

## **Assignment 6: Using Microwave Remote Sensing to study precipitation and soil moisture patterns in West Africa**

**Due Date:** 26 March 2018, 08:45

Submit to Brightspace as a single .pdf file

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### **Data**

In the MWRS\_data.zip file, you will find 25 GeoTiff files. All are 0.25 degree resolution maps in the EPSG:4326 CRS. The data are:

- 1) The dominant IGBP land cover class for each grid cell. See here for details and class definitions:  
([http://daac.ornl.gov/ISLSCP\\_IL/guides/modis\\_landcover\\_xdeg.html](http://daac.ornl.gov/ISLSCP_IL/guides/modis_landcover_xdeg.html))
- 2) The monthly mean precipitation rate (mm/hr) from TRMM 3B43 dataset from January to December 2009.  
([http://disc.sci.gsfc.nasa.gov/precipitation/documentation/TRMM\\_README/TRMM\\_3B43\\_readme.shtml](http://disc.sci.gsfc.nasa.gov/precipitation/documentation/TRMM_README/TRMM_3B43_readme.shtml))
- 3) The LPRM monthly mean soil moisture (January – December, 2009) from C-band AMSR-E observations  
(LPRM/AMSR-E/Aqua Daily **L3** Ascending Surface Soil Moisture, Ancillary Params, and QC from <http://gcmd.nasa.gov/>)  
([ftp://hydro1.sci.gsfc.nasa.gov/data/s4pa/WA0B/LPRM\\_AMSRE\\_A\\_SOILM3.002/GES\\_DISC\\_LPRM\\_AMSRE\\_A\\_SOILM3\\_V002\\_dif.xml](ftp://hydro1.sci.gsfc.nasa.gov/data/s4pa/WA0B/LPRM_AMSRE_A_SOILM3.002/GES_DISC_LPRM_AMSRE_A_SOILM3_V002_dif.xml))

Note that I've extracted West Africa for you to reduce the data volume, and provided only the fields you need.

### **Assignment (Complete using QGIS and/or GRASS)**

#### **Land Cover**

Make a map showing the land cover classes in West Africa.  
What are the major land cover classes in West Africa?

#### **TRMM Precipitation**

- 1) Make a map of the total precipitation in 2009 (in mm).
- 2) What is the mean total precipitation in each of the land cover types?
- 3) Make a new shapefile, and add at least 5 points in a North-South transect so that you have points in each of the major land cover classes.
- 4) Extract a time series of the monthly values of the precipitation rate for each point.
- 5) What is the total annual precipitation (mm) at each point?
- 6) Describe the variation of precipitation vary during the year at each point? (e.g. when is minimum/maximum? Is precipitation uniformly distributed throughout the

year? Or is there a strong seasonal cycle?) Compare the seasonal cycle in the different land classes.

7) What influence does the West African monsoon have on the seasonal distribution of precipitation at each of your sampling points? How does this vary from South to North?

### **AMSR-E Soil Moisture**

1) Extract the time series of C-band soil moisture at each sampling point in your transect.

2) In which land cover class is soil moisture highest/lowest?

3) In which land cover class is soil moisture most uniform during the year?

4) In which land cover class does soil moisture have the strongest seasonal cycle?

5) Explain the variations observed in soil moisture in terms of the observed seasonal cycle in precipitation.

### **SMAP Soil Moisture**

The data you analyzed in this assignment are from the C-band radiometer on AMSR-E. The SMAP mission launched on January 31, 2015 and is now producing soil moisture data from an L-band radiometer.

1) List three advantages of using an L-band radiometer rather than a C-band radiometer for soil moisture monitoring.

2) There are SMAP overpasses at 6AM and 6PM. Give three reasons why only the 6AM observations are used to estimate soil moisture.