Visualization of Spatial and Temporal Pollution Exposure through Temporal Ordered Spacial Matrices

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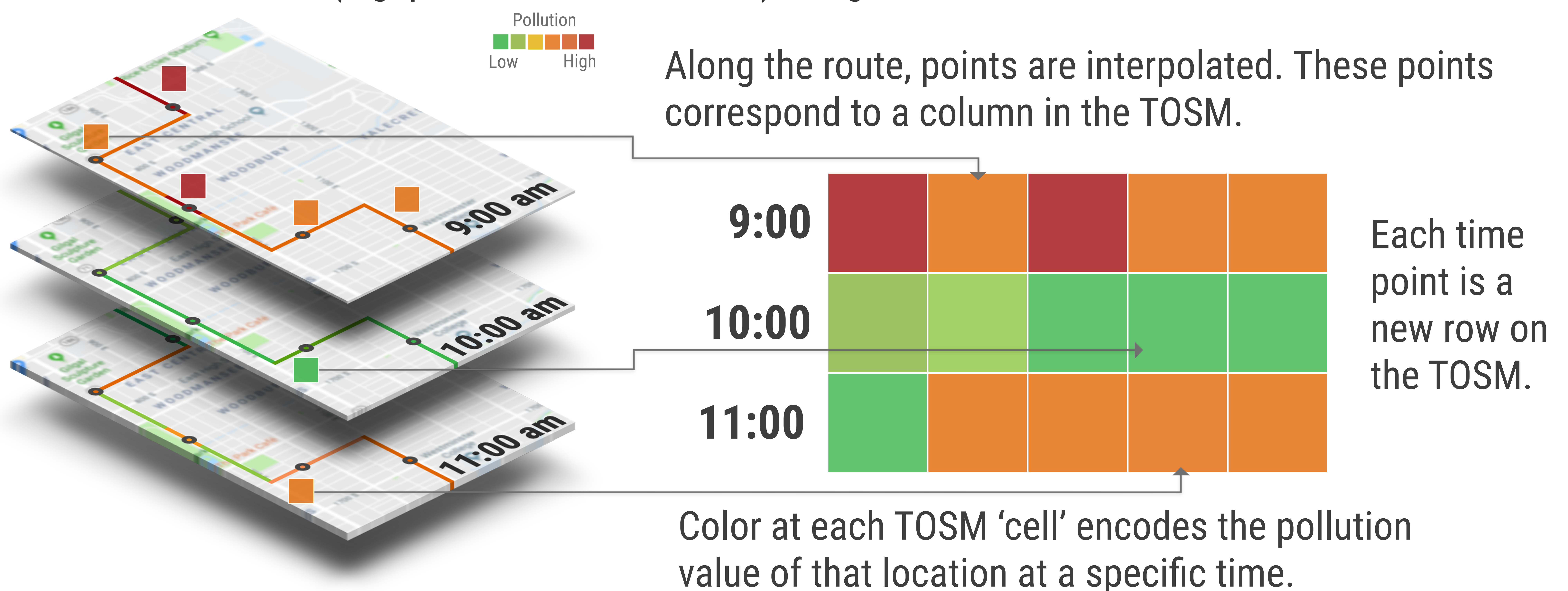**Pascal Goffin, Ph.D.** School of Comuting, Scientific Computing Institute, University of Utah

Introduction

Air pollution exhibits **strong spatial and temporal patterns** [1]. We constructed a visualization tool to help sensitive individuals **identify and circumnavigate hotspots** in pollution. This visualization uses a Temporal Ordered Spatial Matrix (**TOSM**) [2] to display pollution trends along a path and a layout similar to OceanPaths [3]. To improve the TOSM's usefulness, we implemented **interactions** and **a coordinated view** to enhance understanding and enable path comparison.

## Temporal Ordered Spatial Matricies

A TOSM is a visualization that allows for the encoding of time and space using position and an attribute of interest (e.g. pollution concentration) using color. This forms a sheet of rows and columns.

Along the route, points are interpolated. These points correspond to a column in the TOSM.

Each time point is a new row on the TOSM.

Color at each TOSM 'cell' encodes the pollution value of that location at a specific time.

Techniques to Improve TOSM Use

Selective Highlighting helps to highlight what data is currently displayed on the map.

A Coordinated View displays interpolated pollution values across multiple routes.
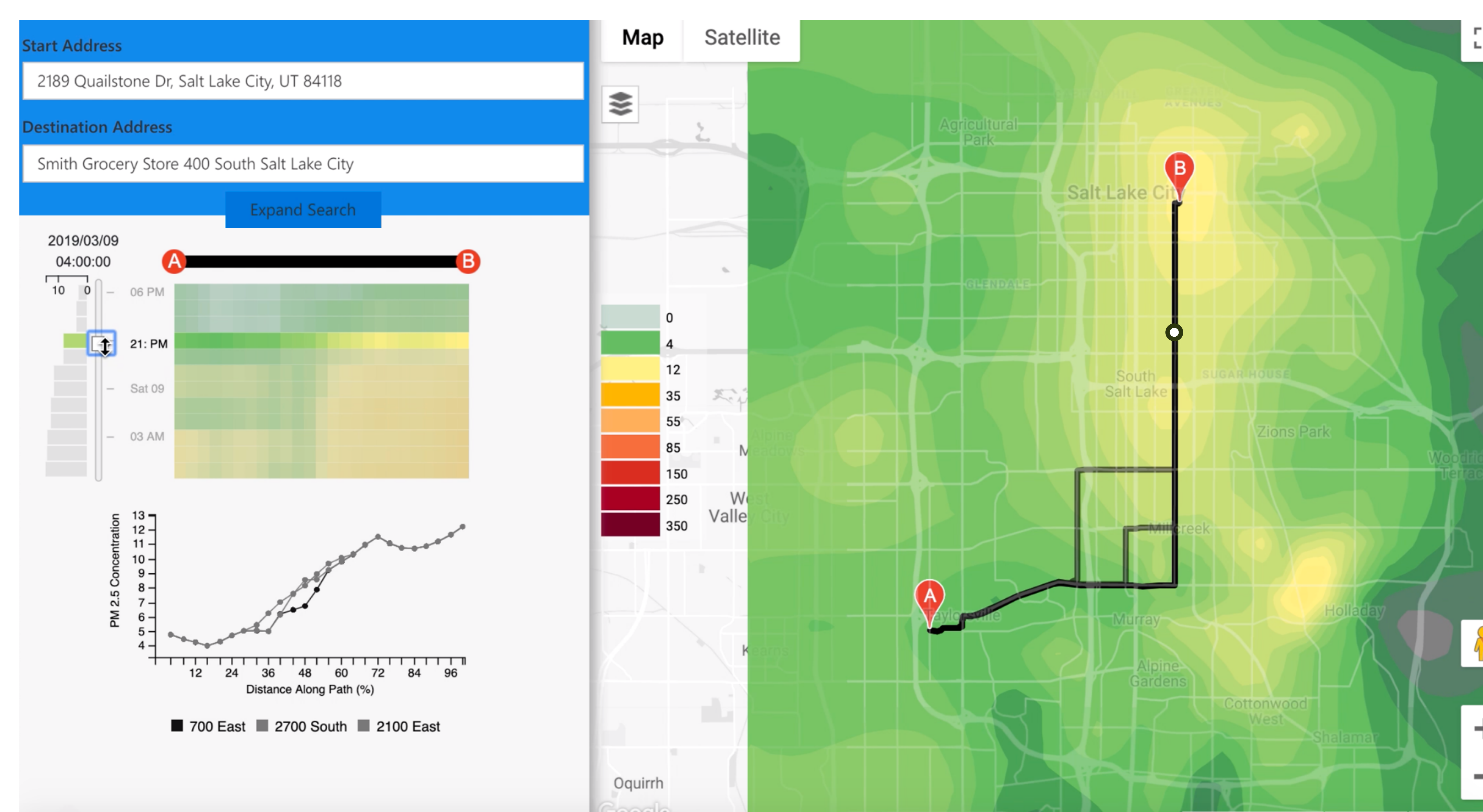
A Path Highlight is used to show where on the map a TOSM cell corresponds to.

Future work will involve a formal study of how these interaction techniques improve TOSM's ability to convey both spatial and temporal trends in data.

[1] S. Steinle, S. Reis, and C. E. Sabel. The Science of the Total Environment. 2013.
[2] MJ Kraak, D.E. Vlag. Understanding Spatiotemporal Patterns: Visual Ordering of Space and Time. 2007.
[3] C. Nobre, A. Lex. OceanPaths: Visualizing Multivariate Oceanography Data. 2015.