SURFACE WATER LAYER PRODUCTS FROM OCM2

FOR BHUVAN NOEDA

GEOPHYSICAL AND SPECIAL PRODUCTS

S D A P S A

NATIONAL REMOTE SENSING CENTRE

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14.	**Abstract:** In this Report, we realize surface water layer features from OCM2 sensor by employing threshold based logic which uses spectral absorption characteristic of water in the visible and NIR bands together with the normalized indices such as NDVI, NDWI. This method is used to generate surface water layer map for the entire Indian Subcontinent at two days interval with a spatial resolution of 360m.				

Introduction

Accurately extracting the spread of rivers, lakes and other inland water bodies form remotely sensed imagery is critically important for evaluation and regular monitoring of water resources, flood prediction, GIS database updation, long-term climate model analysis. Remote sensing has more advantages than the traditional methods of land surface water mapping because it is a low-cost, reliable information source that is capable of providing synoptic coverage of fairly large areas at frequent intervals. Numerous algorithms have been implemented for mapping the spread of water bodies from satellite data such as threshold method, inter spectral relationship method (Duong 2012),density slicing method (Frazier et al. 2000), decision tree (Fu June 2007), texture analysis method (Hua Wang et. al 2010) and other supervised and unsupervised classification techniques.

This document describes the Oceansat-2 water layer products version 1.0 derived from the data acquired by Ocean Color Monitor (OCM2) sensor. The spectral absorption characteristic of water in the visible and NIR bands together with the normalized indices such as NDVI, NDWI (Mc Feeters, 1996) are used for the extraction of water features from OCM imagery. Knowledge map in the form LULC maps are further used to assist the classification of water features. Illumination angle information obtained from DEMs is used to avoid misclassification of terrain shadows as water bodies. Since OCM has temporal resolution of two days, water layer map for the entire country can be generated every alternate day. Currently we propose deliver surface water layer map for the entire Indian Subcontinent at two days interval with a spatial resolution of 360m. This document presents in brief the processing scheme for realizing land surface water layer products.

Products Formats Specification

- Image File Format : Geo TIFF
- Projection : Geographic coordinates (Lat., Long.)
- Datum : WGS-84
- Spatial Resolution : 360m (0.0032727 deg)
- Radiometric resolution : 8 bits per pixel
- Correction Level : precision corrected
- Number of bands : 1
  Surface Water Pixel value (coded output) : 200 - pure water, 100 - mixed water and 0 - no water.
  Image background : 0 (outside country boundary)
- Water Pixel under cloud : 250

File Naming Convention

Image file naming convention contains the following information:

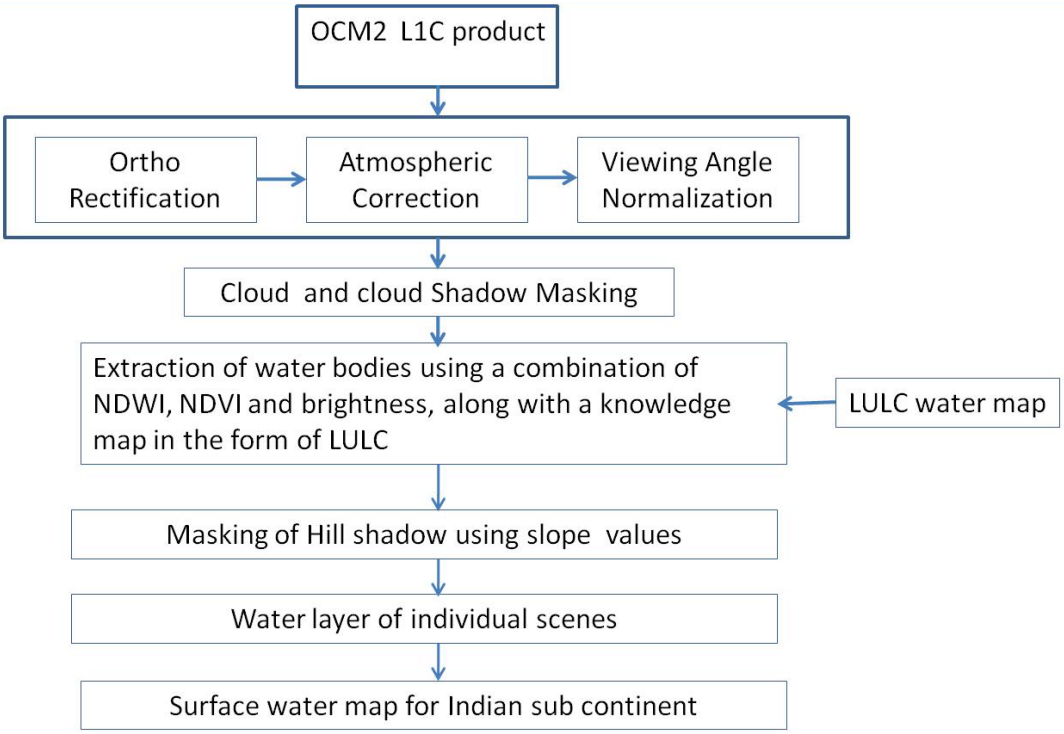
- Sensor name

- Product name(swp-surface water product)
- Days of reference(14 & 15 - using the images acquired on dates 14 and 15)
- Month of reference
- Year of reference
- Version number

Examples: ocm2_swp_14to15_jan2014_v01_01.tif

Data Processing

OCM2 Level-1C imagery has been used to generate land surface water layer products every alternate day. Data preprocessing for generating the water layer products involves following steps: 1) precision correction of images, 2) atmospheric correction to realize surface reflectance products 3) sun and view angle effect corrections across the image swath, 4) cloud and cloud shadow masking 5) generation of water layer using spectral thresholds and normalized indices 6) generation of image mosaics 7) Ocean mask and pseudo color.



The normalized difference water index (NDWI) is one of the common methods used to delineate the water features from the other land cover features. NDWI can be calculated from different band combinations (Visible and NIR). Normalized ratio of OCM bands 5 and 7 are used for computing NDWI. In addition to NDWI thresholds, normalized vegetation index (NDVI) using band8 and band6 values, and pixel brightness values (sum of all bands) were also considered for delineating water features. Further individual band thresholds and band ratios are also used for better delineation of water bodies. To make sure that

there are no omissions errors in the detection of water bodies we use pre existing knowledge on the occurrence of water bodies in the form of LULC map of the previous year and again check for occurrence of water bodies with little relaxed thresholds.

In optical remote sensing images, discrimination between water body and terrain shadow is very difficult. Hence, the slope and aspect values derived from the DEM data along with the solar azimuth and elevation angle information is used for calculating the illumination geometry to differentiate water bodies from terrain shadows. The illumination files were generated for each month using solar position of the mid of the month for identifying terrain shadows in the images corresponding to that particular month.

When the scene is more than 80% cloudy, the scene is not processed.

Products horizontal Accuracy

Geometric accuracy of the land surface water layer products is less than a pixel.

Thematic Mapping Accuracy

Based on the proposed algorithm and chosen threshold values water layer extraction for OCM2 sensor had been carried out. Figure1 shows extracted water bodies in the path 10-13 for the month of November'13. Water bodies filled with solid blue color overlaid on 8, 5, 3 false color composite is shown in the right side.

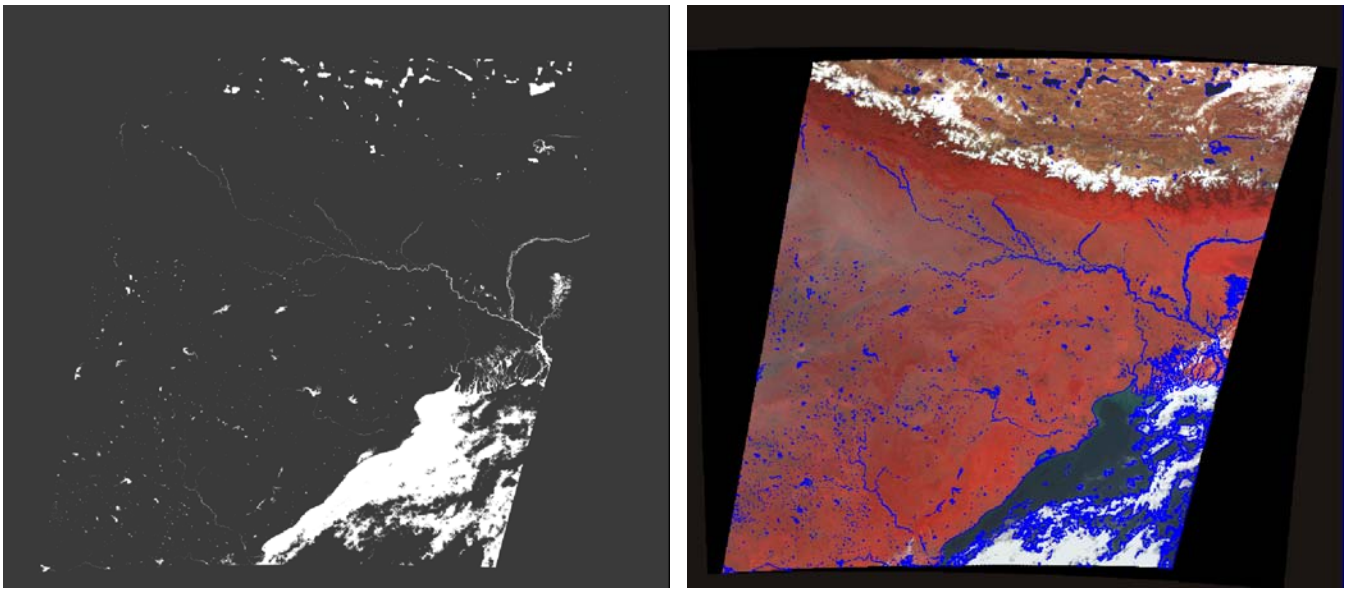


Figure 1. Water layer extracted form 10-13 for the month of November'13(left) and overlay on color composite

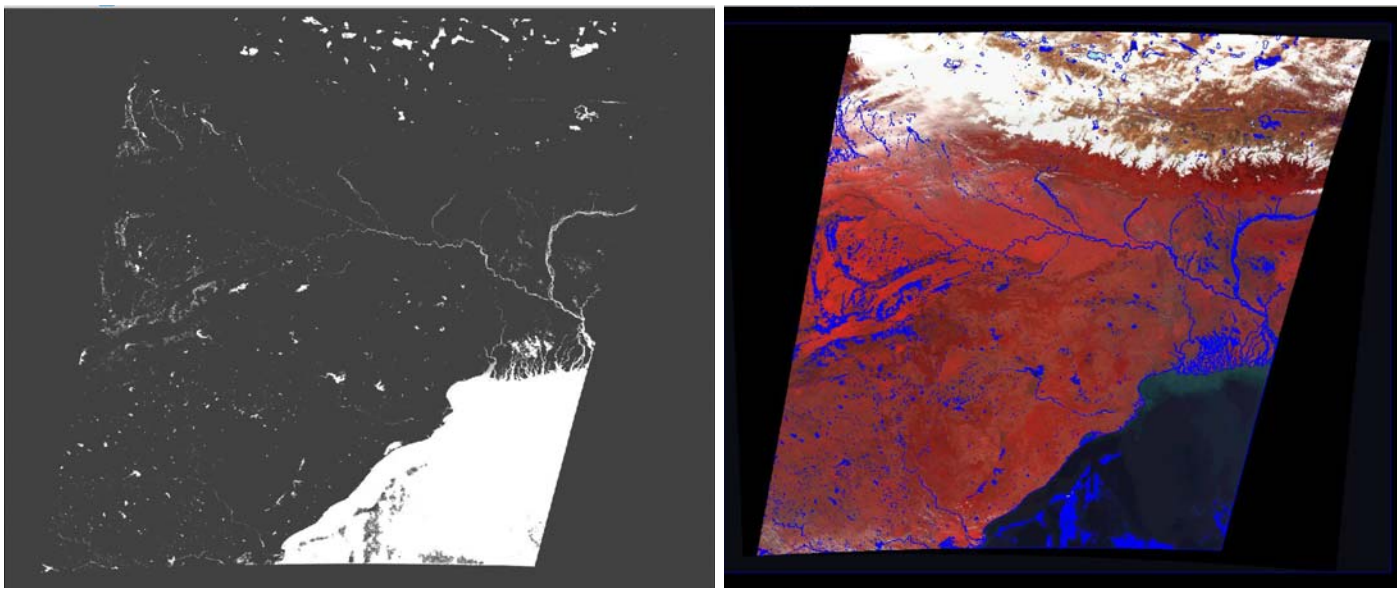


Figure 2. Water layer extracted form 10-13 for the month of April'14(left) and overlay on color composite

To assess the accuracy of the water extraction, visual analysis was carried out by comparing extracted water layer with original reflectance image as well as with AWiFs water maps of the same period. Accuracy was more than 90% for large water bodies but accuracy of detection was falling down with decreasing area by perimeter ratio. Water layer images thus generated for entire OCM2 LAC (Local Area Coverage) data over Indian Sub continent is shown in Figure3a and 3b for the month of Nov'13 and Feb'14 respectively.

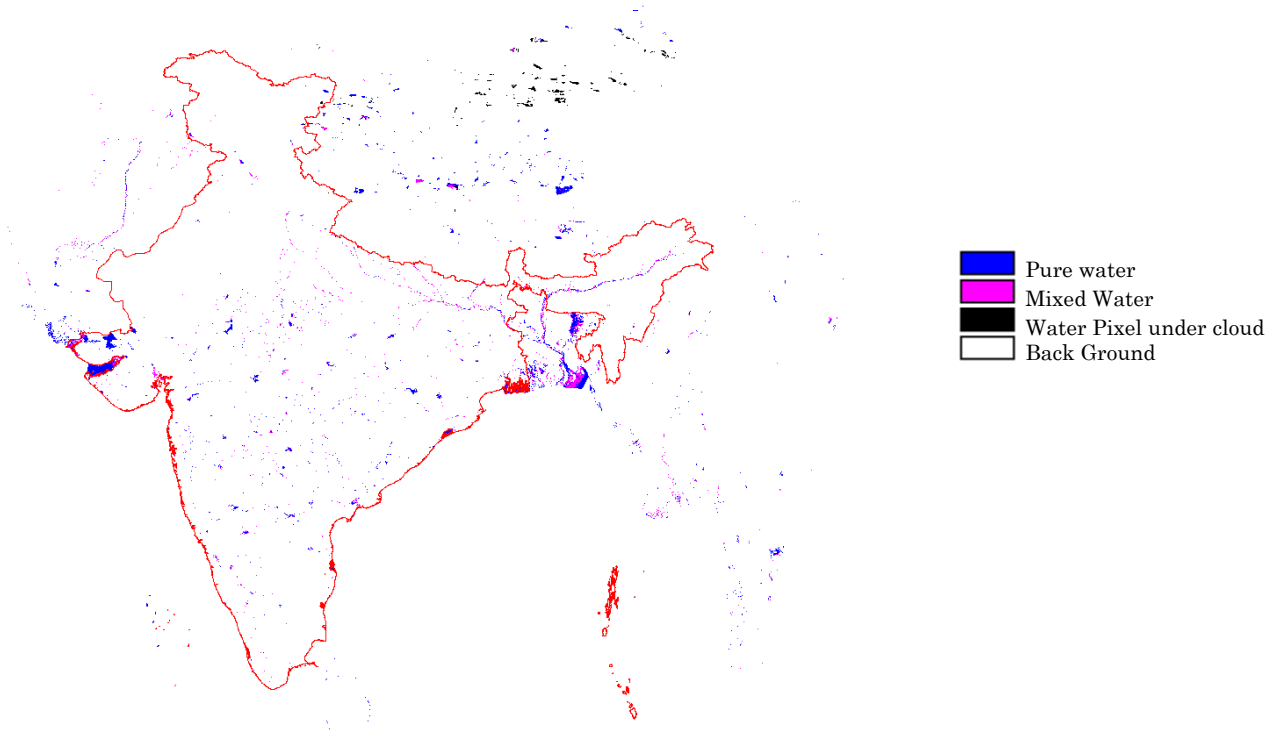


Figure 3a. Water layer extracted for the dates 19 and 20th of Nov'13 for Indian subcontinent

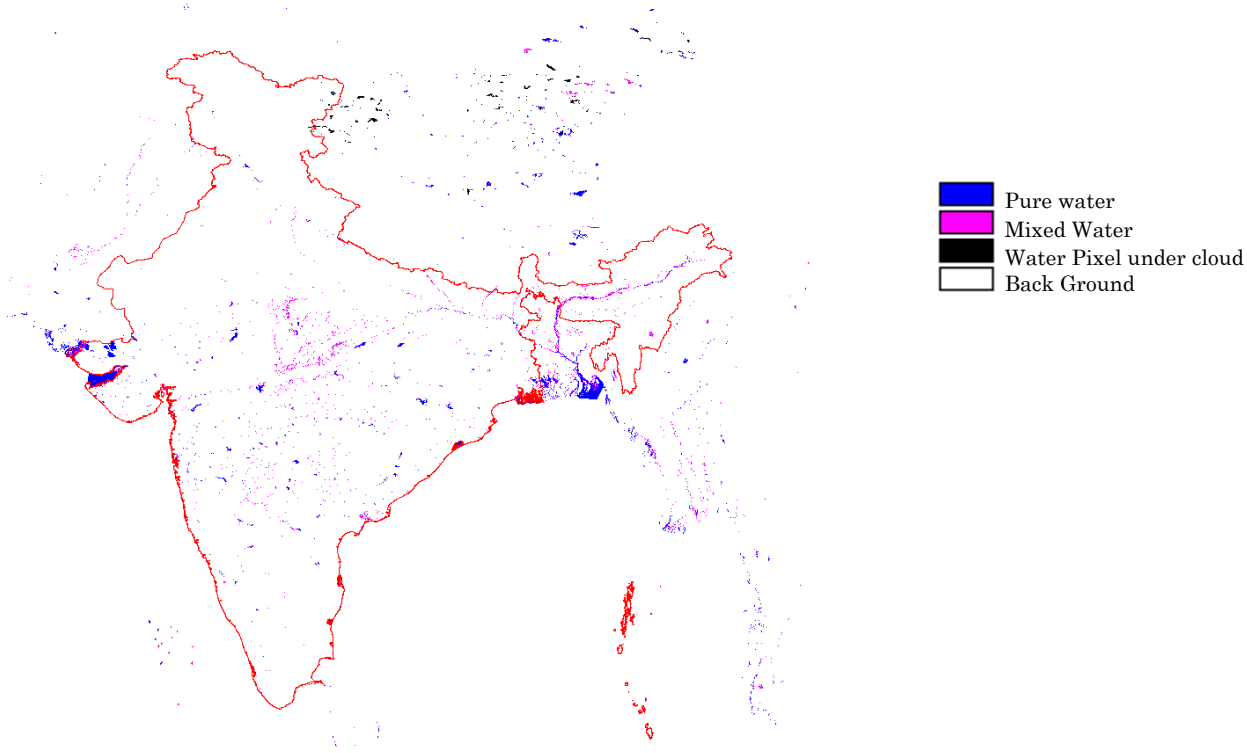


Figure 3b. Water layer extracted for the dates 9th and10th of Feb'14 for Indian subcontinent

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