

Institute of Remote Sensing and Digital Earth Chinese Academy of Sciences

LAnd surface Parameters VAlidation System (LAPVAS)

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Outline

Introduction of LAPVAS

• Evaluation of MuSyQ land surface albedo



Validation

validation





Remote Sensing Products

- difficulties:
 - (1) different sources of data
 - (2) different indicators
 - (3) different validation method

Reference	Land cover	MODIS dataset	Method	Source of reference	RMSE
Wu et al., 2016		MCD43A3 V005 full	multi-site averaged	multi-point ground-based measurements	0.025
		MCD43A3 V005 magnitude			0.02
Wang et al., 2014		MCD43A3 V005 full	D43A3 V005 full Spatial representativeness single-f D43A3 V005 assessment (Landsat (SURFI mitude albedo) AmeriF	single-point measurement	0.025
		magnitude		AmeriFlux)	0.03
Same p	prod	uct bu	t reveal	single point mean ment	ferent
	atio	ⅈ℡⅌⅌	iret comparison	single-point measurement (ARM-E15)	0.0183
				single-point measurement	
				(SURFRAD)	0.0633
Wright et al., 2014	Greenland ice sheet	MCD43A3 V006	direct comparison	4-site averagaed ground	
				value(ASD)	0.026
				Summit (BSRN)	0.029

standardized data processing, indicators, validation system

China Remote Sensing Application Network

CHINA has launched a project called Remote Sensing Application Network, including 4 subprojects. Two of them are:

- Multi-source data Synergized Quantitative remote sensing production system (MuSyQ)
- LAnd surface Parameters
 VAlidation System
 (LAPVAS)



(MuSvQ

What is LAPVAS?

RADI

Validation database and system for RSP
Complex processing, but easy validation

The *in situ* data is global-coverage, including China Validation Network (CVN) data.







Validation Dataset Subsystem

The validation database contains two types of reference data: the groundbased measurements and the pixel-scale reference QRSPs.





The field site map in the databases

The number of stations for each parameter

Validation methods



Validation Methods:

There are two types of validation methods are considered in LAPVAS: the direct validation method and the cross validation method.

Consideration of heterogeneous landscape the scale correction functions are required to ensure a good spatial matching between the ground-based measurements and pixel-scale QRSPs, especially in the case of heterogeneous land surface



Albedo validation with LAPVAS

- Quality comparison of multiple products
- Accuracy of individual product
- Accuracy statistic and comparison of multiple products
- Time series comparison of multiple products

In situ sites:

Site name	Land cover	Network
Desert Rock, NV	Desert	SURFRAD
Fort Peck, MT	Grassland	SURFRAD
Boulder, CO	Grassland	SURFRAD
Morgan Monroe State	Deciduous	AmeriFlux
Forest	broadleaf forests	
Southern Great Plains	Cropland	ARM
Central Facility		
Humboldt_GL	Snow	GCnet
Summit	Snow	GCnet
Ebao	Grassland	CVN (China)
Huangcaoguo	Grassland	CVN
Shenshawo	Desert	CVN
Gobi	Desert	CVN

Reference albedo product: MCD43B3 collection 5

MuSyQ albedo



One of the 13 available remote sensing products of MuSyQ
 1 km spatial resolution and 5 days temporal scale



MuSyQ albedo algorithm

A Multi-sensor Combined BRDF Inversion (MCBI) model (*Wen et al.,IEEE TGRS,2016*) is used to generate the MuSyQ global albedo.

Two key scientific problems:

An archetype of a virtual MODIS sensor observing network and BRDF model

 $\frac{\rho_{T,j}(\theta, \theta, \phi)}{\Psi} = \sum_{i=1}^{N} \begin{bmatrix} a_{i,j} f_{ito,i} + a_{i,j} f_{vol,i} K_{vol}(\theta, \theta, \phi) + a_{i,j} f_{geo,i} K_{geo}(\theta, \theta, \phi) \end{bmatrix}$ Target Linear combination of standard sensor bands with kernel-driven reflectance model

A net information index is employed to reject the low quality sensor observations.
 Cov(f)⁻¹ = (K'K) / σ²
 NII = I_{after} - I_{before}



MuSyQ Albedo temporal feature



 More land surface information can be got by MuSyQ, which has two accumulation windows within one MCD43 albedo accumulation window.



MCD43B3 DOY 25-40

MuSyQ DOY26-35

h11v04 in 2014

MuSyQ DOY31-40

MuSyQ albedo quality



The albedo qualities decrease significantly when shorting windows.

(1) MCD43B3 (16-day)

(2) MuSyQ with 10-day MODIS Obs.



MuSyQ albedo quality



The multi-sensors brings more information for albedo inversion.



MuSyQ albedo over CVN site



- MuSyQ albedo has a similar accuracy in snow-free land surface compared with MCD43B3 C5 albedo product.
- However, MuSyQ has a better performance in snow case.



MODIS 8d

MuSyQ 5d

MuSyQ albedo over all sites



RMSE statistic (mean, max, min) of all sites over five land surface types.

RMSE by product: Most MuSyQ < MCD43B3

RMSE by land cover:

snow

> grassland, desert, forest> cropland



MuSyQ albedo time series at individual site





Summary



- LAPVAS provides a suite of methods to reveal feature and accuracy of albedo product.
- MuSyQ albedo is in similar accuracy with MODIS C5 albedo and has a potential to be long-term albedo product.
- MuSyQ albedo is more sensitive during land cover change period, e.g. snowing, when compared to MODIS C5 albedo.

Thanks!



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