resolution of 10 by 10 kilometers. While the results of measurement in the stations can hardly represents 100 square kilometers.

Conclusion

A positive relationship between aerosol optical depth and particulate matter of less than 10 nanometer size is discovered by many workers. To supply a model for this relationship use has been made from MODIS AOD products as well as in situ measurements of pollutions specially PM10. Despite low resolution of MODIS products, a correlation of about 0.7 was found between AOD and PM10 in Tehran. The results seem acceptable in situation of lack of continuous observation due to the present financial problems.

Keywords: Remote Sensing, MODIS, Aerosol, Optical Depth.

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