IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Data Management Systems (4)

Author: Prof. Marco Schmidt
Bochum University of Applied Sciences, Germany, marco.schmidt@hs-bochum.de

AUTOMATED CLOUD AND CLOUD SHADOW DETECTION, REMOVAL AND FILLING ON LANDSAT, MODIS AND SENTINEL DATA

Abstract

Optical remote sensing satellite data nowadays are used in numerous applications. They provide a variety of information over any area on the Earth's surface. However, they are greatly affected by clouds which is a major hindrance for any optical remote sensing satellite, since they collect information by capturing the reflected solar radiation. Clouds obstruct the optical sensors on-board the satellites. Due to their high reflective index, clouds reflect more incident radiation back to the space than the surface. This overwhelms the optical sensors and completely blocks the land surface directly below them. Moreover, they also cast a shadow over a large area which again partially disrupts the reflected radiation from the non-cloud covered area. In either case the real ground truth is missing, this affects the performance of many remote sensing applications such as crop monitoring and ecology change detection, which highly depends on cloud free data. This issue cannot be handled directly on the sensor level during the capturing of images. They should be fixed after obtaining the images from the satellites. There are many cloud and cloud shadow detection and filling methods available for individual satellite data. There has never been a generic approach proposed, which can be used on multiple satellite data. In this paper, a generic approach to perform cloud and cloud shadow detection and filling for multiple satellite data is proposed. Our approach contains a single cloud and cloud shadow detection method and a single gap filling method for different satellite data. This approach is also developed into a fully automated process which eliminates most of the user related errors. So far our approach supports the following satellites (LANDSAT, MODIS, Sentinel) and it can be easily expanded to support other satellites. Cloud and cloud shadow detection in MODIS is performed using the State_1km Reflectance Data State QA layer from the MOD09GA data product. For Landsat and Sentinel images the cloud and cloud shadow masks are generated using FMASK. After the detection and removal of cloud and cloud shadows, gap filling is performed on different satellite data individually using a common interpolation technique. In this paper, the accuracy of the State_1km: Reflectance Data State QA and the cloud and cloud shadow mask generated using FMASK in identifying the cloud and cloud shadow on the images are assessed and the optimal number of images required to obtain a completely cloud free image is determined.