CLASIC07 Vegetation Water Content Map, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Cosh, M. 2015. *CLASIC07 Vegetation Water Content Map, Version 1* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/NXWA8C8TLCWH. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/CL07VWC

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

The Vegetation Water Content (VWC) map for the Cloud and Land Surface Interaction Campaign 2007 (CLASIC07) was derived by calculating Normalized Difference Water Index (NDWI) from ResourceSat-1 satellite imagery.

1.1 Format

Data are provided in a binary file and a header file. An associated Extensible Markup Language (XML) metadata file is also provided.

Samples: 6647
Lines: 5605
Number of bands: 1
File layout: Band Sequential (BSQ)
Upper left corner in east-west direction: 452625.440
Upper left corner in north-south direction: 4120433.791
Pixel size in east-west direction: 56 m
Pixel size in north-south direction: 56 m
Projection: Universal Transverse Mercator (UTM) Zone 14 N, North American 1983 (NAD83) Datum

1.2 File and Directory Structure

Data files are available at:

`https://n5eil01u.ecs.nsidc.org/SMAP_VAL/CL07VWC.001/`

1.3 File Naming Convention

The binary data file is named `CL07VWC_vwc.bin`, and the header file is `CL07VWC_vwc.hdr`.

1.4 File Size

The data file is approximately 143 MB.

1.5 Spatial Coverage

Southernmost Latitude: 34.35°N
Northernmost Latitude: 37.23°N
Westernmost Longitude: 99.53°W
Easternmost Longitude: 95.47°W

1.6 Spatial Resolution

56 m

1.7 Projection

Data are projected to Universal Transverse Mercator (UTM) Zone 14 N, North American 1983 (NAD83).

1.7.1 Grid Description

Data are on a rectangular grid with a cell size of 56 m by 56 m.

1.8 Temporal Coverage

A satellite image obtained for 15 July 2007 is the basis for this data set.

1.9 Parameter or Variable

The parameter for this data set is VWC [kg/m^2].

1.9.1 Parameter Range

Valid parameter values are as follows:

VWC: 0-10 kg/m^2
Missing data: 0

2 SOFTWARE AND TOOLS

Various software packages can be used to read the data, such as the Environment for Visualizing Images (ENVI) and Interactive Data Language (IDL).

3 DATA ACQUISITION AND PROCESSING

Traditional methods of vegetation water content estimation during the study period was significantly hampered by the presence of clouds in all available scenes during the CLASIC study period. After review of the data records for the AWiFS, Landsat-5 Thematic Mapper (TM), Moderate Resolution Imaging Spectroradiometer (MODIS), and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) sensors, it was determined that there were no sufficient data to produce daily VWC estimates for the CLASIC study region during the experimental period. The two closest satellite images were a partly cloudy scene on 3 June from the Landsat-5 TM and a high-quality 15 July 2007 scene from AWiFS on ResourceSat-1. The 15 July scene, while outside of the study period, is the basis for this vegetation water content product. Due to the significant flooding and weather conditions in June 2007 in central Oklahoma, the harvest of much of the winter wheat crop was delayed until late in the month. Therefore much of the study domain has a low vegetation water content due to fallow fields or harvested winter wheat and summer crops were yet to be planted.

3.1 Atmospheric Correction

As the weather was always very cloudy during the CLASIC campaign, atmospheric corrections were needed to reflect the true ground. Table 1 shows important input parameters used in the MODerate resolution atmospheric TRANsmission (MODTRAN) computer program, which is designed to model atmospheric propagation of electromagnetic radiation for the 100-50,000 cm-1 (0.2 to 100 um) spectral range. These input parameters were used to generate the images.

Table 1. Important Input Parameters for MODTRAN for all Images

Images	O3STR	VIS	ML	IDAY	PARM1	PARm^2	TIME
0415	a0.375	74.5724	54	105	35.276	97.037	17.492
0429	a0.325	41.1477	48	119	36.857	98.666	17.624
0519	a0.350	19.9010	44	139	36.857	94.445	17.341
0603	a0.325	40.52940	56	154	35.328	-98.048	17.034
0715	a0.325	30.6211	55	196	35.276	98.099	17.554
0806	a0.270	28.44432	49	218	35.319	-97.994	17.021
0808	a0.283	40.6304	56	220	35.276	98.100	17.551
0813	a0.294	28.35889	56	225	35.277	97.045	17.480
0814	a0.295	24.3875	48	226	37.654	95.312	17.121
0828	a0.300	28.69239	43	240	37.218	95.485	17.260
0901	a0.295	46.82300	47	244	35.862	97.928	17.541

The reflectance of AWiFS cannot be validated because there was no observed reflectance on the same day. The validation results of TM are shown in Figure 1.

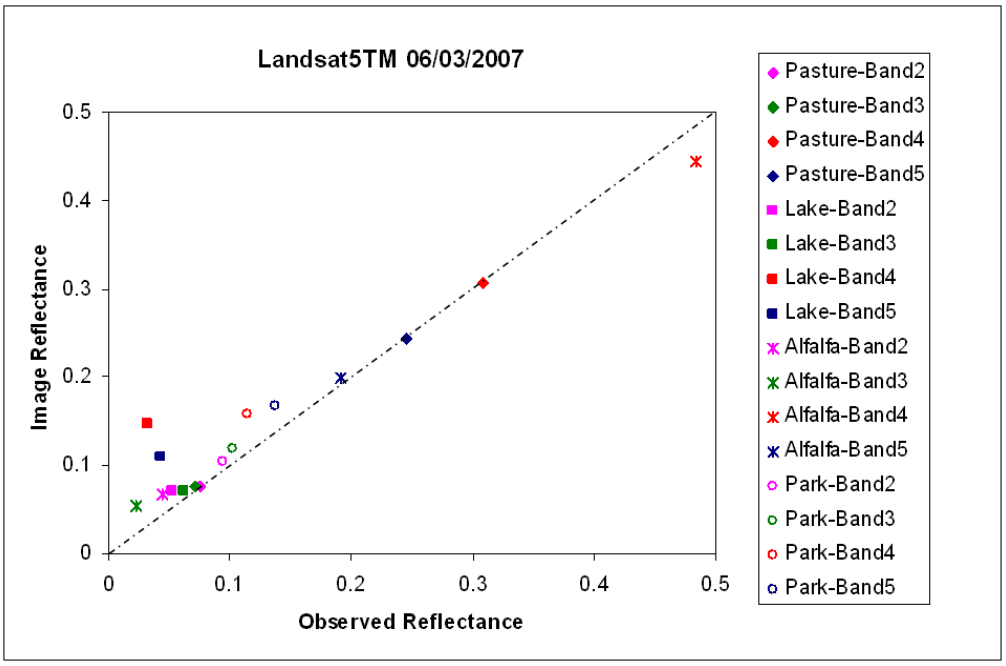

Figure 1. Validation of reflectance in TM images.

The big error appears on lake pixels, which is reasonable. The root mean square error (RMSE) is 0.022462 if calculated data without lake pixels. This is an indication of the accuracy of the process of atmospheric correction using the available data. No RMSE is available for 15 June 2007, on which the VWC is based.

3.2 Regression between Observed Normalized Difference Water Index (NDWI) and VWC

Due to the insufficient observed data, the regression equation cannot be drawn for all of the crops. Regressions can be calculated for Pasture and Wheat, but the number of data points is small. See Figures 2 and 3.

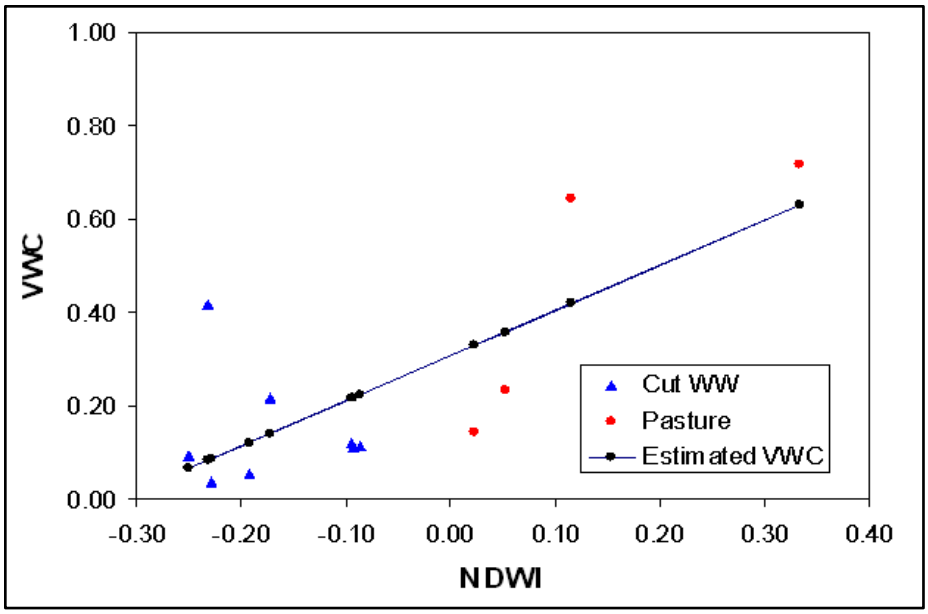

Figure 2. Regression between NDWI and VWC for Pasture (together with cut winter wheat).

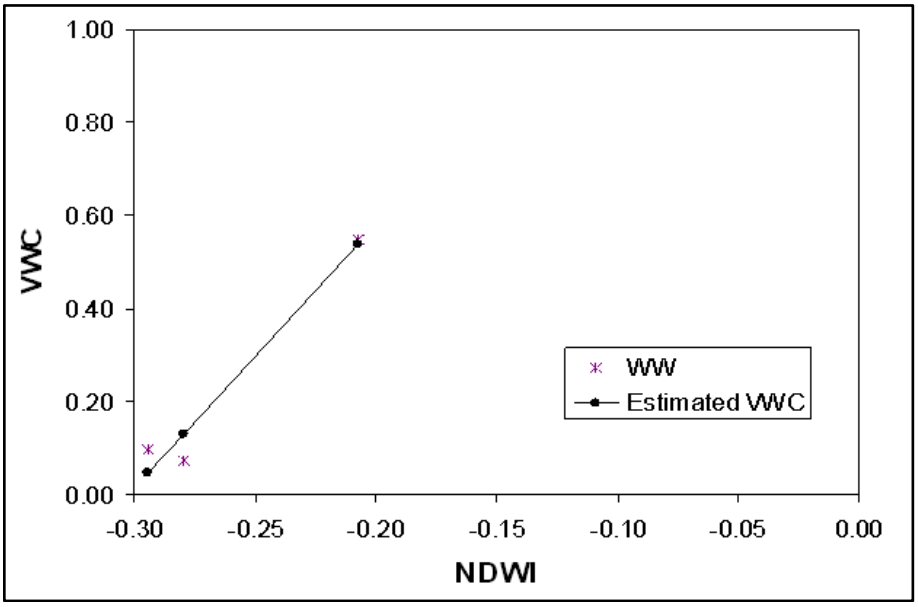

Figure 3. Regression between NDWI and VWC of winter wheat.

The regression equations for winter wheat and pasture are:

Winter Wheat:

*VWC=5.60680*NDWI+1.69831 (kg/m^2)*

RMSE=0.044013

Pasture and Harvested Winter Wheat:

*VWC=0.96567*NDWI+0.30753 (kg/m^2)*

RMSE=0.148642

Since data were insufficient to generate an equation for the other crops, we referenced equations from other experiments and extrapolated/theorized an algorithm.

Soil Moisture Experiment 2002 (SMEX02):

Alfalfa, Cotton, and Soybean: $VWC= 1.468 * NDWI2 + 1.3615 * NDWI + 0.3394 (kg/m^2)$

Soil Moisture Experiment 2003 (SMEX03):

Corn:$VWC = 5.3347 * NDWI + 2.1957(kg/m^2)$

Unclassified, Water and Urban:$0(kg/m^2)$

Forest: $10(kg/m^2)$

3.3 Vegetation Water Content Mapping

When combining land cover and NDWI for the 15 July scene, a VWC image can be generated. Almost all the data during CLASIC were contaminated by cloud. Users should take the cloud contamination into consideration to use these data reasonably.

3.4 Errors Sources

Almost all the data during CLASIC were contaminated by cloud. Users should take the cloud contamination into consideration to use these data reasonably.

3.5 Quality Assessment

The quality of the data is compromised due to errors caused by cloud cover (see the Error Sources section).

4 REFERENCES AND RELATED PUBLICATIONS

Jackson, T. J., D. Chen, M. Cosh, F. Li, M. Anderson, C. Walthall, P. Doriaswamy, and E. R. Hunt. 2004. Vegetation water content mapping using Landsat data derived normalized difference water index for corn and soybeans. *Rem. Sens. Env.*, 92: 475-482.

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

June 2015

6.2 Date Last Updated

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