**BROSS User Manual- SASWE App**

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1. **Introduction**

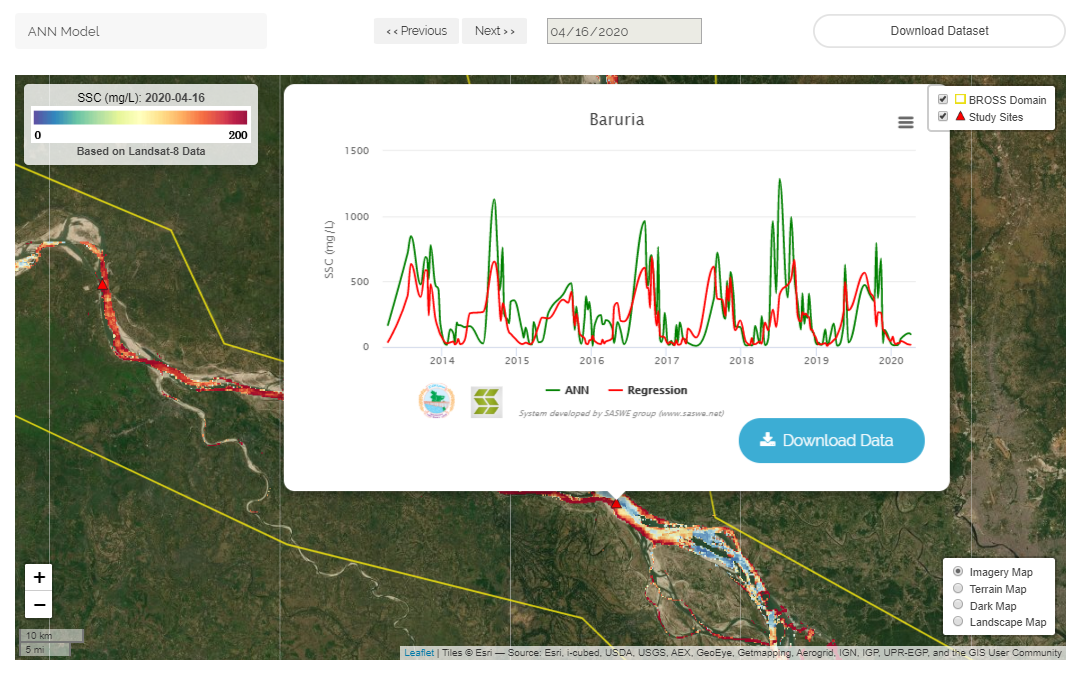
BROSS (“Bangladesh Remote Sensing of Suspended Sediments”) is a tool developed for the Bangladesh Water Development Board (BWDB) by the University of Washington SASWE Research Group. BROSS provides spatially and temporally distributed suspended sediment concentration (SSC) predictions for the Brahmaputra-Jamuna, Ganges-Padma, and Padma rivers of Bangladesh (Figure 1). BROSS uses satellite remote sensing imagery in the visible (red, green, blue) and near-infrared (NIR) spectra as inputs to models calibrated to Bangladesh rivers. It is intended that BROSS will help BWDB with river sediment monitoring and management.

This manual provides instructions for operating BROSS in the standard SASWE system format. Detailed technical background on the model calibration is found in the technical manual at [INSERT LINK].



**Figure 1: BROSS (SASWE tool) domain**

This manual is for the BROSS system implemented in the standard SASWE monitoring system. This system provides two data output options: (1) SSC estimated from Landsat 8 satellite data using a regression model; and (2) SSC estimated from Landsat 8 satellite data using an artificial neural network (ANN) model. Each of these outputs are provided in two forms (Figure 2): (1) a time series of SSC estimates at four in situ monitoring stations (Bahadurabad, Hardinge Bridge, Baruria, and Mawa) since 2013; and (2) SSC mapped over the BROSS domain (Figure 1) for the past 6 months. Both the SSC time series and map data can be downloaded.



**Figure 2: Example output of BROSS in SASWE system**- A map of SSC from and ANN model along the Padma river and a time series of SSC predicted from satellite data at Baruria

In addition to the SASWE tool, there is a system implemented in Google Earth Engine (GEE) which displays the SSC predictions from regression as well as satellite reflectance data. This GEE tool has an accompanying notebook to generate SSC time series from ANN. Table 1 summarizes the difference capabilities of the three tools. The GEE tool is found at <https://cbev.users.earthengine.app/view/bwdb-ssc-prototype> and its manual is found at [INSERT LINK].

**Table 1: Comparison of BROSS tools- GEE and SASWE standard monitoring systems**

1. **Operational steps**
2. **Start application.** In a web browser, navigate to the BROSS SASWE system website: <http://depts.washington.edu/saswe/bross/>
3. By default, the initial SSC map that will appear is developed from the most recent Landsat 8 data using the regression model
4. **Optional Steps**. Note that these steps can be conducted in any order
   * **Click on a “Study site” symbol (red triangle) to view the full time series of SSC predicted from Landsat 8 and the regression and ANN models at that location.**
     + To obtain the data as comma separated values, click on “Download data” at the bottom right corner of the time series box. Copy and paste the values into an Excel sheet or text editor.
   * **Click a pixel of mapped to get the value at that point.**
   * **Export the map as a .tif file by clicking on the “Download Dataset” button on the top right hand corner of the application window.**
   * **View SSC map from a different model (Regression or ANN) by clicking on the “Regression Model” or “ANN Model” dropdown menu at the top left corner of the application window, and selecting the desired model.** 
     + Note that it may take several seconds for the new map to load. Be patient during this time and minimize interaction with the application.
     + Table 2 summarizes the difference in performance between the regression and ANN models for Landsat 8. More information about each metric is included in the technical manual (link is in Section 1)

**Table 2: Statistical Tests for Model Performance of SSC Predictions for Landsat 8 (ANN vs Regression).** Stronger results for each satellite group and indicator is in **bold.**



* + **View data from a different date over the past 6 months by clicking the “<<Previous” or “Next >>” button at the top center of the application screen.**
    - Only 1st and 16th date of each month is available in the application. This is because Landsat 8 collects data every 16 days. Since there are multiple satellite images collected across the domain, we grouped the data by the 1st and 16th date for convenience.
    - Only data over the past 6 months is available.
    - Note that it may take several seconds for the new map to load. Be patient during this time and minimize interaction with the application.

1. **Troubleshooting**
2. **The computation is taking too long or is timing out.** This is a challenge with working with such a large study domain, high resolution, and extensive computations. Please be patient when operating the system. After making one change, wait for the map to finish loading before going to the next change (a change, for example, would be changing the data or model, or zooming in/out of the map). If the system is persistently crashing and/or persistently taking several minutes for a single change to occur, please contact the system administrator.
3. **Why do there appear to be “stripes” in the images?** Unfortunately, this is a known issue with Landsat data. Please see the following link for more information: <https://www.usgs.gov/land-resources/nli/landsat/detector-striping?qt-science_support_page_related_con=0#qt-science_support_page_related_con>
4. **Frequently Asked Questions (FAQ)**
5. **How do I cite this tool?** Click the “How to Cite” button at the top right of the application window for more information.