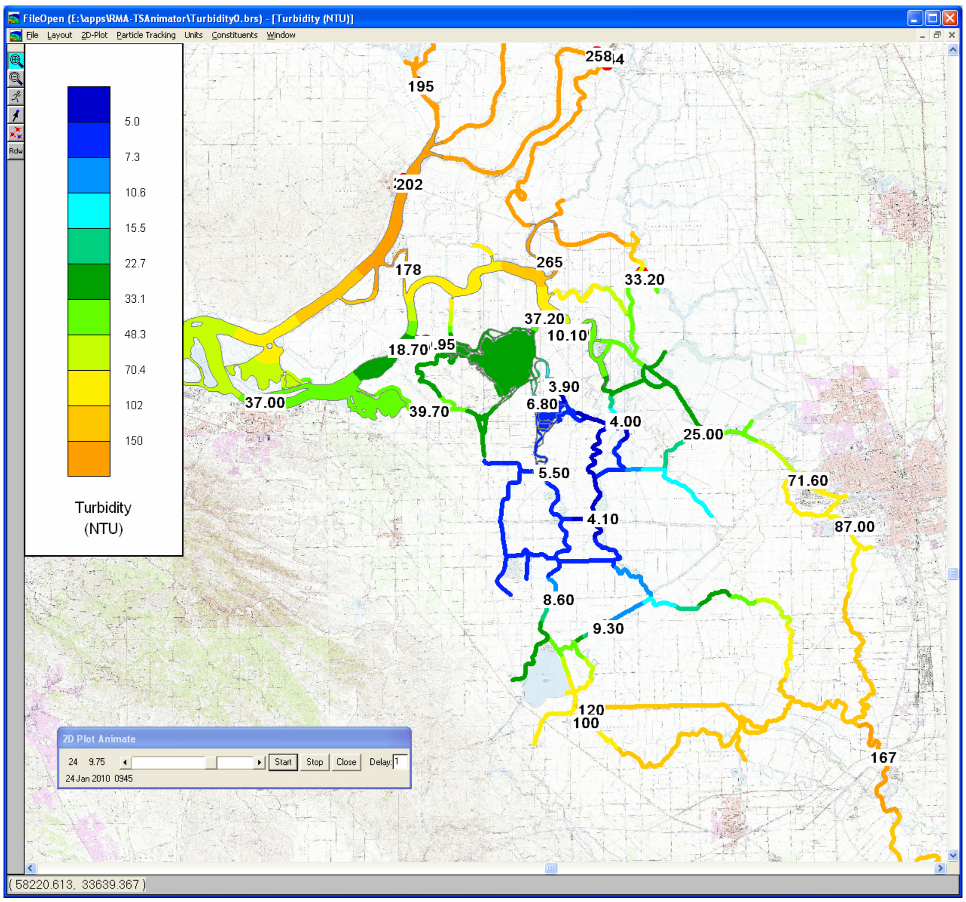
Spatial Animation of Observed Turbidity Time Series for the Sacramento-San Joaquin Delta

Software Quick Start Guide



Resource Management Associates, Inc.

February 26, 2010

Introduction

Resource Management Associates (RMA) has developed a method of generating spatial contours of point time series data based on interpolation over an RMA finite element model geometry. The first application of this capability has been to display the observed turbidity data in the Delta for January and February 2010.

The spatial interpolation methodology leads to an approximately linear variation between observed stations. The accuracy of the spatial distribution depends both on the quality of the point data, and the density of the observation stations. The observed turbidity data received only limited QA/QC and missing data was filled with simple linear fills. THE COLOR CONTOURS MAY NOT PROVIDE A GOOD REPRESENTATION OF THE TURBIDITY DISTRIBUTION IN ALL AREAS!

Turbidity monitoring stations used to generate the spatial interpolation include the following.

Antioch
Cache Slough at Ryer Island
Dutch Slough
False River
Sacramento River at Freeport
Sacramento River at Hood
Sacramento River Blw Georgiana Slough
Sacramento River at Rio Vista (U)
Sacramento River at Rio Vista
Sacramento River at Decker Island*
Georgiana Slough at Sacramento River
Grant Line Canal
Holland Cut
Little Potato Slough
Mallard Island
Martinez
Middle River at Holt
Middle River at Middle
Miner Slough
Mokelumne River at San Joaquin River
Old River at Bacon Island
Old River at DMC
Old River at Ft Term
Old River at Hwy 4
Old River Quimby Island
San Joaquin River at Jersey Point
San Joaquin River at Prisoners Point
San Joaquin River at Rough and Ready Is
San Joaquin River at Garwood
San Joaquin River at Mossdale
San Joaquin River at Mccune
ThreeMile Slough
Turner Cut
Victoria Canal

*Data for Sacramento River at Decker Island is only available starting from January 20th, 2010.

This application works only on MS Windows XP/Vista/7 operating systems.

Downloading the Software and Data

The viewer software and turbidity result file is available for download from the following link.

http://www.rmanet.com/RMA-TSAnimator/rma-tsanim-install-2010-02-26.zip

The zip file is approximately 1GB. Download speed from the RMA web site is currently limited to 1.5 Mbits/sec, so the download will take over 1 hour.

Installation

Unzip the installation file into any directory on your computer. The contents of the zip file are as follows.

RMAPLT.exe	Viewer Application
Turbidity_Jan+Feb2010.brs.plt	Workspace File to view interpolated turbidity
delta0_TRIMMED.geo	Binary finite element geometry for the Delta
Turbidity_Jan+Feb2010.brs.brs	Turbidity results
d1b-stations.bmp	Delta background map
d1b-stations.doqhdr	Geo-referencing information for background map
RMA Spatial Animation for Point Time Series-2010-02-26.pdf	This guide

If desired, you may associate *.plt and *.geo file types with the RMAPLT application within MS Windows Explorer.

Starting the Application

From Windows Explorer select and run RMAPLT. When the application is open use the **File->Open** menu command and select "Turbidity_Jan+Feb2010.brs.plt" from the "**Open Workspace or Geometry File**" dialog. If you have associated the *.plt file extension with the RMAPLT program, you can just double click on the "Turbidity_Jan+Feb2010.brs.plt" file. When the workspace file has loaded the Delta geometry will be displayed as shown in Figure 1.

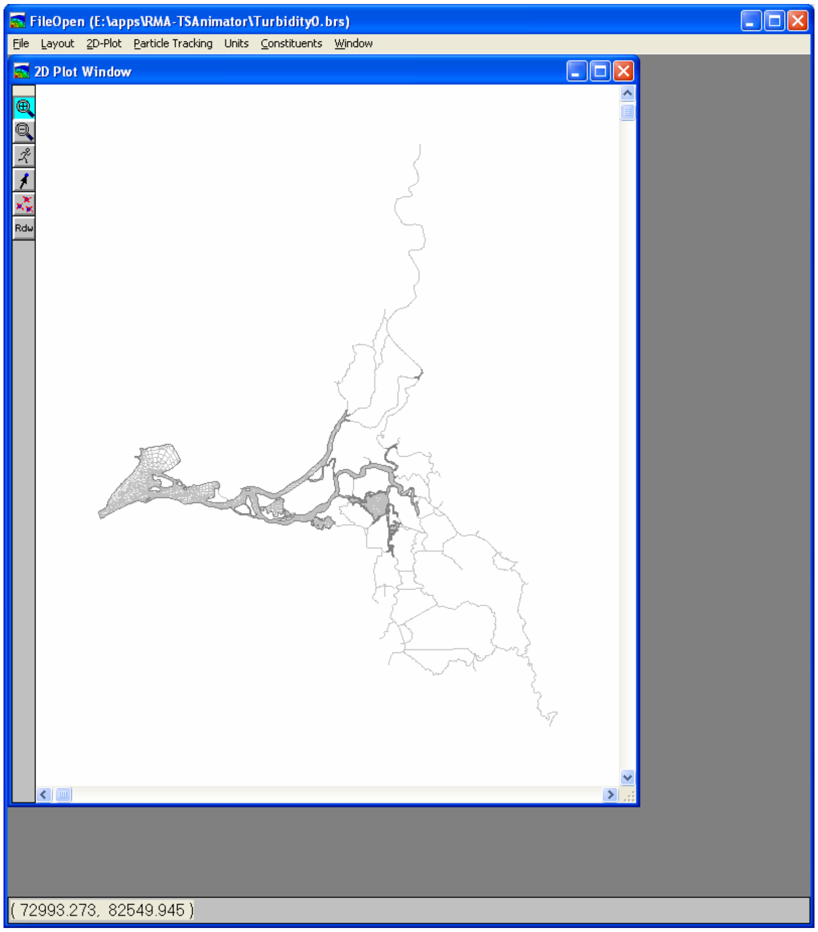


Figure 1. Delta Geometry is displayed after opening the workspace file.

Viewing the Data

Using Layouts

From the **Layout** menu select one of the pre-defined layouts listed below the menu separator (Figure 2). For example, selecting the layout "**Turbidity with values**" will display turbidity color contours and point values at the monitoring stations as shown in Figure 3. The display will vary with the application window size and aspect ratio. You may want to maximize the application window before selecting the layout.

If you change any viewing characteristics (zoom, contour intervals, etc.) you can use the **Layout->Save** menu command to save the changes to a new or existing layout. You must then use the **File-Save Workspace** menu command to save the changes to disk.

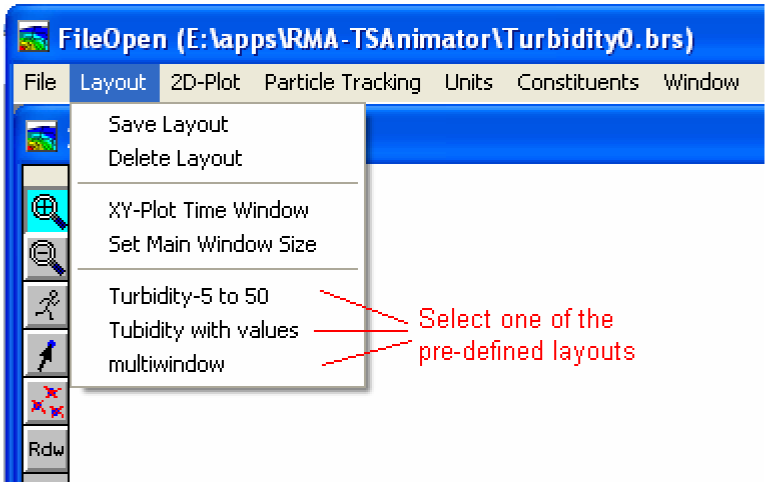


Figure 2. Select a pre-defined layout

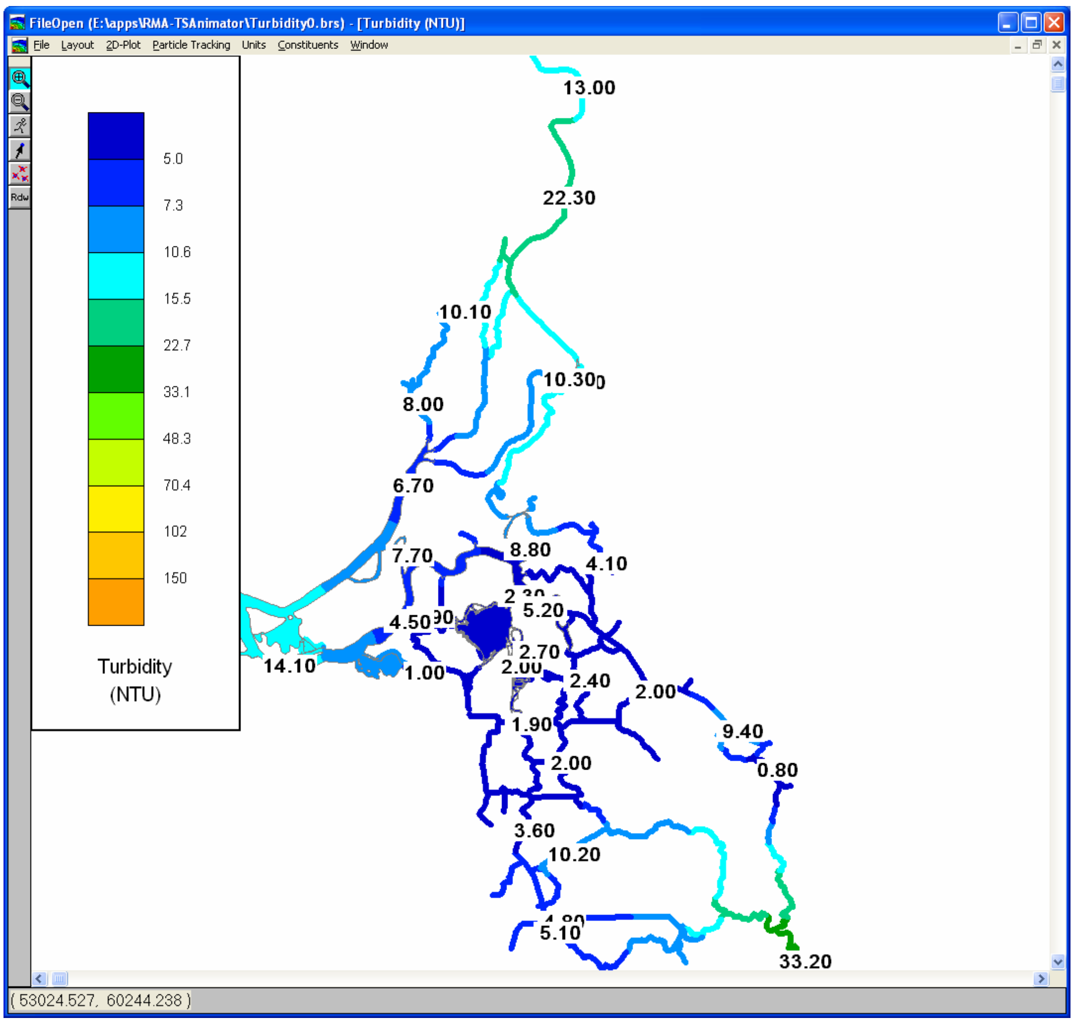


Figure 3. Display after selecting the layout “**Turbidity with values**”.

Displaying a Background Map

Use the **2D-Plot->Select DOQs** menu command select the "db1-stations.doqhdr" for display in the map window. In the selector dialog, highlight "db1-stations.doqhdr" and click on the **Add->** button, then click on the **OK** button. It will take a few moments to load the background image. Once the image is loaded, the map will refresh and display the image (Figure 4).

The background map display can be quickly turned on and off using the **2D-Plot->Show DOQs** menu command.

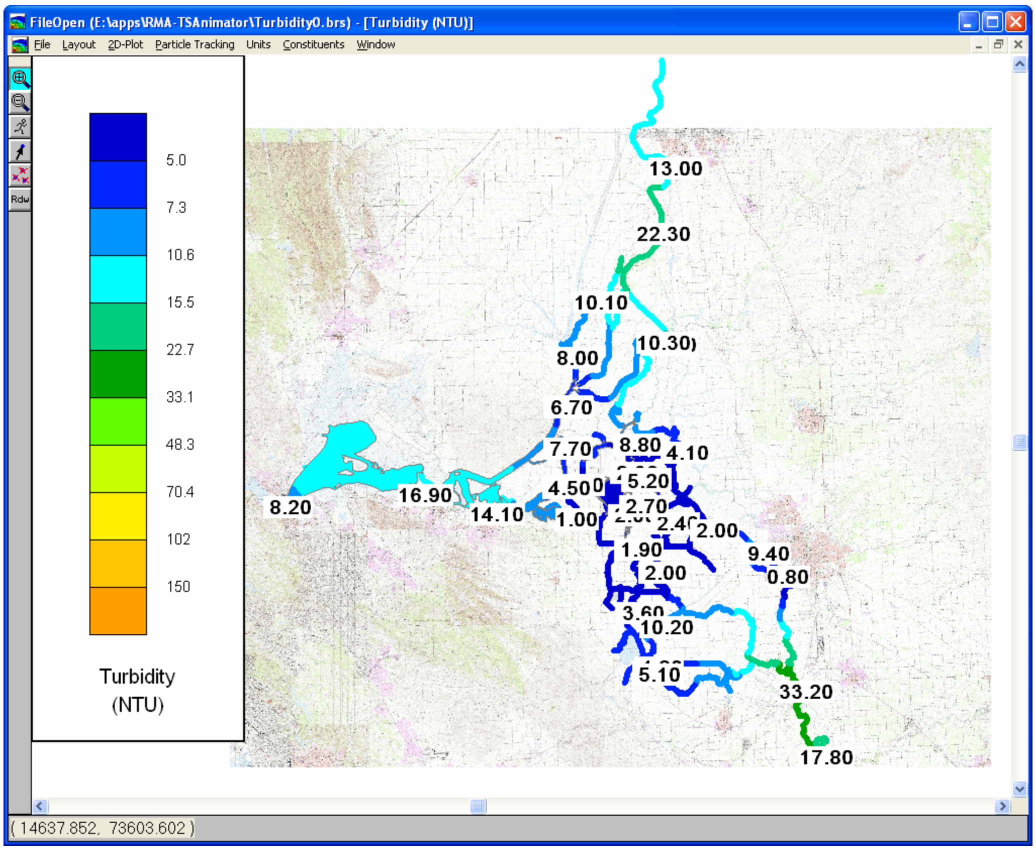
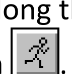


Figure 4. Map with background image.

Animation

On the map tool bar located along the left edge of the map window, click on the "running man" tool bar button . This will display the **2D Plot Animate** window. You may animate the display by clicking the Start button or by dragging the animation slider control (Figure 5). Increasing the delay factor will slow the animation rate.

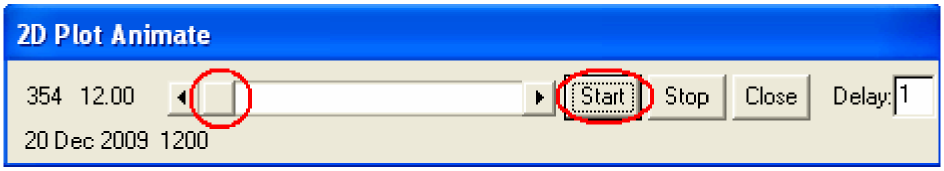
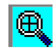


Figure 5. Animation Control.

Zoom and Pan

To zoom into a region of the map, select the zoom-in tool  on the map tool bar. Hold down the left mouse button and drag a rectangle over the area of interest. Complete the zoom action by right clicking.

To zoom out, click the zoom-out tool  in on the map tool bar.

Pan the view by dragging the scroll bars on the right and bottom edges of the map.

Controlling Color Contours

The **2D-Plot->Contour Plot Options** menu command displays the **Contour Settings** dialog (Figure 6). This dialog provides access to the min/max contour range and other parameters that control the contour drawing. If you make changes to the contour drawing options, you can save and retrieve the settings as part of layout.

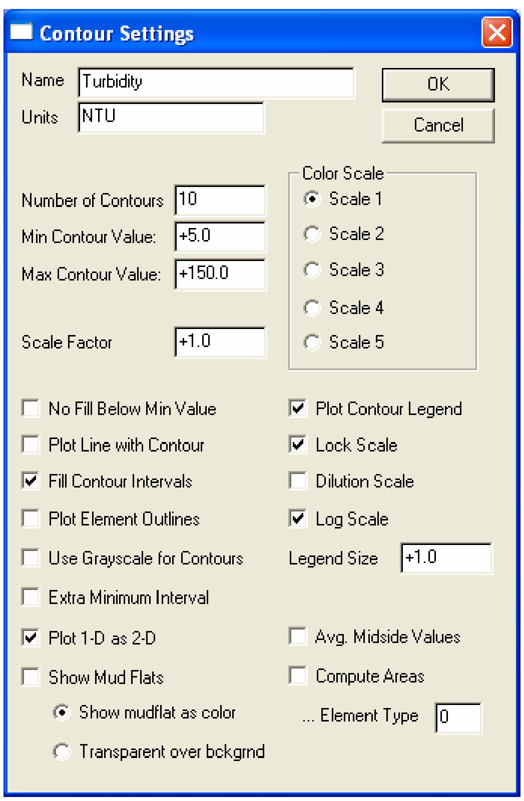


Figure 6. Contour Settings Dialog.

Color contour drawing is quickly turned on and off using the **2D-Plot->Contour Plot** menu command.

Displaying Point Values

Point values can be displayed at selected "Profile Nodes" (this type of selection is also used for the separate purpose of plotting concentration profiles). First, zoom into the region where you would like to see point values displayed. The **2D-Plot->Select Profile Nodes** menu command puts the map into a special mode that allows selection of "Profile Nodes" (Figure 7). Nodes are displayed as red dots. Left click on a node to select/deselect that location. Selected nodes are shown in blue. Holding down the Ctrl key while clicking will clear all previously selected nodes.

Point value drawing is quickly turned on and off using the **2D-Plot->Plot Value** menu command.

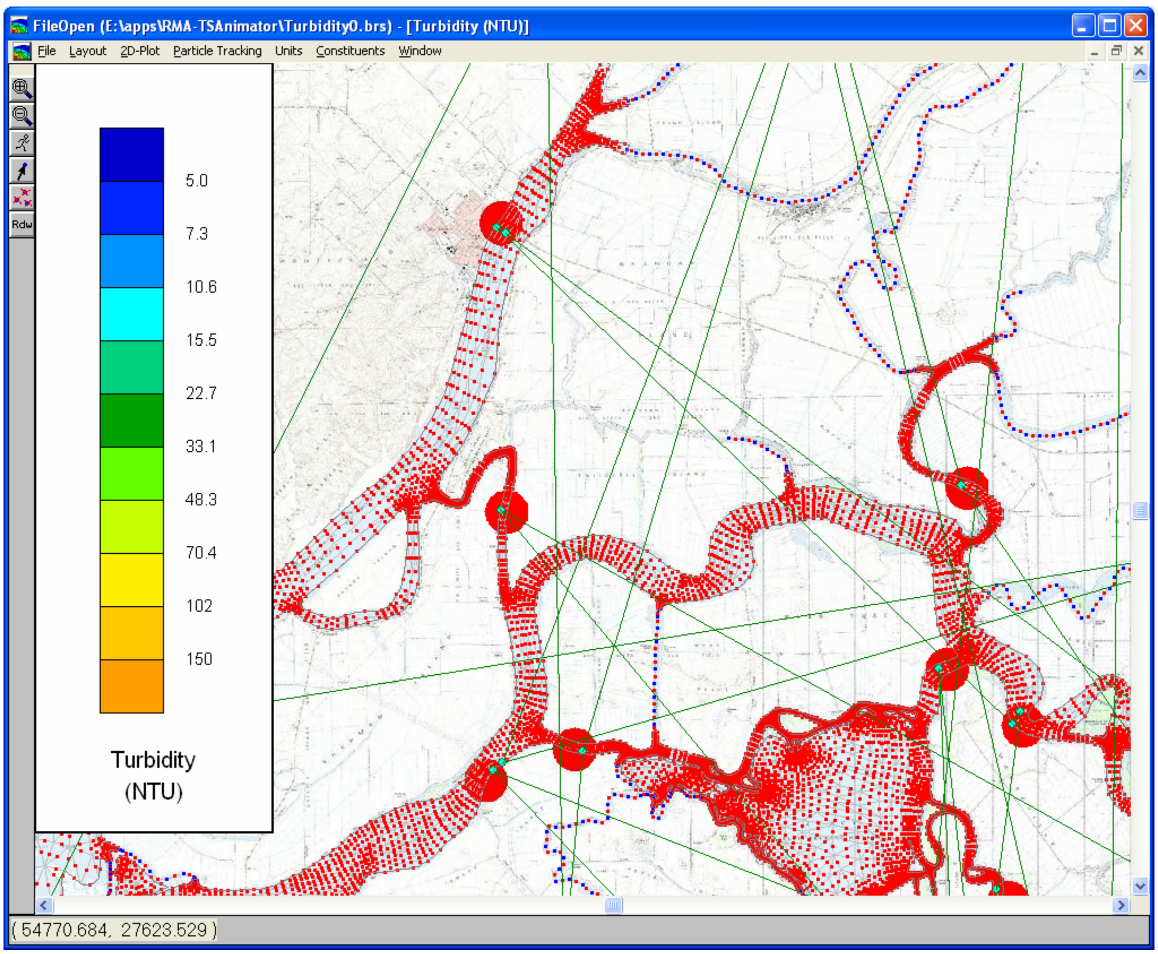


Figure 7. Select Profile Node mode (**2D-Plot->Plot Value** is off)**.**

Other Viewing Options

Other capabilities of the RMAPLT viewer are described in the RMAPLT Users Manual.

Spatial Interpolation

The spatial interpolation is performed by linear super-position of point values multiplied by spatial weighting functions. Point values are collected at monitoring stations with a fixed location. Each monitoring station is associated with exactly one node in the finite element model network.

A sequence of weight functions ϕ_i, $i = 1, \ldots, m$ is constructed such that

- $0 \leq \phi_i(x) \leq 1$ for all nodes x on the grid.
- $\phi_i = 1$ at station i .
- $\phi_i = 0$ at stations different from i .
- $\sum_{i=1}^{m} \phi_i(x) = 1$ at any node x .
- m is the number of monitoring stations.

Given the complicated geometry of the delta, the best approach to produce the weight functions is to solve the Laplace equation with Neumann boundary conditions

$$\frac{d^2\phi_i}{dx^2} + \frac{d^2\phi_i}{dy^2} = 0$$

$$\phi_i = 1 \text{ at station } i$$

$$\phi_i = 0 \text{ at every station } \neq i$$

$$\frac{d\phi_i}{dn} = 0 \text{ at boundaries}$$

Once the weight functions have been computed, the value at a given node of the grid is given by

$$E(x) = \sum_{i=1}^{m} E_i \phi_i(x).$$

Where E_i is the point values observed at the station location associated with weighting function Φ_i.

Contact Info

John DeGeorge, Ph.D.
Resource Management Associates, Inc
4171 Suisun Valley Road, Suite J
Fairfield, CA 94534
(707) 864-2950
jfdegeorge@rmanet.com
www.rmanet.com