ColoradoView – Spring 2015
Project Report Guidelines

All student interns involved with the ColoradoView project during Spring 2015 are expected to complete the following:

STATUS REPORT: Due by April 24

1. **Project theme (e.g., Grazing Lands; Invasive Species; UV-B Monitoring) and title**
   UV-B monitoring, model of ultraviolet radiation index.

2. **Project Team: Include team members' names, departments, and email addresses**
   Alfonso de Lara, Soil and Crops, adelara@rams.colostate.edu

3. **Faculty Advisor and his/her contact information: who is primarily providing direction and guidance for your project**
   Michael Coughenour, michael.coughenour@colostate.edu

4. **General overview/description/background of project**
   In Colorado, UV B is measured directly at only 3 places and a map is prepared from readings at those stations. Because number of stations is very little for the entire state, maps are not representatives of the correct UV B radiation received by any point in the state of Colorado. UV B radiation received is dependent on a lot of factors, including but not limited to, solar irradiance, Ozone layer cover, Cloud cover, and amount of aerosols. Better maps are needed by farmers to estimate crop yield and reduce crop damage due to UV B radiation

5. **Your objectives or research questions: What you were asked to do?**
   My job for this project involves finding appropriate datasets to estimate UV B radiation across the whole surface of the Colorado State.

6. **Your experience with the project**
   a. **What have you accomplished so far?**
      Data preprocessing, download necessary layers (OMI Satellite, DEM). Need to get new layers from them (aspect, temp, etc).
      Weather stations were geo-located, with their UV-B readings on a spreadsheet since 2012/01/01 to 2012/12/31. I will test 2012 (every day), to see if the date factor has a significant influence.
      Once the preprocessing is done all the layers values will be extracted to the Weather Stations points.
      I use R Project software to run a Generalized Linear Model (GLM) to predict the stations UV readings (independent variable) using all the above dependent variables. There will know which layers are significant to include in the final model. Once I get the final equation, I can rerun the model for a single present day and calculate the UV B and draw it in ArcGIS. Also, in case of being spatial autocorrelation in the residuals, kriging may be used to calculate them.

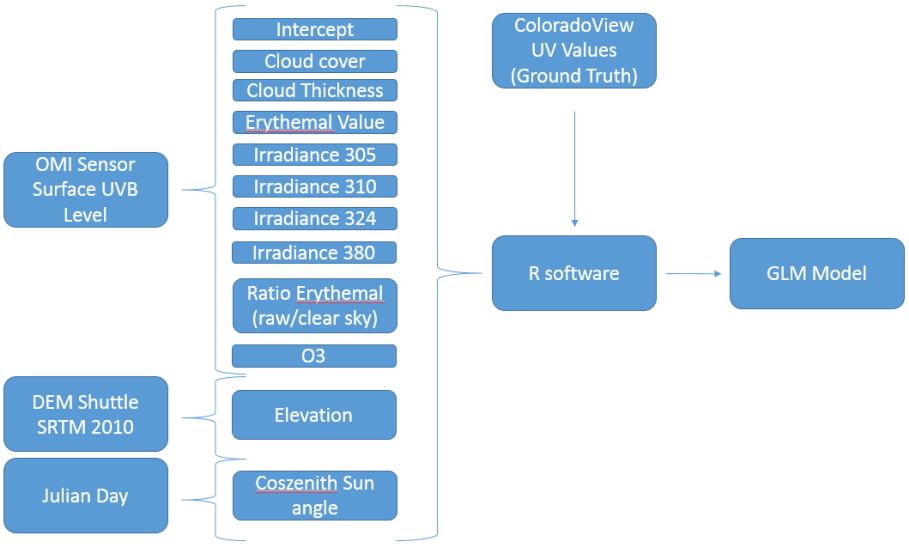
      Have you had the guidance you need?
      Yes from Michael, not much from Zhibin Sun.
      Have you had the technology and resources you need?
      Yes, Michael has sent me lot of useful links where I got important information. I also was offered to use a SERVER (powerful computer) to do the final processes.

7. **Any questions or concerns you may have about finishing**
   Struggling to open some files in Arcgis (projections problem) so I will either try to figure it out or use another soft to convert them

FINAL REPORT: Due May 15

1. - 5. (Same as above)

6. Lessons learned
    a. methodology with flowcharts



    b. discussion of main issues examined

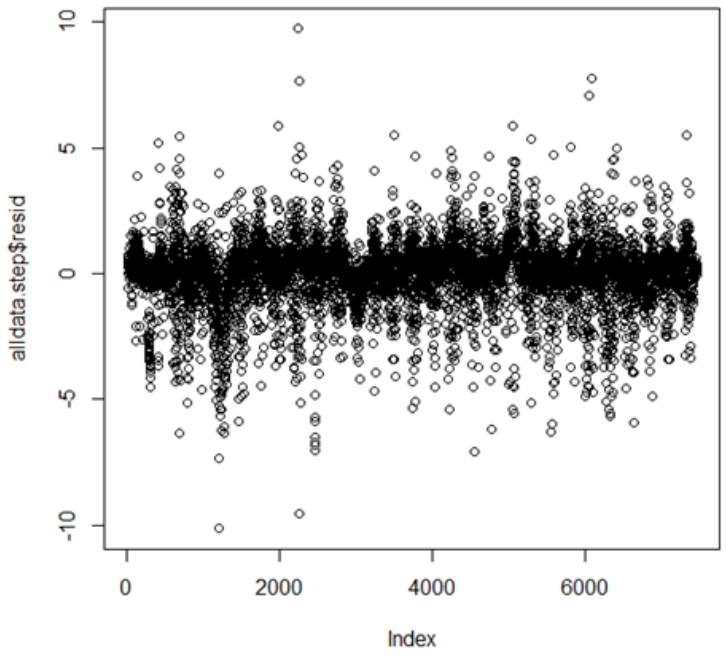
Main issues were to extract the data from the HE5 files, new format provided by the Aura Satellite (improvement over HDF files, but not recognized by most of the cutting edge software, like ArcGIS). Need for specific packages developed to manage this type of files.

7. Major products
    a. Relevant datasets
        i. with proper metadata: Aura OMI Surface UVB Level 2G, Shuttle v2010 DEM, ColoradoView weather stations UV Values (Ground Truth)
        ii. schematic of database
        iii. readme files
        iv. store on Centroid L: drive in proper folder
            1. L:\Projects_active\ColoradoView
    b. include map(s) if appropriate and/or link to final project materials

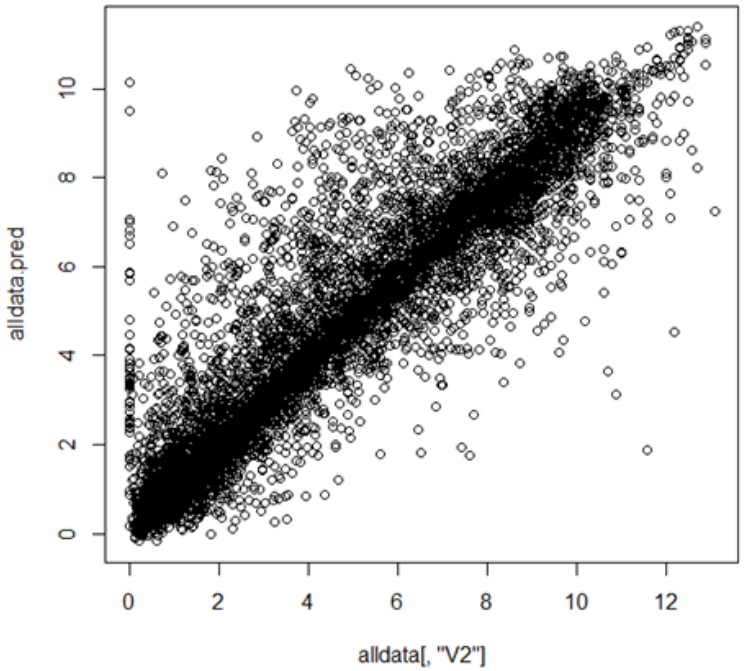
Model:

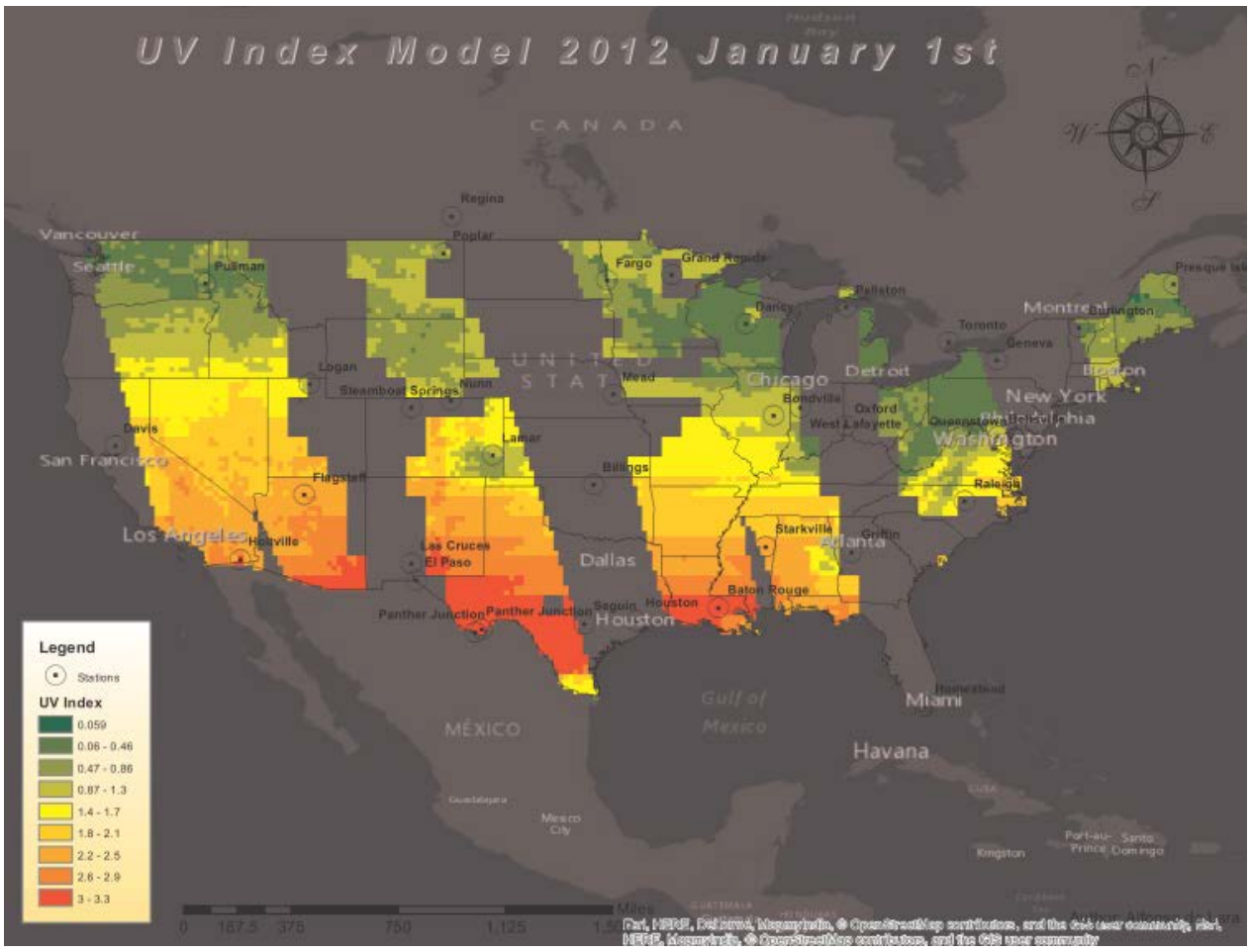
```
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)             -6.203e-01  2.917e-01  -2.127   0.0335 *
day.stk                  8.703e-04  1.659e-04   5.246 1.60e-07 ***
clouds.stk...1.         -7.869e-01  8.509e-02  -9.247  < 2e-16 ***
cloudthick.stk...1.     -5.188e-03  3.090e-03  -1.679   0.0932 .
elevation.stk...1.       1.912e-04  3.045e-05   6.279 3.59e-10 ***
erythemal.stk...1.       9.747e-03  4.193e-03   2.324   0.0201 *
irrad305.stk...1.        6.400e-02  1.185e-02   5.402 6.80e-08 ***
irrad380.stk...1.        2.708e-03  4.426e-04   6.117 1.00e-09 ***
ratioerythemal.stk...1. -1.423e+00  2.873e-01  -4.954 7.42e-07 ***
O3.stk...1.              4.853e-03  5.772e-04   8.408  < 2e-16 ***

These are the significant layers to model UV. There is not a trend in the
residuals (but there were 2 outliers):
RESIDUALS:
```



The R squared is: 0.8310921
And this are the real values VS predicted:





c. Include any literature cited or websites (sources of data)

8. Final reflection

a. Benefits to the society and other researchers

The possibility to use the results from this model to keep studying correlation of other layers that might explain UV index. In addition, for future satellite launch purposes, analyze the possibility of including sensors with higher spatial resolution, and radiometric resolution.

b. Challenges you faced while conducing this research

As explained above, the handling of this type of files is fairly new, therefore the most used software cannot be used to develop an automatic methodology.

c. Recommendations and limitations- talk about how your products can be used and any caveats you have about them

There is still lots of missing data in the original layers (OMI), but that might be caused by the daily mapping attempt. Otherwise, the outcomes threw a significantly high correlation between variables.