# BRDF AND ILLUMINATION CALIBRATION FOR VERY HIGH RESOLUTION IMAGING SENSORS

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## ABSTRACT

Airborne and spaceborne imagery provides panchromatic and multi-spectral data (including near infra-red) together with high resolution capability. The advent of very high resolution airborne and spaceborne imaging systems provides opportunities quantitative mapping and monitoring applications. Manual interpretation of analogue photography has been widely used for natural resource applications, but quantitative applications for monitoring are limited. A major problem is the lack of adequate radiometric calibration methods which allow numeric values to be compared over space and time. While current evaluations of very high resolution imaging systems have focussed on geometric accuracy aspect mainly, methods and standards for radiometric calibration are required to realise the opportunities of the very high resolution airborne and spaceborne imagery. There is now the potential to apply the imagery to a range of natural resource monitoring applications such as detecting drought stress, green space in urban environments, waterlogging, tree disease and nutrient deficiency in vegetation, and to provide high-resolution capacities for to wide-scale applications. However, without consistent radiometric calibration both in space and time dimensions, the ability to extract environmental indicators or perform other numerical calculations would be severely compromised. Radiometrically calibrated imagery is essential for carrying out classification and trend monitoring robustly and consistently. In the past decade, several radiometric calibration techniques [2,4] were developed by the authors for medium resolution satellite imagery such as Landsat TM/ETM+, SPOT, ASTER etc, and these techniques are used operationally in several broad scale land use and land use change monitoring programs in Australia such as NCAS (National Carbon Accounting System) and Land Monitoring [3,5]. In recent years, a series of enhanced radiometric calibration methods have been developed particularly for very high resolution imagery in order to solve the above mentioned radiometric calibration problems [1].

This paper describes an investigation of radiometric calibration methods applied to very high resolution airborne and spaceborne imagery. The investigation includes various Bi-directional Reflectance Distribution Function

(BRDF) models applicable for very high resolution imagery; removal of illumination effects caused by undeleted terrain; shadow, occlusion detections of objects (such as buildings and trees) in an urban environment with the aid of very dense Digital Surface Models (DSM). The newly developed methods not only need to address issues at the unprecedented spatial resolution from various imaging sensors, but also to achieve the practical efficiency by taking advantage of parallel computing. In this paper, these methods are described in details and demonstrated by case studies. These developed methods have been implemented into the procedure which is now used routinely in our Urban Monitor project. Some results from Urban Monitor program show that these methods are well suitable for monitoring applications of using very high resolution aerial digital imagery. Some current work and further investigation areas are also discussed.

## REFERENCES


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