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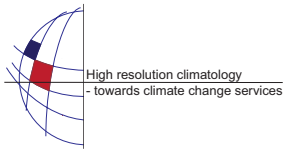

Evaluating the impact of alternative stable boundary layer heights formulations for air quality modelling in south-eastern France

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Air quality models such as Gaussian plume models are strongly sensitive to some input parameters describing the structure of the atmospheric boundary layer. In particular, the estimation of stable boundary layer heights still remains a problem for local air dispersion modelling as current numerical weather prediction models are still not fully able to reproduce with accuracy the structure of the boundary layer for stable cases.

AIRFOBEP is the regional air quality agency in charge of the survey of the air pollution over the Berre pond region, which is one of the two main industrial areas in France. From several years, AIRFOBEP has decided to develop an operational automated platform which routinely monitor and forecast air pollution over its territory. This study explores the benefits that can be achieved when using specific boundary layer heights formulations for stable cases in the framework of operational air quality forecasting at the local scale for a specific refinery located in the area of survey of AIRFOBEP. The site which is under study is located in the southeast of France, on the border of the Mediterranean Sea and it is characterized by its proximity with a pound and small foothills (approximately 150 meters high). The boundary layer height is then completely heterogeneous over this area and may rapidly change when maritime air coming from the sea passes over the site of interest, thus making particularly difficult the prediction of pollutant dispersion in this area.

The modelling chain used for this study consisted of very high resolution weather forecasts conducted with the RAMS model and used as inputs for the ADMS4 dispersion modelling system. Starting from RAMS forecasts performed at the kilometric scale, five different formulations have been used to derive boundary layer heights in stable regimes: the original Richardson number method which is implemented in the RAMS diagnostic module and four diagnostic formulations specifically designed for the evaluation of stable boundary layer heights. The results were then used to perform five ADMS4 simulations only differing by the formulation used to provide boundary layer heights inputs. Two kinds of statistical comparisons were then conducted using the observation network of AIRFOBEP: the comparison of modelled boundary layer heights against UHF radar observations and predicted SO2 peaks of concentrations against SO2 measurements located in the vicinity of the site of interest. Statistical results suggested that using alternative boundary layer heights formulations for stable cases led to a better estimation of stable boundary layer heights and improved the prediction of the SO2 peaks for the site under study.