



# CityZen Science Policy Brief: East Mediterranean

The East Mediterranean region is an air pollution hotspot, located at a cross road of air masses from the surrounding regions that add to locally generated emissions. At the boundaries between the tropics and the mid-latitudes, the region is vulnerable to climate change. The warm and sunny climate of the area favors formation of secondary pollutants, such as ozone, compounding the air pollution problem.

Main local anthropogenic air pollution sources:

- Traffic
- Combustion
- Energy generation

Open fire emissions in the region and from upwind areas degrade air quality and affect the regional energy balance.

The region has a high regional background level of air pollution owing to:

- Local anthropogenic pollutant emissions from the region's megacities (i.e., Istanbul, Athens, Cairo),
- Long range transport from upwind pollution (i.e., anthropogenic emissions from continental regions) or dust sources (i.e., Sahara desert),
- Significant natural emissions originating from within the region (i.e., sea salt, dust, plant emissions),
- Interactions of transported air masses with local/regional emissions.

Over the last one to two decades air quality observations have shown significant improvement in the region. These improvements have been linked to a reduction in primary

emissions owing to changes in transportation fuels and industrial emissions controls. These improvements vary between megacities depending on the efficiency of measures adopted and the timing of implementation. However, future increases in emissions (e.g., owing to economic growth, shipping emissions) could counteract the current trend of improvements.

## Policy Implications

- Regional characteristics should be taken into account when developing air pollution control strategies, considering the influence of natural sources and long-range transport.
- Improvement of air quality in the East Mediterranean will require a coordinated effort among the countries in the region and beyond.
- In addition to national legislation, a regional strategy for air quality and climate change mitigation should be pursued in order to be able to effectively achieve improvements in air quality.





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### Ozone Exceedances

- Ozone exceedances are problematic during the summer.
- At urban center and traffic air quality monitoring sites ozone exceedances occurred during summer and were limited (less than 15% of days).
- At suburban air quality monitoring sites ozone exceedances have been decreasing, however are still problematic 40-50% of days during summer.
- Urban centers have fewer ozone exceedances because of high primary emissions, particularly of NO, that suppress ozone in the city by reacting with and depleting ozone, however, ozone levels are then typically enhanced downwind of the city.

**Future Climate**

- With increasing temperatures, average summer ozone levels are expected to be enhanced by 0.9 ( $\pm 0.1$ ) ppbv per degree increase owing to more natural emissions from plants which are expected to increase by 9% ( $\pm 3\%$ ) per degree.
- In a warmer climate, lesser increases are expected for secondary organic aerosol and nitrate aerosols, while sulfate aerosols are expected to decrease in future summers with warmer temperatures.
- The risk of open fires is also expected to increase in a warmer climate.

### Particulate Matter Exceedances

- Particulate matter exceedances are most common during the winter period, and least common during summer.
- A general decreasing trend in pollution has led to less exceedances of the particulate matter limit.
- At urban air quality monitoring sites exceedances range between 40-70% of days in the region.
- The occurrence of particulate matter exceedances has fallen from 60% of days in a year a decade ago to 40% currently at cities where air pollution reduction measures have been adopted (e.g., Athens); the exceedances at suburban sites occur about half as often.

Significant contributions to particulate matter originate from natural sources of dust (e.g., deserts) that are transported into the region and from within in the region itself. This influence is strongest in the southeast of the Mediterranean basin with a decreasing gradient of influence to the northwest.

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