

Package ‘MSScvm’

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Type Package

Title Automated Cloud Masking for Landsat MSS Images

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Description An automated cloud and cloud shadow masking system for Landsat MSS imagery. It provides a means of more easily incorporating MSS imagery in large-area and time series analysis by providing an efficient way to prevent cloud and cloud shadow pixels from contaminating mosaics, composites, and time series.

Depends R (>= 3.2.1)

Imports gdalUtils, igrph, raster, rgdal, SDMTools

SystemRequirements GDAL binaries

License GPL-2

URL <http://www.msscvm.jdbcode.com/>

LazyData true

NeedsCompilation no

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eudist	<i>Earth-Sun distance by day-of-year</i>
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Description

Retrieve the Earth-Sun distance by day-of-year. It is helper function used by the [MSSdn2ref1](#) and [MSScvm](#) functions when calculating TOA reflectance.

Usage

```
eudist(doy)
```

Arguments

doy integer. image day-of-year.

Details

The function returns the Earth-sun distance for a specific day-of-year as defined [here](#).

Examples

```
dist = eudist(215)
```

getMetadata	<i>Retrieve Landsat image metadata</i>
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Description

Uses the image file name to find the corresponding *MTL.txt image metadata file provided with LPSG Landsat images and returns a data.frame with image information.

Usage

```
getMetadata(imgFile)
```

Arguments

imgFile filename (character). Full path to a Landast LPGS MSS file that includes the original image ID as the first block of characters.

Value

data.frame with image information.

Examples

```
## Not run:

getMetadata("C:/mss/LM10360321973191AAA04/LM10360321973191AAA04_dn.tif")

## End(Not run)
```

`mosaicDEMs`*Create a DEM mosaic from a directory of DEM's*

Description

A helper function to create the large-extent DEM file required by the [MSScvm](#) function.

Usage

```
mosaicDEMs(dir, projRef, srcNodata = NA, dstNodata = -32768)
```

Arguments

<code>dir</code>	directory name (character). Full path to a directory containing digital elevation model (DEM) files to be mosaiced.
<code>projRef</code>	filename (character). Full path to an image file produced by the MSSunpack function to be used as the projection reference.
<code>srcNodata</code>	numeric. Specify the background value of the DEM files in the directory. If there is no background value, use NA (default) .
<code>dstNodata</code>	numeric. Specify the value to represent background pixels in the mosaic DEM. -32768 is the default.

Details

The provided directory path should only contain decompressed digital elevation files from the same source (SRTM, NED, GTOPO, etc). The function will search the directory and include all files found in the mosaic. It is important that each file have the same background value and that it is correctly assigned to the 'srcNodata' parameter, if not, intersection between DEMs could have unexpected results. Each individual DEM file will be adjusted to match the projection and pixel resolution of the 'projRef' image. Then they will be merged using the mean value of intersecting pixels.

Value

A GeoTIFF raster file representing the union of all individual DEM files found in the provided directory path. The mosaic file will be written to the provided directory as "dem_mosaic.tif".

See Also

[reprojectDEM](#)

Examples

```
## Not run:  
  
mosaicDEMs(dir = "C:/mss/dems",  
           projRef = "C:/mss/LM10360321973191AAA04/LM10360321973191AAA04_dn.tif",  
           srcNodata = -9999, dstNodata = -32768)  
  
## End(Not run)
```

MSScvm

Landsat MSS cloud and cloud shadow masking

Description

Creates a cloud and cloud shadow mask for Landsat MSS imagery.

Usage

```
MSScvm(imgDir, demFile, classify = F)
```

Arguments

<code>imgDir</code>	directory name (character). Full path to a MSS image directory produced by the MSSunpack function.
<code>demFile</code>	filename (character). Full path to image-corresponding DEM file.
<code>classify</code>	logical. If TRUE clouds, cloud shadows, and clear pixels have unique values (0 = clear, 1 = cloud shadow, 2 = cloud). If FALSE obscured pixels = 0 and clear = 1.

Details

It is important that the input DEM file, specified by the 'demFile' parameter, be the same projection and pixel resolution as the input image. It must also be \geq in spatial extent, relative to the image. The program will check for these attributes and throw an error message if there is a violation. There are two helper functions to prepare a suitable DEM. Use the [reprojectDEM](#) function to ensure proper projection and pixel resolution of an existing DEM, and the [mosaicDEMs](#) function to create a mosaic from several DEMs to ensure proper extent, projection, and pixel resolution.

Value

A GeoTIFF raster image file with the same dimensions as the MSS image. The file will be placed in the 'imgDir' directory with the name equal to the image ID followed by '_msscvm'.

Examples

```
## Not run:  
  
MSScvm(imgDir = "C:/mss/LM10360321973191AAA04",  
       demFile = "C:/mss/dem/wrs1_p036r032_dem.tif")  
  
## End(Not run)
```

`MSSdn2rad`*Convert MSS DN values to TOA radiance*

Description

Convert MSS DN values to TOA radiance.

Usage

```
MSSdn2rad(imgFile)
```

Arguments

<code>imgFile</code>	filename (character). Full path to *dn.tif image file produced by the MSSunpack function.
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Details

The equation used to convert DN to TOA radiance can be found [here](#).

Value

A 4-band Landsat MSS GeoTIFF raster image file in units of top-of-atmosphere (TOA) radiance. The file will be placed in same directory as the 'imgFile' with the name equal to the image ID followed by 'toa_radiance'. Note that the values are scaled by 100 and rounded to the nearest integer to reduce the file size.

See Also

[MSSdn2refl](#)

Examples

```
## Not run:  
  
MSSdn2rad("C:/mss/LM10360321973191AAA04/LM10360321973191AAA04_dn.tif")  
  
## End(Not run)
```

`MSSdn2refl`*Convert MSS DN values to TOA reflectance*

Description

Convert MSS DN values to TOA reflectance.

Usage

```
MSSdn2refl(imgFile)
```

Arguments

`imgFile` filename (character). Full path to `*dn.tif` image file produced by the [MSSunpack](#) function.

Details

DN values are first converted to top-of-atmosphere (TOA) radiance using the equation found [here](#). Then TOA radiance is converted to TOA reflectance using the equation found [here](#). The ESUN values used are from the publication 'Chander et al. 2009. Summary of current radiometric calibration coefficients... Remote Sensing of Environment. 113'.

Value

A 4-band Landsat MSS GeoTIFF raster image file in units of top-of-atmosphere (TOA) reflectance. The file will be placed in the same directory as the `'imgFile'` with the name equal to the image ID followed by `'toa_reflectance'`. Note that the values are scaled by 10,000 and rounded to the nearest integer to reduce the file size.

See Also

[MSSdn2rad](#)

Examples

```
## Not run:

MSSdn2refl("C:/mss/LM10360321973191AAA04/LM10360321973191AAA04_dn.tif")

## End(Not run)
```

MSSunpack

Decompress and stack Landsat LPGS MSS images

Description

Decompresses and stacks Landsat LPGS MSS images provided by USGS as `*.tar.gz` files. Optionally outputs top-of-atmosphere (TOA) radiance and reflectance files.

Usage

```
MSSunpack(imgFile, toaRad = FALSE, toaRef1 = FALSE, useL1G = FALSE)
```

Arguments

`imgFile` filename (character). Full path to compressed LPGS Landsat MSS image file provided by USGS.

`toaRad` logical. If TRUE, a TOA radiance image will be created.

`toaRef1` logical. If TRUE, a TOA reflectance image will be created.

`useL1G` logical. If TRUE, L1G images will be processed.

Details

It is important that the 'imgFile' be an unaltered tar.gz-compressed LPGS image file that you receive from USGS through [EarthExplorer](#). Note that DN values ≤ 1 are set to NA across all bands. This mitigates a problem caused by bad columns on the east and west edge of images when mosaicing adjacent images together.

Value

A 4-band Landsat MSS GeoTIFF raster image file in DN units. If optional 'toaRad' and/or 'toaRef1' parameters are set to TRUE, then similar TOA radiance and reflectance image files will be created. The files will be placed in the same location as the 'imgFile' with the name equal to the image ID plus an appended descriptor. Descriptors include 'dn' (digital number), 'toa_radiance' (TOA radiance), and 'toa_reflectance' (TOA reflectance).

See Also

[MSSdn2rad](#), [MSSdn2ref1](#)

Examples

```
## Not run:

MSSunpack(imgFile = "C:/mss/LM10360321973191AAA04.tar.gz")
MSSunpack(imgFile = "C:/mss/LM10360321973191AAA04.tar.gz",
          toaRad = FALSE, toaRef1 = TRUE, useL1G = TRUE)

## End(Not run)
```

reprojectDEM

Reproject a DEM file

Description

Reproject a DEM file to match the projection and pixel resolution of an image file. A helper function to make a DEM conform to the properties of an image file prior to using it as an input to the [MSScvm](#) masking function.

Usage

```
reprojectDEM(demFile, projRef, srcNodata = NA, dstNodata = -32768)
```

Arguments

demFile	filename (character). Full path to DEM file.
projRef	filename (character). Full path to an image file produced by the MSSunpack function.
srcNodata	numeric. Specify the background value in the input DEM. If there is no background value, use NA (default).
dstNodata	numeric. Specify the value to represent background pixels in the reprojected DEM. -32768 is the default.

Details

The DEM file will be adjusted to match the projection and pixel resolution of the 'proRef' image.

Value

A GeoTIFF raster file with '_reprojected.tif' replacing the last 4 characters of the input DEM filename.

See Also

[mosaicDEMs](#)

Examples

```
## Not run:
```

```
reprojectDEM(demFile = "C:/mss/dem/wrs1_p036r032_dem.tif",  
             projRef = "C:/mss/LM10360321973191AAA04/LM10360321973191AAA04_dn.tif",  
             srcNodata= -9999, dstNodata= -32768)
```

```
## End(Not run)
```


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