Geophysical Research Abstracts, Vol. 7, 08634, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08634


# Improved SAR surface water classification by the use of vegetation cover generated from optical satellite data

**I. Solheim,** S. Solbø, and B. Johannsen

NORUT Information Technology, Tromsø Norway

inger.solheim@itek.norut.no / Phone: +47 77 62 94 00

Flood extent images or surface water maps can be used to improve flood zone maps, as input to flood forecast models and simply to get an overview of the situation during a flood season. For hydrological applications, surface water maps should be available on a daily or regular basis. Optical satellite data offers the simplest and best methods for water body detection and classification of vegetation; however, a major drawback is that no clouds can be tolerated, haze and atmospheric conditions disturbs the signal. Satellite-borne synthetic aperture radars (SAR) are sensors of special interest, since they can acquire images independently of daylight and in practically all weather conditions. SAR data are often thought to be optimal for continuous surveillance of the earth surface. However, detection of surface water in SAR imagery may be distorted by non-optimal polarizations, waves and surface stream, in particular at low incidence-angels. Currently surface-water detection in SAR imagery is a semi-manual process. We show how a vegetation cover map generated from optical satellite images can be used as auxiliary information to support the classification of surface water in SAR imagery.

We have processed a ten-day sequence of Envisat ASAR scenes with VV and VH polarizations. The image sequence is from the snow-melting period in 2004 from the Kemijoki area in Northern Finland. The SAR scenes were geo-referenced and classified in terms of land or surface water. We have generated a vegetation cover map based on a combination of Landsat TM-7 scenes and map data from other sources. Wetlands and mires were verified in field. For each land cover type (water, forest, wetland, farmlands and exposed mountain heaths) we have done a statistical analysis of the SAR scenes. We analysed the correct and misclassified surface water, as well as the variations in radar backscatter.

Surface water has a lower backscatter than land surfaces, except when distorted by waves. Areas within lakes or rivers with a high backscatter, indicated either disturbance due to waves, ice, or inundated edge vegetation such as rushes or bushes. We found that mire and wetland classes have a strongly varying backscatter, depending on the water content. Low backscatter therefore indicated partially inundated or saturated mires. A high backscatter indicated a drier state. Forest classes generally cannot be distinguished in the SAR imagery, since they all had a moderate backscatter. However, open forest stand with a higher backscatter than expected, indicated inundated forest floor. Farmed areas generally had a high backscatter. A low backscatter was a clear indication of inundation or saturated soils. Sparsely vegetated, exposed mountain areas, often showed a low backscatter, and were therefore falsely classified as surface water. The land cover map was here used to reject the classification and hence reduce the classification error.

The main purpose of analyzing SAR scenes from the Kemijoki area is to improve run-off forecasts, and hence flood monitoring. The two parameters extracted from the SAR data are surface water coverage and soil moisture. Our analysis show that the normal variation and the seasonal trends in the backscatter signatures significantly varies between the land-cover types. We conclude that by combining SAR data with vegetation cover classified generated from optical satellite data we can significantly improve classification of surface water and reduce falsely classified surface water in the SAR scenes. Further we can use the statistics of the backscatter for each land-cover types to determine irregular situations such as flooding or saturated soils.