On the determination of atmospheric stability in an urban area

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To run a dispersion model, at least wind and stability information on an hourly or half-hourly basis is needed. Whereas the measurement of wind direction and wind velocity and its use in dispersion models is quite straightforward, atmospheric stability is not so easily representatively measured. Simple methods to assess stability from routine meteorological measurements (e. g. via discrete stability classes) are generally derived from data representing rural conditions and will show limits when applied to urban areas. In the latter, the use of z/L, where L is the Monin-Obukhov length, is recommended, which can be derived from ultrasonic anemometer measurements.

In the course of a field experiment in Linz, Austria, which lasted for several months, atmospheric stability parameters were determined from observations with two sonics, one installed at an industrial, the other at a rural site, as well as from wind speed and net radiation data. At the industrial site, the ultrasonic anemometer was subject to building influence and external heat sources affecting especially daytime data. The comparison of results shows clearly the superiority of the z/L method to discrete stability classes. Whereas the latter do not reflect an urban influence on stability, the former is well able to show the decreasing atmospheric stability when going from rural to urban areas. These findings are supported by RASS potential temperature measurements at the two sites, which also show more unstable and less stable situations at the industrial compared to the rural site.