Geophysical Research Abstracts
Vol. 13, EGU2011-6736, 2011
EGU General Assembly 2011

A review on Satellite time series for Aerosols Monitoring and air quality estimation in urban area

Fortunato De Santis, Rosa Lasaponara, Antonio Lanorte, and Tiziana Montesano
CNR-IMAA Tito Scalo PZ - Italy (desantis@imaa.cnr.it)

There are numerous satellite sensors with some type of aerosol detection capability: each type of satellite system and its sensors have strengths and weaknesses for aerosol detection. The NOAA Polar Operational Environmental Satellite (POES) Advanced Very High Resolution Radiometer (AVHRR), the NASA Moderate Resolution Imaging Spectroradiometer (MODIS) and the ESA Medium Resolution Imaging Spectrometer (MERIS) on board the Environmental Satellite (ENVISAT) yield high spatial resolution in the monitoring of aerosol optical thickness (AOT),. which measures the total amount of light attenuated by the aerosol in an air parcel. The particulate optical thickness can be used in monitoring pollution, because the presence of particles in the atmosphere always causes a reduction in the optical thickness.
Recently, some studies have compared the aerosol optical thickness (AOT) retrieved using different satellite instruments and algorithms and the results provided by AVHRR have been found in accordance with those provided by MODIS and MERIS. Remote sensing of aerosol properties with the Advanced Very High Resolution Radiometer (AVHRR) has a long tradition even though aerosol detection was not the initial aim of this instrument.

There are currently four major satellite remote sensing techniques used to determine air quality in urban areas. The first and most prominent method is measuring the aerosol thickness in the atmosphere, second is black particle measurement, third is a visual inspection of satellite imagery, and last is land-use/land-cover change analysis.

The retrieval of aerosol properties from satellite radiometers is a challenging problem for three main reasons:
1. Aerosol retrievals are highly sensitive to cloud contamination. The much greater particle size and optical thickness of clouds compared to background aerosol means that even a small amount of cloud contamination will greatly effect the retrieved aerosol properties.

2. It is difficult to disentangle the top-of-atmosphere (TOA) radiance contribution of aerosol from the surface contribution. This is particularly true over bright and heterogeneous land surfaces, where the TOA signal can dominated by the surface.

3. Even taking the above two factors as read, there are still many more factors effecting the TOA signal than current measurement systems can unambiguously distinguish. These factors include the gaseous composition of the atmosphere as well as properties of the aerosol itself (composition, variation with height, particle shape, mixing state, etc.)

In order to overcome these problems, a number of different approaches to aerosol retrieval from satellite radiometers have been developed. All of these algorithms rely on empirical thresholds of the measured radiance to remove cloudy pixels

The main parameter retrieved by most algorithms is the aerosol optical depth (AOD) at some measurement wavelength. Many also use the spectral variance of the AOD to give an indication of the size and composition of aerosols by using a range of representative aerosol types or mixtures of components (for which the size and composition is fixed) and picking the one that best reproduces the observed radiance. Perhaps the biggest difference in the various algorithms
is in how they separate the surface and atmospheric contributions to TOA signal. The approach taken is largely determined by the capabilities of the instrument being use

The available algorithms for the aerosol optical thickness (AOT) retrieval are generally sensor-specific due to the different characteristics of the satellite instruments. For some instruments several algorithms have been developed.

In this paper, MODIS products downloaded free of charge from NASA web site will be analysed for the Basilicata Region