Package 'WCM'

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Type Package

Title Water Cloud Model (WCM) for the Simulation of Leaf Area Index (LAI) and Soil Moisture (SM) from Microwave Backscattering

Version 0.2.1

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Description Retrieval the leaf area index (LAI) and soil moisture (SM) from microwave backscattering data using water cloud model (WCM) model . The WCM algorithm attributed to Pervot et al.(1993) <doi:10.1016/0034-4257(93)90053-Z>. The authors are grateful to SAC, ISRO, Ahmedabad for providing financial support to Dr. Prashant K Srivastava to conduct this research work.

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Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Imports pracma,stats,raster

Suggests knitr,rmarkdown

VignetteBuilder knitr

NeedsCompilation no

Repository CRAN

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R topics documented:

`lai_inversion_lut` *Inversion of LAI from look up table generated by WCM*

Description

Inversion of LAI from look up table generated by WCM

Usage

```
lai_inversion_lut(img, lookuptable)
```

Arguments

`img`	raster object
`lookuptable`	Look up table simulated from 'wcm_sim' function

Value

a raster object (pixel value represents LAI)

Examples

```
radar <- raster::raster(ncol=10, nrow=10)
val <- seq(-12,-7, length.out=100)
radar[] <- val
A= -9.596695
B= -0.005331
C= -11.758309
D=  0.011344
lut <- lut_wcm(LAI=seq(1,6,0.1), SM=seq(0,.6,.01),coeff=c(A,B,C,D))
out_lai <- lai_inversion_lut(img = radar,lookuptable = lut)
```

`lut_wcm` *Look up table of WCM*

Description

Look up table of WCM

Usage

```
lut_wcm(LAI, SM, coeff)
```

Arguments

LAI	one dimensional row vector or a range of LAI value
SM	one dimensionalrow vector or a range of SM value
coeff	Generated A, B, C, D fitted coefficient for WCM using non linear least square using in situ data

Value

look up table for WCM for given range of LAI and SM

Examples

```
A= -9.596695
B=-0.005331
C=-11.758309
D=0.011344
lookuptable <- lut_wcm(LAI=seq(1,6,0.1), SM=seq(0,.6,.01),coeff=c(A,B,C,D))
```

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sm_inversion_lut *Inversion of SM from look up table generated by WCM*

Description

Inversion of SM from look up table generated by WCM

Usage

```
sm_inversion_lut(img, lookuptable)
```

Arguments

img	raster object
lookuptable	Look up table simulated from 'wcm_sim' function

Value

a raster object (pixel value represents SM)

Examples

```
radar1 <- raster::raster(ncol=10, nrow=10)
val <- seq(-12,-7, length.out=100)
radar1[] <- val
A= -9.596695
B= -0.005331
C= -11.758309
D=  0.011344
lut1 <- lut_wcm(LAI=seq(1,6,0.1), SM=seq(0,.6,.01),coeff=c(A,B,C,D))
out_sm <- sm_inversion_lut(img = radar1,lookuptable = lut1)
```

wcm_sim *Simulate backscattering coefficient using WCM model*

Description

This function can be used to simulate the backscattering coefficient using WCM. This function can be called in nls function for generation of model coefficients (A,B,C,D).

Usage

```
wcm_sim(X, Y, theta, A, B, C, D)
```

Arguments

X	In situ LAI or vegetation descriptor
Y	In situ SM soil moisture
theta	incident angle of Satellite sensor
A	fitted coefficient for WCM using non linear least squre using in situ data
B	fitted coefficient for WCM using non linear least squre using in situ data
C	fitted coefficient for WCM using non linear least squre using in situ data
D	fitted coefficient for WCM using non linear least squre using in situ data
wcm_sim	is simulated backscattering coefficient

Value

simulated backscattering coefficient

Examples

```
# For single value.
 n <- wcm_sim(4,.3,48.9,-9.596695,-0.005331,-11.758309,0.011344)

#For list of value
X<-c(5.34, 4.34, 4.32, 4.12, 4.17, 3.58, 5.39, 5.66, 5.47, 5.73, 5.76, 5.93, 4.91, 5.36, 6.15,
    4.56, 5.44, 6.54, 6.20, 6.34, 5.56, 5.88, 7.34, 5.74, 4.81, 5.73, 3.63, 4.61, 4.76, 4.02)
Y<-c(35.0, 26.0, 18.0, 13.0, 18.0, 22.0, 19.0, 16.5, 20.0, 24.0, 24.0, 21.0, 13.0, 22.0, 25.0,
    24.0, 30.0, 23.0, 18.0, 17.6, 15.0, 17.0, 27.0, 22.0, 21.0, 15.0, 15.0, 18.0, 31.0, 10.0)

w<-c(-9.604, -11.648, -11.556, -11.556, -11.090, -10.444, -10.444, -10.042,  -9.200,  -9.750,
      -9.200,  -9.200,  -9.812,  -9.972,  -8.938,  -9.200,  -8.198,  -7.722,  -7.348,  -7.348,
      -8.198, -10.082,  -6.870,  -8.104,  -8.732,  -7.830, -10.686, -10.964, -10.976, -10.976)

theta<-48.9
nlc<-nls.control(maxiter = 50000, tol = 1e-05, minFactor = 1/100000000000,
printEval = FALSE, warnOnly = FALSE)
k<-nls(w~wcm_sim(X,Y,theta,A,B,C,D),control=nlc,
 start=list(A= 0.01,B=0.01,C=-21,D= 0.00014),trace = T)
```

```
y<-predict(k)
n <- wcm_sim(X,Y,theta,-9.596695,-0.005331,-11.758309,0.011344)
```

Index