



Trend Maps

Temporal trend maps are used to evaluate temporal trends across an area of interest. The simplest way to map temporal trends is to calculate the temporal trend at individual wells using traditional statistical methods, such as Theil-Sen or linear regression. For each well, the numerical value of the slope of the temporal trend is plotted next to the well symbol on the map. The symbol representing the well can be colored or symbolic, based on the trend direction (increasing, decreasing, or indeterminate) and magnitude.

Understanding the Results [▼Read more](#)

Any of the simple, more complex, or advanced geospatial methods can be used to interpolate the trend estimates in order to generate a map (such as a contour map) showing trends across the area of interest—even in places with no wells. If there are few wells with trends available, advanced methods such as kriging may give better interpolation results than simple methods. The approach used to krig the trends is similar to the approach used to interpolate other quantities.

A more sophisticated approach would be to perform spatial-temporal interpolation, in which the interpolation is performed in space and time simultaneously based on all of the concentration data at all wells. This approach can use either more complex methods or advanced methods. As described in the optimization of groundwater monitoring [case study](#), GWSDAT can be used to perform this interpolation using local regression. The results are a series of grids with interpolated concentrations at different times. These grids can be mapped directly and the series of maps evaluated side-by-side to determine trends qualitatively. Alternatively, the concentration grid for each time can be subtracted from the grid from the previous time in order to generate a grid of concentration changes. These changes can be mapped directly, or the changes can be divided by the time period (ratio of the difference in concentration to the difference in time) in order to calculate and map the temporal trend rate.

Simple geospatial methods can be used to interpolate the slopes of regression trends evaluated for individual monitoring wells.

Trend maps provide a way to visualize trends across the entire data set and to find patterns in the data indicating broader areas with increasing, decreasing, or stable concentrations. Trend maps can help to optimize future plume delineation, remediation efforts, or monitoring to focus on areas with increasing trends. Finally, certain regulatory programs have closure criteria specifying that wells have stable or decreasing trends, and trend maps can be used as a line of evidence to document that these conditions have been met.