AMSR-E/AMSR2 soil moisture and vegetation optical depth product using MCCA (2002-2021)

Product User Guide, version 1

Developed by

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1. Abstract

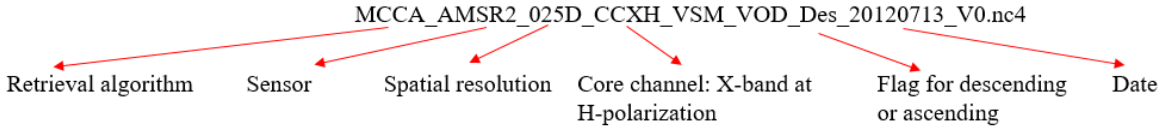
Soil moisture (SM) plays a vital role in regulating the water and energy exchange between land surfaces and the atmosphere and is declared an essential climate variable by the Global Climate Observing System (GCOS). Vegetation optical depth (VOD) is a crucial parameter describing vegetation attenuation properties in microwave radiative transfer equation, and it has been proven to be a promising ecological indicator for studying plant hydraulics, carbon stocks, and vegetation phenology.

A long-term SM and polarization-, frequency-dependent VODs (C/X/Ku) product was derived from the inter-calibrated AMSR-E/2 multi-frequency brightness temperature, using the multi-channel collaborative algorithm (MCCA). The MCCA comprehensively considers the physical relationship between multiple microwave channels and could simultaneously retrieve frequency- and polarization-dependent VODs and SM.

The new MCCA AMSR-E/2 SM dataset was validated over 25 dense soil moisture networks from the International Soil Moisture Network (ISMN) and United States Department of Agriculture (USDA) watersheds. The results showed that MCCA performs best in terms of ubRMSE among the current publicly available SM datasets related to AMSR-E/2. In addition, polarization-, frequency-dependent VODs from MCCA may provide new insights for better understanding the water fluxes in plant physiology.

2. Data details

1. Spatial resolution：0.25 degree
2. Geographical coordinate： WGS 1984， Global
3. file size： 4-6 M per file
4. format： nc4
5. file name：



6. Data structure：

MCCA_AMSR2_025D_CCXH_VSM_VOD_Des_20120713_V0.nc4	MCCA_AMSR2_025D_CCXH_VSM_VOD_Des_20120713_V0.nc4	Local File
lat	latitude	1D
lon	longitude	1D
QC	Bit flags for quality control	Geo2D
sm	Retrieved volumetric soil moisture using MCCA iterat...	Geo2D
vod_06h	Vegetation optical depth from 6.925 GHz at H-polariz...	Geo2D
vod_06v	Vegetation optical depth from 6.925 GHz at V-polariz...	Geo2D
vod_10h	Vegetation optical depth from 10.65 GHz at H-polariz...	Geo2D
vod_10v	Vegetation optical depth from 10.65 GHz at V-polariz...	Geo2D
vod_18h	Vegetation optical depth from 18.7 GHz at H-polariza...	Geo2D
vod_18v	Vegetation optical depth from 18.7 GHz at V-polariza...	Geo2D

lat: the central latitude of each grid；
lon: the central longitude of each grid；
QC: bit flags for quality control；
sm: MCCA derived SM；
vod_06h: MCCA derived VOD at Horizontal polarization for C-band；
vod_06v: MCCA derived VOD at Vertical polarization for C-band；
vod_10h: MCCA derived VOD at Horizontal polarization for X-band；

vod_10v: MCCA derived VOD at Vertical polarization for X-band；
vod_18h: MCCA derived VOD at Horizontal polarization for Ku-band；
vod_18v: MCCA derived VOD at Vertical polarization for Ku-band；

Latitude and longitude can be extracted from the daily file, and we provide a demo code for some basic processes (e.g. read the nc4 file and convert it to the GeoTIFF file).

3. Quality control

Bit number	Binary presentation (From right to left)	Description
1st	XXXXXXX1	frozen ground
2nd	XXXXXX1X	RFI detected from TB Polarization Difference: TBV-TBH<0
3rd	XXXX01XX	RFI detected from TB Spectral Difference, Moderate RFI: -10 K <TB(High)-TB(Low)<= -5 K
4th	XXXX10XX	RFI detected from TB Spectral Difference, Strong RFI: TB(High)-TB(Low)<= -10 K
5th	XXX1XXXX	IGBP Snow and Ice >= 5%
	11111111	Filling value, 255

4. Data citations

Hu, L., Zhao, T., Ju, W., Peng, Z., Yao, P., Shi, J. (2022). ASMR-E/AMSR2 soil moisture and vegetation optical depth product using MCCA (2002-2021). National Tibetan Plateau Data Center.

5. Reference

[1]. Zhao, T.J., Shi, J.C., Entekhabi, D., Jackson, T. J., Hu, L., Peng, Z.Q., Yao, P.P., Li, S.N., and Kang, C. S. (2021). Retrievals of soil moisture and vegetation optical depth using a multi-channel collaborative algorithm, Remote Sensing of Environment, 257, 112321, https://doi.org/10.1016/j.rse.2021.112321.

6. Disclaimer

(1) When users use the data, please clearly state the source of the data in the text, and quote the citation method provided by this data in the reference section.

(2) The data provider shall not be liable for any direct, indirect, special, incidental, or consequential losses caused by the use (or inability to use) of this data

(3) This data is only for academic research purposes and is not allowed to be used for other purposes such as commercial use. This data shall not be transferred to any third party, and all the consequences arising therefrom shall be borne by the data user.

7. Contract

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