

**STATE ENVIRONMENTAL HEALTH INDICATORS COLLABORATIVE (SEHC)  
CLIMATE CHANGE INDICATORS**

**Indicator:** Air Quality

**Measure(s):** Annual number of air mass stagnation events  
Annual average monthly events June-August  
Annual average monthly events November-February  
Annual maximum monthly number of events

**MEASURE DESCRIPTION**

| <b>Last updated:</b>            | May 28, 2009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| <b>Measurement units:</b>       | Numbers of events                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Geographic scale:</b>        | Statewide                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Time scale:</b>              | Annual, 1973-2008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Significance/background:</b> | Air mass stagnation events, which increase ozone production and will increase in frequency as weather conditions favorable to heatwaves increase (CCSP 2008), are another important indicator of air quality changes associated with climate variability. The National Climate Data Center, National Oceanic and Atmospheric Administration (NOAA), has proposed Climate Impact Indicators that include an air mass stagnation index (ASI). A stagnation day is defined as one with sea level geostrophic wind less than 8m/sec, 500mb wind less than 13m/sec, and no precipitation (Wang and Angell 1999) and, while not directly related to pollutant emissions, air stagnation days can exacerbate the effects of existing air pollution. |
| <b>Data resources:</b>          | National Climate Data Center: <a href="http://www.ncdc.noaa.gov">http://www.ncdc.noaa.gov</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## **HOW-TO GUIDE: Air Mass Stagnation Events**

**Note:** SEHIC has already obtained air mass stagnation events data for 1973 through 2008 for every state from NOAA. The data are available from SEHIC in an Excel file. The how-to guide illustrates how to calculate air mass stagnation events for a 35 year time period. It is also possible to calculate the number of air mass stagnation events for a one year time period and will be left up to your discretion.

1. Open the Air mass stagnation events Excel file. Select the data for your state and copy and paste it into a new worksheet.
2. Copy the labels from the Air mass stagnation events Excel file. In the new worksheet containing your state data, paste the labels into the row above the first row of data. Columns B through M should be labeled as January through December and Column N as Total. The three columns after column N (the totals column) should be labeled in this order: June-Aug mean, Nov-Feb mean, Mo. max.
3. Copy the formulas from the Air mass stagnation events Excel file into the new columns and verify their accuracy as follows:
  - For the June-Aug mean column, in the first cell insert: `=AVERAGE(G3:I3)`. Your cell references may be different from G3 and I3. Be sure to reference the column letter and row number of the first cells of the August column of data in the Average formula. After you have entered the formula in the first cell of the June-Aug mean column, right click on the cell, copy the formula, highlight the remaining cells in the column and right-click again to paste the formula in those cells.
  - For the Nov-Feb mean column, in the first cell insert: `=AVERAGE(L3,M3,B3,C3)`. Your cell references may be different from these. Be sure to reference the column letter and row number of the first cells of the November, December, January and February columns in the Average formula. After you have entered the formula in the first cell of the Nov-Feb mean column, right click on the cell, copy the formula, highlight the remaining cells in the column and right-click again to paste the formula in those cells. Note that 2008 data only goes through September, so be sure to correct the formula accordingly.
  - For the mo. max column, in the first cell insert: `=MAX(B3:M3)`. Your cell references may be different from these. Be sure to reference the column letter and row number of the first cells of the January through December column in the Average formula. After you have entered the formula in the first cell of the mo. max column, right click on the cell, copy the formula, highlight the remaining cells in the column and right-click again to paste the formula in those cells.
4. The next step is to calculate the total means, standard deviations, and confidence intervals for the new columns created in Step 3.
  - In the first blank cell under each of the new columns of data, enter the formula for calculating the overall average for 1973-2008: `=AVERAGE(N3:N38)`. The N3:N38 is only an example; your cell letters and numbers may be different from this. Note: An annual measure can also be calculated for a single year to allow tracking of trends over time.
  - In the next blank cell under each of the new columns created in Step 4, enter for the formula for calculating the standard deviation of the overall mean: `=STDEV(N3:N38)`. As in the bullet above, your actual cell references may differ from N3:N38.
  - Finally, in the next blank cell enter the formula for calculating confidence intervals: `=CONFIDENCE(0.05,[STDEV],36)`. In this formula, 0.05 refers to the .05 confidence level, [STDEV] should be replaced with the standard deviation calculated in the step above or to the column letter and row number of the cell that contains the standard deviation, and 36 is the

number of years (rows) of data.

- All results should be formatted as number with 2 decimal places
5. When you are finished, be sure to save the Excel file. Enter the total means, standard deviations, and confidence intervals calculated in Step 4 into indicators template.