SUPPLEMENTARY MATERIAL

Atmospheric corrections methods

Two sets of L-8 OLI images at Ciudad Bolivar station (path/row: 1/54) were downloaded from the USGS Earth Explorer (see http://earthexplorer.usgs.gov). The first set of images are Level 1T processed, meaning that they have been processed with geometric correction and terrain calibration, however, no atmospheric correction has been applied. When performing the atmospheric correction, the uncalibrated digital numbers (DN) from Level T1 scenes for each band of OLI was first converted to dimensionless top-of-atmosphere (TOA) radiances and reflectance values using the following equations:

$$L_\lambda = M_l Q_{cal} + A_l \quad (1)$$

where:

- L_λ is spectral radiance
- M_l is band specific multiplicative rescaling factor
- Q_{cal} is the quantized and calibrated standard product pixel values (*DN*).
- A_l is band specific additive rescaling factor

$$\rho_{TOA} = M_\rho Q_{cal} + A_\rho \quad (2)$$

where:

ρ_{TOA} is the planetary reflectance

M_ρ is the band specific multiplicative rescaling factor

A_ρ is the band specific additive rescaling factor.

Once the TOA reflectance was corrected by the sun angle, the atmospheric correction was carried out using the dark object subtraction (DOS) method. DOS is based on the assumption that, within the image, some pixels are in complete shadow and their radiances received by the satellite are due to the path radiance (Chavez, 1988, 1996). The path radiance L_p was provided by Sobrino *et al*. (2004):

$$L_p = L_{min} - L_{DO1\%} \quad (3)$$

where L_{min} is "the radiance that corresponds to a digital count value for which the sum of all the pixels with digital counts lower or equal to this value is equal to the 0.01% of all the pixels from the image considered" (Sobrino *et al*., 2004), and $L_{DO1\%}$ is the radiance of dark object. The surface reflectance is thus computed using the following Equation (4).

$$\rho = \frac{[\pi \times (L_\lambda - L_p) \times d^2]}{[ESUN_\lambda \times \cos\theta_s]} \quad (4)$$

The second method is FLAASH, which is a first-principle atmospheric correction tool that corrects wavelengths in the visible through near-infrared and shortwave infrared regions, up to 3 µm. We can choose any of the standard MODTRAN model atmospheres and aerosol types to represent the scene; a unique MODTRAN solution is computed for each image (Adler-Golden *et al*., 1999).

For images that do not contain bands in the appropriate wavelength positions to support water retrieval (for example, Landsat or SPOT), the column water vapor amount is determined by the user-selected atmospheric model (Anderson *et al*., 2002).

The third method of atmospheric correction is L8SR – it was evaluated using the second set of images. The L8SRs were ordered through the Earth Explorer on-demand service. These products directly provide the atmospherically-corrected land surface reflectance data through a series of processing, which ensures the comparability of satellite imagery data across different acquisition dates. In addition, a new cloud mask is also produced for each Landsat imagery data using the CFMask algorithm (Zhu *et al*., 2015). This cloud mask can help users to identify whether a pixel is cloud, cloud shadow, snow, or water, and thus useful for selecting good quality data for further analysis (USGS, 2015).

References

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Tables

Table SM1. L-8/OLI bands for each atmospheric correction model and the “reference reflectance” from the *in situ* spectral profile August-2014 using a field spectroradiometer.

L-8 OLI	Band	Wavelength (nm)	Obs. Value (sr^{-1})	P. DOS (sr^{-1})	P. FLAASH (sr^{-1})	P. L8SR (sr^{-1})
Coastal	1	443	0.038	0.018	0.085	0.031
Blue	2	482.6	0.044	0.025	0.070	0.039
Green	3	561.3	0.068	0.045	0.081	0.065
Red	4	654.6	**0.080**	0.063	0.090	**0.080**
NIR	5	864.6	**0.032**	0.025	0.033	**0.030**
ROOT-MEAN-SQUARE DEVIATION				**RMSE DOS**	**RMSE FLAASH**	**RMSE L8SR**
VALUE				0.0179	0.0251	0.0040

Table SM 2. Validation using the SSC-derived model during the year 2016

Site /sample - CB station (8°11'28.06"N / 63°24'28.12"W)	Observed SSC Date	Observed SSC ($mg \cdot l^{-1}$)	Estimated SSC date	Estimated SSC ($mg \cdot l^{-1}$)	days apart	Residual SSC ($mg \cdot l^{-1}$)
HYBAM Dataset - 2016						
1	01/09/2016	**71.88**	01/06/2016	**59.13**	3	**12.75**
2	01/16/2016	**53.62**	01/13/2016	**49.21**	3	**4.41**
3	02/10/2016	**20.10**	02/07/2016	**33.01**	3	**-12.91**
4	03/10/2016	**21.14**	03/10/2016	**36.37**	0	**-15.23**
5	04/23/2016	**103.36**	04/27/2016	**101.23**	4	**2.13**
6	05/07/2016	**212.96**	05/04/2016	**205.97**	3	**6.99**
7	07/23/2016	**65.02**	07/23/2016	**66.67**	0	**-1.65**
8	08/11/2016	**51.02**	08/08/2016	**53.71**	3	**-2.69**
9	09/10/2016	**45.34**	09/09/2016	**51.32**	1	**-5.98**
10	09/25/2016	**70.40**	09/25/2016	**80.23**	0	**-9.83**
11	10/11/2016	**102.82**	10/11/2016	**100.47**	0	**2.35**
12	10/29/2016	**38.40**	10/27/2016	**58.81**	2	**-20.41**
13	11/10/2016	**117.80**	11/12/2016	**83.12**	2	**34.68**
14	11/27/2016	**108.22**	11/28/2016	**102.34**	1	**5.88**
15	12/10/2016	**115.54**	12/07/2016	**110.83**	3	**4.71**
Mean		**79.84**		**79.49**		**0.35**
Min		**20.10**		**33.01**		**-20.41**
Max		**212.96**		**205.97**		**34.68**
SD		**49.38**		**42.95**		**13.25**