The Relationship between the Synoptic and Meso-Scale Conditions and the No_x Pollution in the Metropolitan Area of Tel-Aviv, Israel

H. Saaroni (1), B. Ziv (2) and T. Uman (1)

(1) Department of Geography and the Human Environment, Tel Aviv (2) Department of Natural Sciences, The Open University of Israel University, Israel

saaroni@post.tau.ac.il/Fax: +972-3-6406243

The metropolitan area of Tel-Aviv is highly populated and suffers from dense traffic. The NO_x concentration exceeds the value of 500 ppb in $>$20% of the days. The study region is located along the eastern coast of the Mediterranean, subjected to sea-breeze and its induced marine inversion, almost all year-round. The objective of the study is to evaluate the role of the synoptic conditions on NO_x concentration, and their relation to the coastal meso-scale factor. This is done using the 19 synoptic types defined by the semi-objective classification of Alpert et al. (2004).

The data base is 1/2 hourly NO_x measurements, taken from 7 monitoring stations, 4 of them located near main roads, for the years 1998-2004.

Four out of the 19 synoptic types were found to have high potential for NO_x pollution, 2 of them are high pressure types. In contrast to expectations, the partial contribution of high pressure types to the total number of pollution events was found only 35%.

The type having the highest pollution potential is a low pressure trough extending from south, known as the Red Sea Trough. This trough induces easterly, offshore, winds and has a 82% probability for NO_x concentration above 500 ppb. The majority of the types having high pollution potential are associated with offshore flow, no matter whether the synoptic system is anticyclonic or not. These types induce abnormal warm conditions, on the synoptic scale. We argue that the crucial factor for high NO_x concentration in Tel-Aviv is a shallow marine inversion, in the order of 100 meters height, that is formed by the sea-breeze underneath the warm and dry air-mass.

The marine inversion is most permanent in the summer season. However, this season has the lowest potential for air pollution. It is explained by the seasonal synoptic types, all of them induce onshore winds, known as the Etesian winds, which while interacting with the coastline produce a higher marine inversion, in the order of 1,000 meters height. Thus, the pollution is removed both horizontally by the onshore wind and vertically by mixing within the thicker marine boundary layer.