USE OF NEURAL NETWORK TO MODEL THE PBL TEMPERATURE PROFILES

(°) Pelliccioni A., (°) C. Gariazzo, (*) S. Argentini, (*) A. Viola, (*)
Italian Institute for Occupational Safety and Health (ISPESL)- Via Urbana 167, Roma (ITALY)
Istituto di Scienze dell' Atmosfera e del Clima (ISAC)- CNR Via Fosso del Cavaliere, 100, 00133 Roma (ITALY)

SUMMARY
The choice of mechanic and thermal atmospheric turbulence profiles formulation has a great influence on air pollution dispersion modelling in the Planetary Boundary Layer (PBL). Unfortunately data are often only available in the surface layer where conventional meteorological stations are located and it is not possible to investigate the upper air layer directly by turbulence measurements. The similarity theory can be applied to estimate the wind and temperature meteorological profiles and turbulence parameters by the surface measurements of the friction velocity U*, the temperature scaling θ*, and the Monin-Obukov length L. These estimates at best are valid over flat terrains where the turbulence structure is not too complex. When this theory is not valid, we need to use another approach to calculate the PBL profiles using surface measurements.

In this paper we propose a new application that uses a Neural Network (NN) to evaluate PBL temperature profiles using surface layer measurements. We trained the NN using as input variables the horizontal wind (U) and the vertical wind component (W) and their standard deviations $\square_{u,w}$ which are all linked to the turbulence stability classes. Our target thus consists in deriving the air temperature and gradient, the friction velocity and Turbulent Kinetic Energy.

A field campaign will be conducted during spring 2002 using the ISPESL meteorological mobile laboratory in the experimental field of ISAC in Rome Tor Vergata where a microwave radiometer for the measurement of the temperature profile from ground level up to 600 m is also available. The site is in a grape-growing area 25 Km SE of Rome with rolling hills and scattered buildings. Meteorological surface parameters such as wind speed and direction at two different heights (at 3 and 10 m a.g.l.), absolute air temperature and its surface gradient (at 1.6 and 10 m a.g.l.), net and global solar radiation, pressure, relative humidity, will be measured at 1Hz and averaged every 10 minutes. Wind component measurements will be done with a couple of GILL three-axis sonic anemometers.

The comparison between the microwave and simulated temperature profiles is expected to produce good agreement. The proposed methodology may be used, after appropriate on-site training of the NN, to improve the capacity of simple ground based meteorological stations to give an indication of the characteristic turbulence profiles in complex situations, as verified in the monitored area.