APPLICATION OF REMOTE SENSING AND REGRESSION TECHNIQUES TO ESTIMATE RELATIVE HUMIDITY

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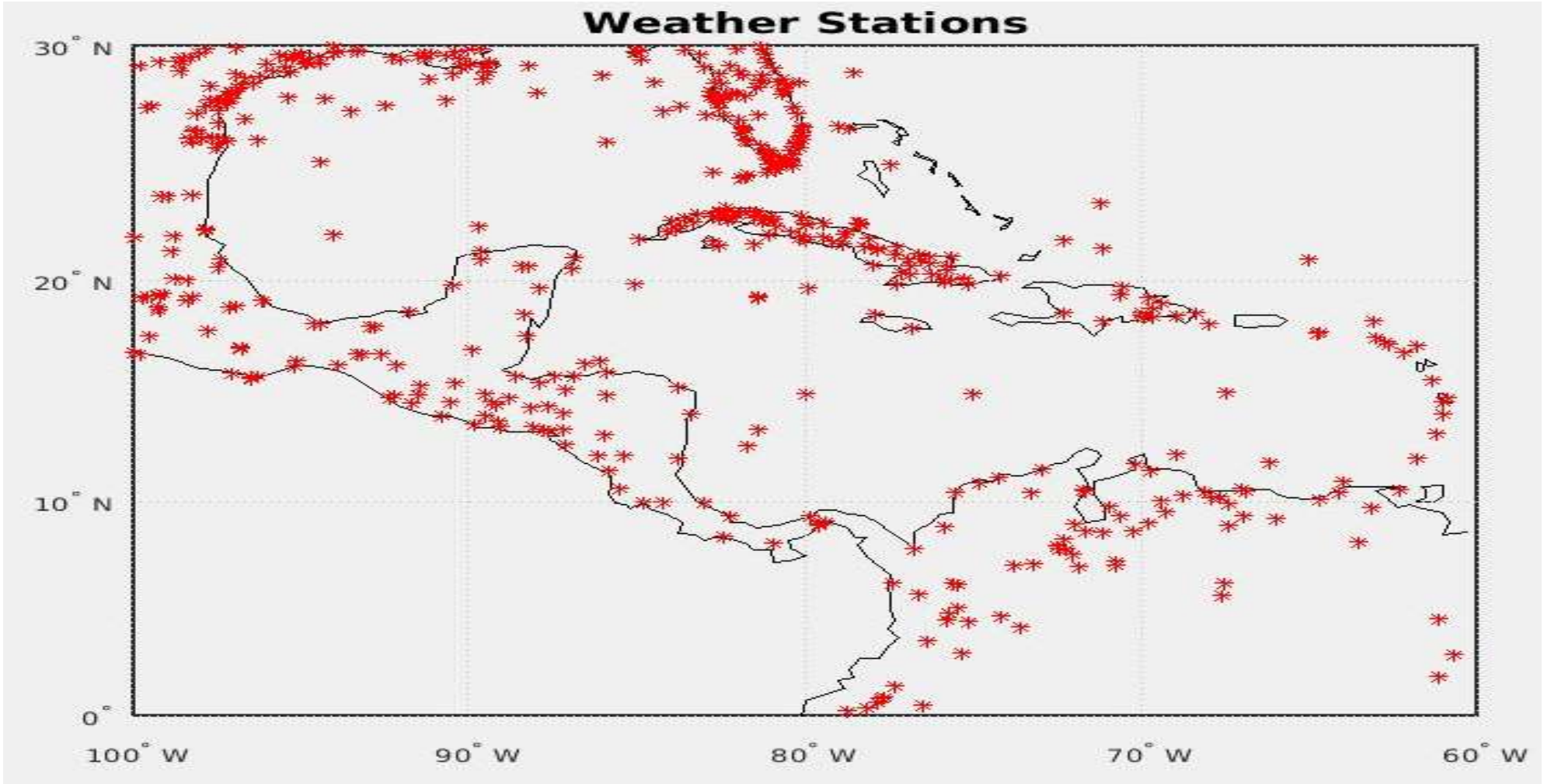
PRYSIG 2016
October 7,2016

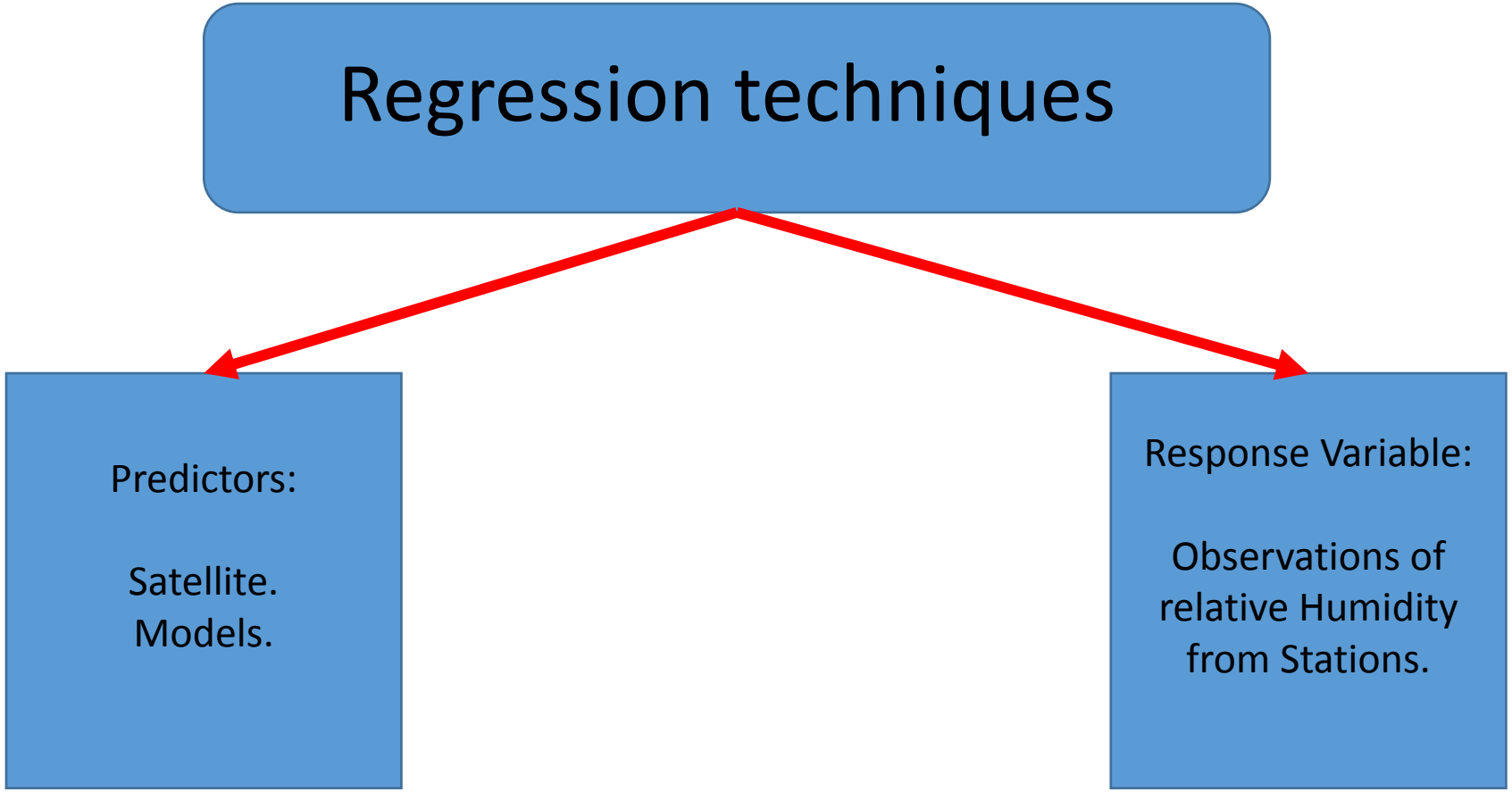
Motivation



Objectives:

- To obtain a hourly model Estimated Relative Humidity product, capable to represent the values for the Entire MesoAmerican Caribbean (MAC) region.

Methodology:



Estimation of relative humidity

- Response variable:
  - relative humidity (stations)
- Characteristics of the data:
  - Stations located on the MAC region
  - Hourly observations of relative humidity.
  - Data availability from 2010 at least

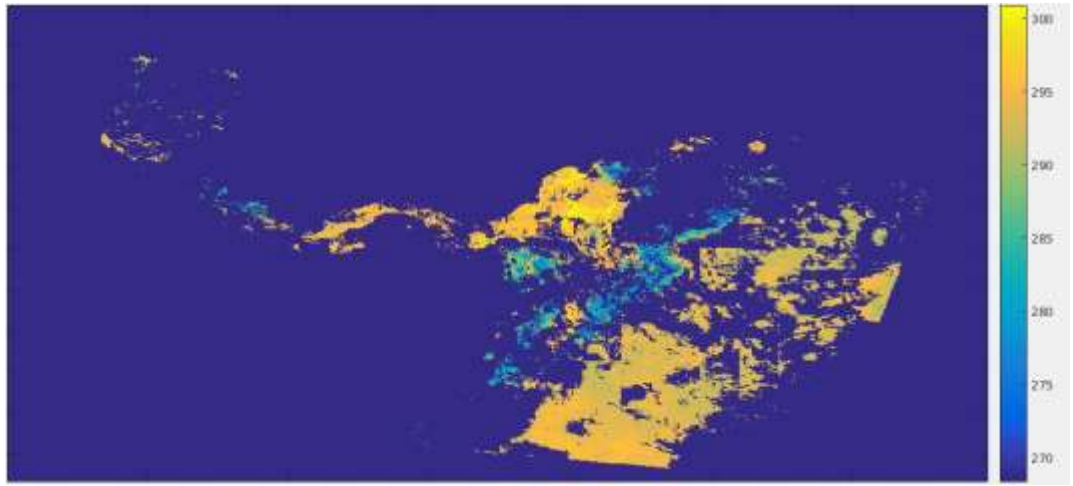
Estimation of relative humidity

- The following variables were suggested by literature (Peng et al. 2006) (K.S. Han et al. 2005) and as important and will be introduced as predictor variables:
  - LST
  - PW
  - NDVI
  - GOES channel 2 to 6 brightness temperature (GOES)
  - Elevation (DEM)
  - Seasonal components (sin and cos for approximately 12 and 24 hours)

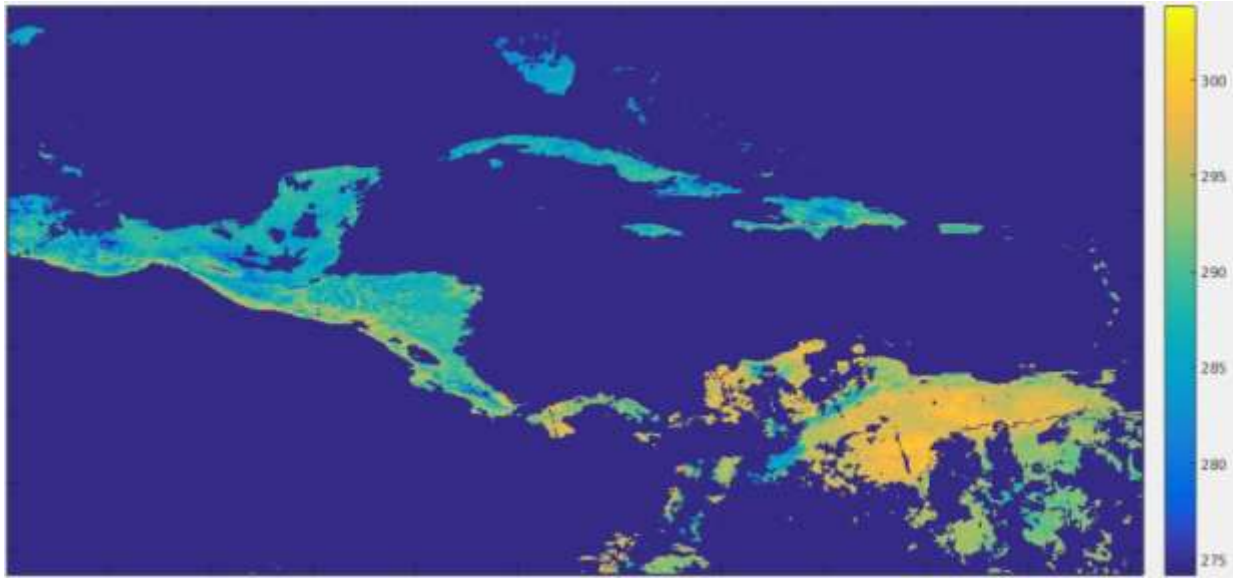
Specification of the data

Physical parameter	Data source	Spatial Resolution	Time resolution
Land Surface Temperature	MODIS	1 km.	2 times per day
Precipitable Water	MODIS	5 Km.	2 times per day
NDVI	MODIS	1 Km.	Every 16 days
Relative Humidity	Stations	N.A.	Hourly

Products improvements (LST)

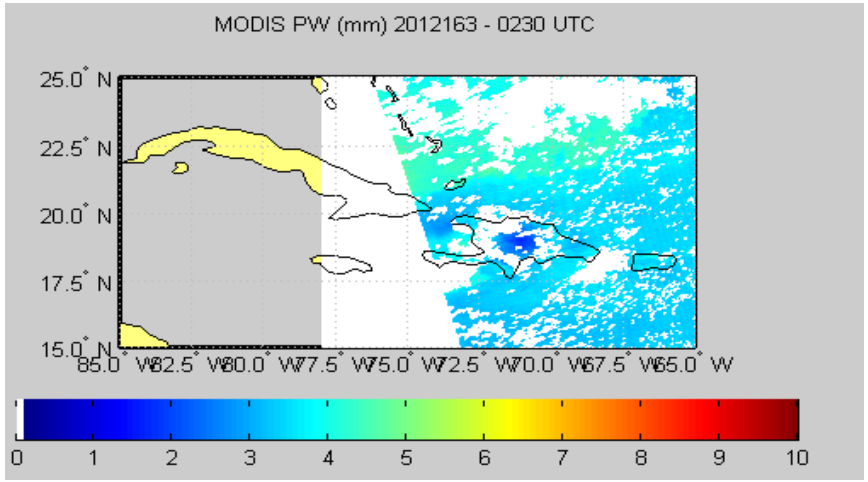


MODIS aqua LST, January 02 6:45 UTC.

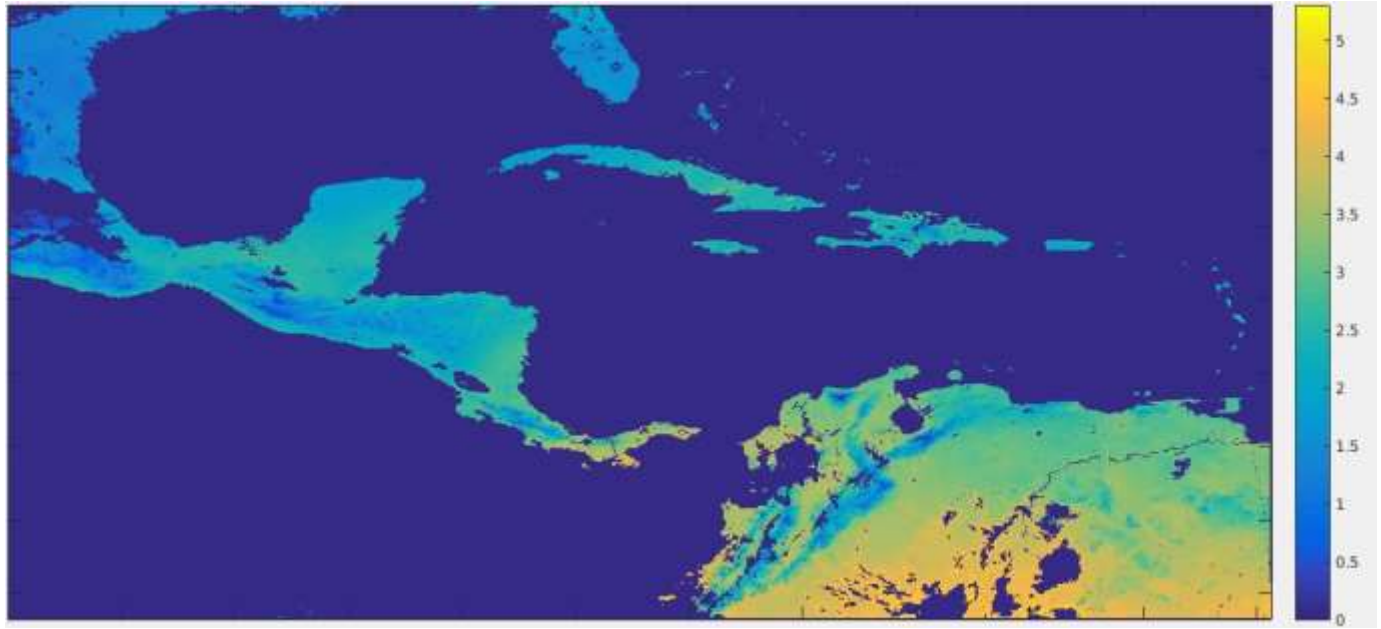


Estimated LST, January 18 12:00 UTC.

Products improvements (PW)



MODIS aqua PW, June 11 2012 2:30 UTC.



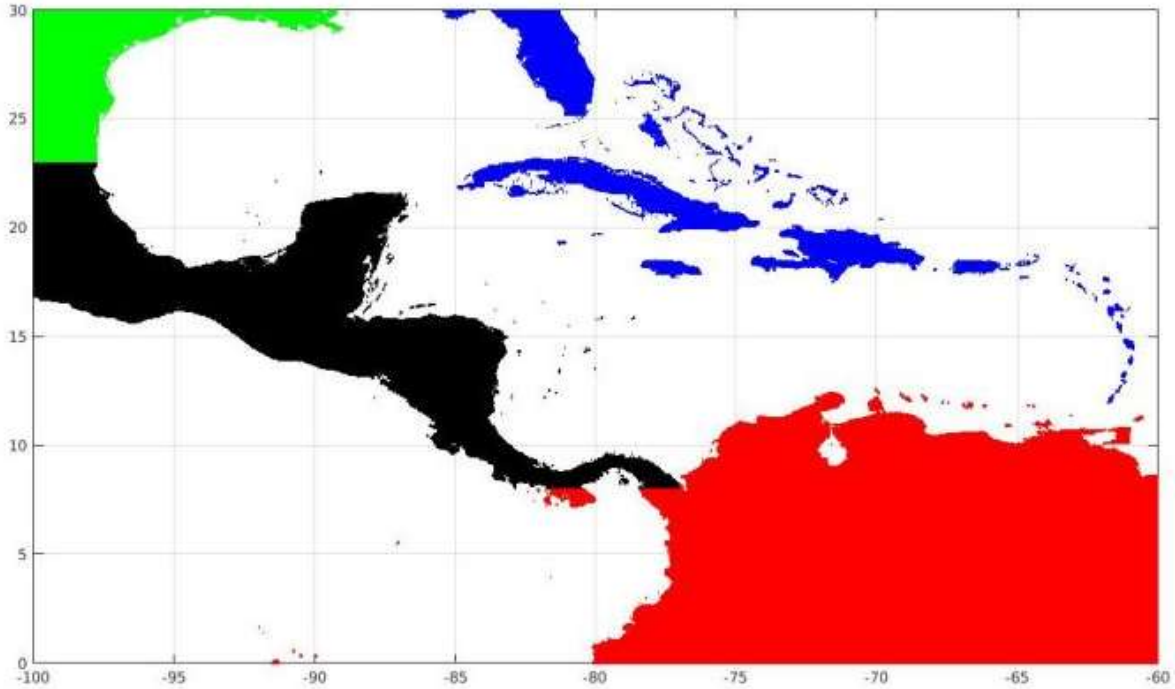
Estimated PW, January 18 12:00 UTC.

Specification of the data

Physical parameter	Data source	Spatial Resolution	Time resolution
Land Surface Temperature	GOES/MODIS	4 km.	Hourly
Precipitable Water	GOES/MODIS	4 Km.	Hourly
NDVI	MODIS	4 Km.	Hourly
Relative Humidity	Stations	N.A.	Hourly

Division in groups

- MAC region has been divided into 4 groups with similar characteristics: USA (green), Center America (black), South America (red) and Caribbean (blue).



Results

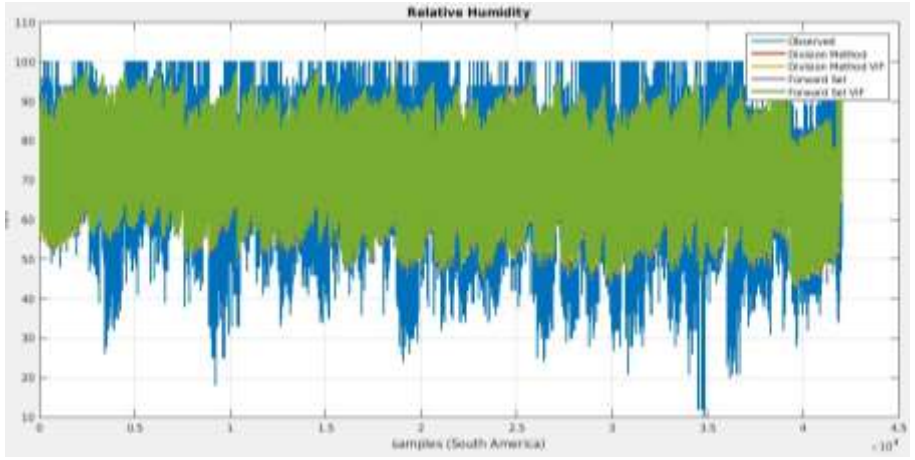
- Estimation of Relative humidity, based on GOES satellite data:

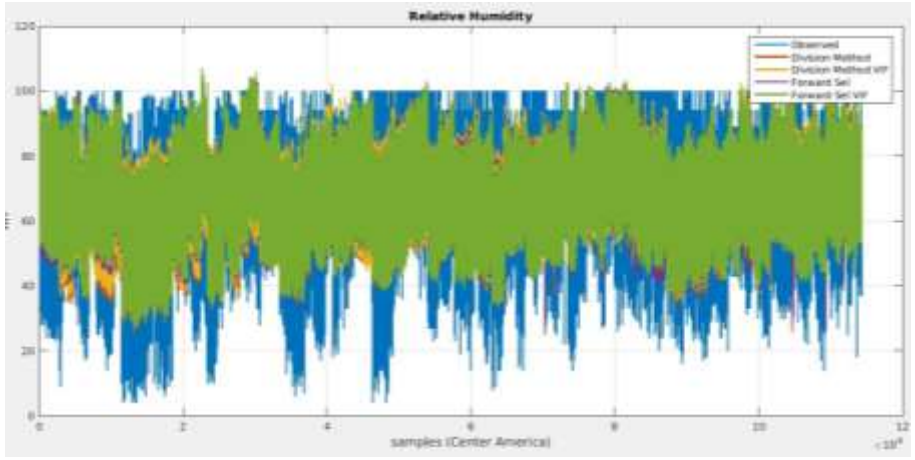
Zone	R2 (Train)
Antillean islands	0.6031
Center America	0.5245
South America	0.4869
North America	0.5664

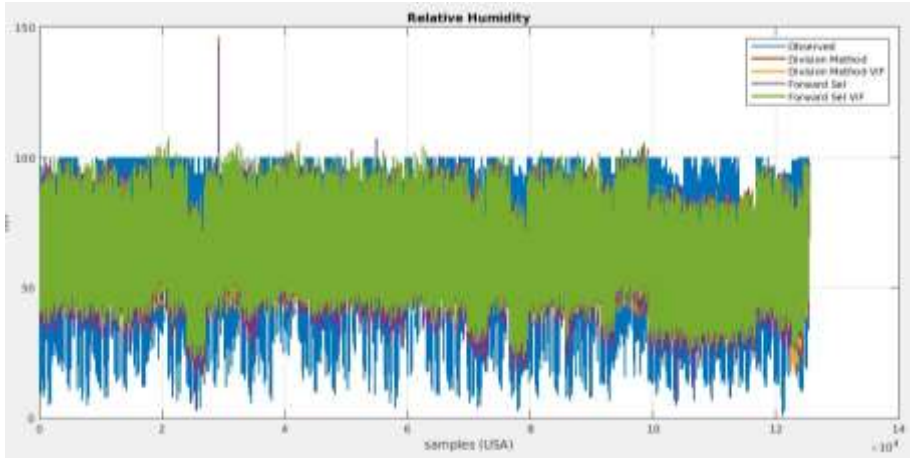
- Model developed based on MODIS terra

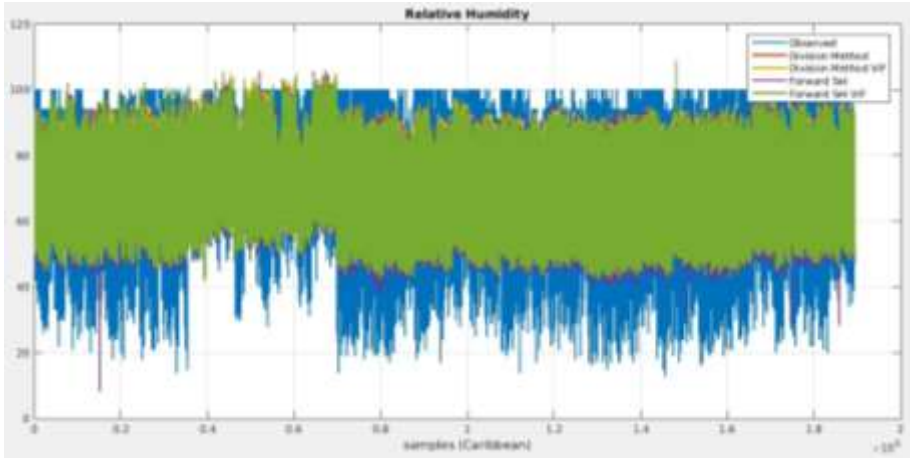
Results

- Estimated vs observed:









Results

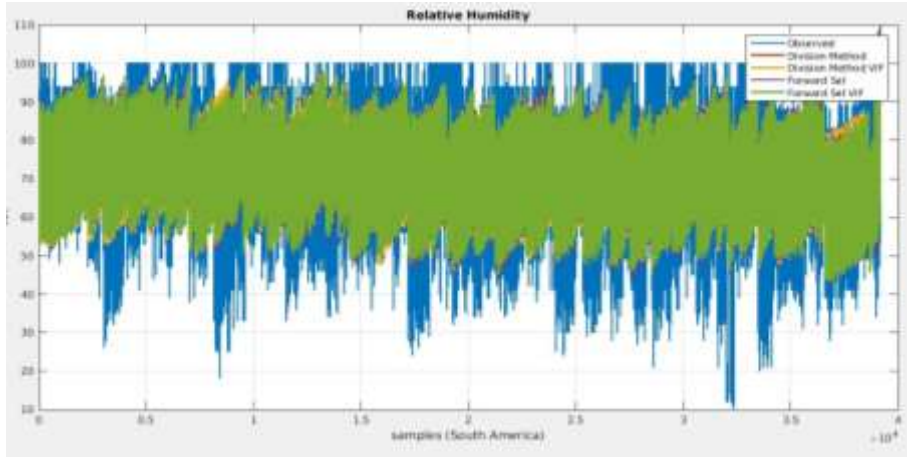
- Estimation of Relative humidity, based on GOES satellite data:

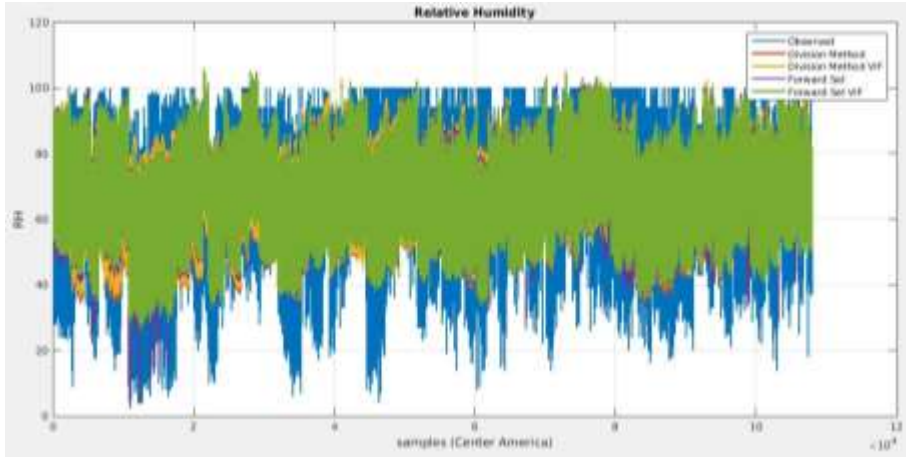
Zone	R2 (Train)
Antillean islands	0.6167
Center America	0.5164
South America	0.4843
North America	0.5733

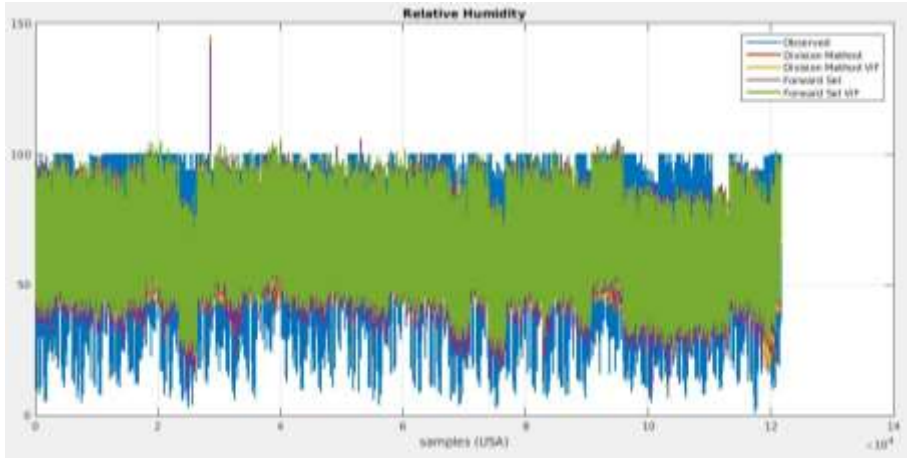
- Model developed based on MODIS aqua

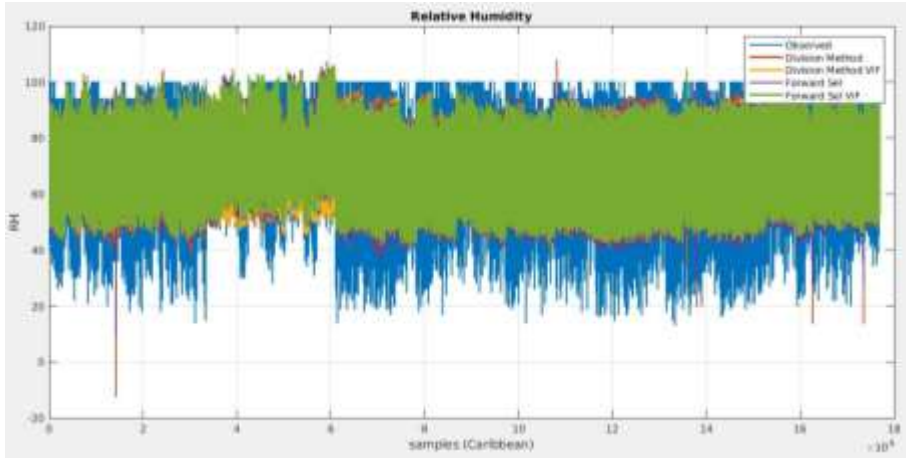
Results

- Estimated vs observed:

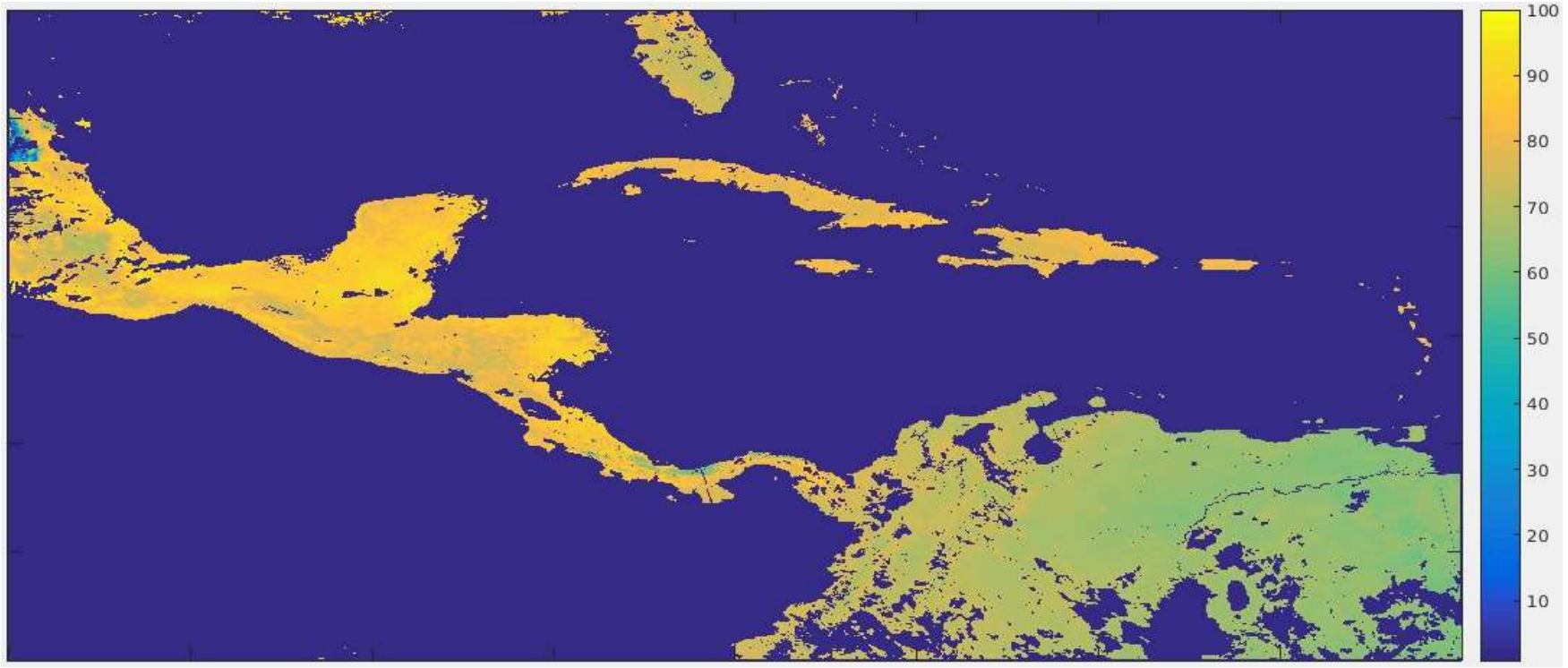








Estimated relative humidity



Modeled RH. Date: January 15 2011 at 18:00 UTC.

Conclusions

- It has been developed a model capable to estimate hourly relative humidity.
- This model is based on remote sensed satellite data.
- The inclusion of the seasonal components helps on the estimation of this product.
- This model can be applied to monitor relative humidity or in different applications.

Future work

- To study alternatives and new products that can contribute on the improvement of the estimation of relative humidity.
- To increase the number of months used to train the different models developed, include 1 year as the training period.
- To include a validation dataset, it will be a different period of time exclusively used to test the model.

References

- Han, K.S., Viau, A.A., Kim, Y.S. and Roujean, J.L. (2005). Statistical estimate of the hourly near-surface air humidity in eastern Canada in merging NOAA/AVHRR and GOES/IMAGER observations. *International Journal of Remote Sensing Vol. 26, No. 21*, 4763–4784.
- Peng Guangxiong, Li Jing, Chen Yunhao, Norizan Abdul P and Tay Liphong. (2006). High-resolution Surface Relative Humidity Computation Using MODIS Image in Peninsular Malaysia. *Chinese Geographical Science 16(3)*, 260–264.