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Using GIS to Integrate the NOAA HYSPLIT Model with Surface-based Air Quality Data

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Regional air quality varies considerably through time and space. It is often difficult to model or assess the contributions of atmospheric transport and source emissions to a specific location. General air movement trends are not of sufficient resolution to explain daily and seasonal variation. This project uses GIS to integrate the United State's National Oceanic and Atmospheric Administration (NOAA) HYSPLIT model and surface based air quality data to better understand air quality trends. Air transport patterns were collected using the NOAA HYSPLIT back trajectory model for 2003. These data provided twice daily back trajectories from an Environmental Protection Agency (EPA) monitoring location in Western Pennsylvania, USA. The resulting data sets were used to generate transport frequency surfaces. The United States EPA's Continuous Emissions Monitoring System data was used to produce daily emission intensity surfaces. A case study was conducted using Sulfur Dioxide (SO2) measurements from the EPA monitoring site. Seasonal wind patterns were examined for the case study location and showed a shift from primarily Northwesterly flow during winter months to a more regional recirculating pattern during summer months. Highest local SO2 measurements were found during slow southwesterly flow while lowest levels were recorded during faster northwesterly transport. The case study demonstrated a rapid means of compiling annual wind patterns for specific locations and their integration with air quality data. This method allows for more precise identification of anthropogenic contributors to local air quality degradation.