

## Interpolating nitrogen dioxide levels from ambient pollution monitoring data for the USA

### **Scenario:**

The health impact of nitrogen dioxide, associated with car emissions and burning of fossil fuels, is of increasing concern in the USA. Exposure to high levels of nitrogen dioxide has been associated with a loss of lung function with asthma sufferers and the elderly being particularly at risk. The federal government wishes to estimate the changing risks of respiratory disease resulting from nitrogen dioxide in populated places. Data from the Aerometric Information Retrieval System (AIRS) Monitoring Sites have been made available to the federal government for the U.S. & the Virgin Islands.

As a GIS analyst, you are required to produce a digital map of annual trends in nitrogen dioxide levels for the mainland USA using this data set. Aside from the production of the map itself, you are required to brief your colleagues on any methodological shortcomings that may affect the resultant data set.

### **Data**

- **Locations of AIRS monitoring sites** are provided with this exercise as a point vector file in Shape file format – the Shape file is named *airs\_pts*. You can find this type of data by visiting the US Environmental Protection Agency (EPA) web site and following the link to 'air quality and deposition':

<http://camddataandmaps.epa.gov/gdm/>

- **yearly trends in nitrogen dioxide**, which are provided as a .dbf table of attributes called **aistrnd.dbf**. Within this table, the field '**monitor**' contains ID numbers for each monitoring station and can be used to link to the shape file of monitoring station locations. The field '**NO29599**' contains the yearly trend in nitrogen dioxide concentrations between 1995 and 1999.

## Task

1. Using an interpolation technique of your choosing, produce a map of yearly trends in nitrogen dioxide (NO<sub>2</sub>) between 1995-1999 for the mainland USA.
2. Comment on any potential weaknesses in the map that you've produced. If possible, suggest ways that the output data set could be improved.

Some hints to assist you in this task are available below:

- You can link the trends data to your shape file by right-clicking on the **airs\_pts**, then choosing *joins and relates*, and then *join...* from the menu. You will need to use the option *join attributes from a table* here. You will need to match up values in the **monitor** field in the **airs\_pts** shape file with the values in the **monitor** field in the **aistrnd.dbf** table
- Note that there are no nitrogen dioxide measurements for some of the monitoring stations and the field 'NO29599' appears blank for these stations. Stations with no nitrogen dioxide records can be removed before interpolating using the 'selection' facility within ArcGIS. To do this, go to the 'selection' menu and choose 'select by attributes'. Since all nitrogen dioxide trends are >-100 units/year, double-clicking on **aistrnd.no29599** under *fields*, then clicking on > and then typing in **-100** into the box at the foot of this screen would select only those stations that have data on nitrogen dioxide trends.
- When you have selected just those monitoring stations that have nitrogen dioxide trend data, you can use the ArcGIS interpolation tools to develop a map of trends. For example, going to the *spatial analyst tools* within the ArcToolBox, choosing *interpolation*, and then selecting *IDW* activates one technique for producing a gridded map layer of nitrogen dioxide trends. The *input point features* are the **airs\_pts** monitoring sites and the *Z value field* (the attribute that will be interpolated) is **aistrnd.no29599**. Note that the technique will only interpolate the selected points (those that have nitrogen dioxide measurements).