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AN INTERCOMPARISON OF MODELLED TRENDS OF NITROGEN AND SULPHUR WET DEPOSITION IN EUROPE OVER THE PERIOD 1990-2010 IN THE FRAMEWORK OF THE EURODELTA/TFMM TREND MODELLING EXERCISE

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Abstract: Reliable estimates of atmospheric deposition of nitrogen and sulphur are essential for assessing the risks of eutrophication and acidification to sensitive ecosystems. Atmospheric chemistry and transport models are frequently used to provide these estimates. Several models could be used to estimate deposition rates and, therefore, it is desirable that the models' abilities to estimate atmospheric deposition are evaluated and compared. Since these models are used to study future scenarios (e.g. emission abatement), it is also desirable that the model estimates respond realistically to changing conditions (e.g. emissions, boundary conditions, meteorology, etc.), something that can only be tested by evaluating the models' abilities to estimate past changes in deposition. As part of the EURODELTA/TFMM trend modelling exercise, wet deposition of sulphur and nitrogen in Europe was simulated by seven models for the period 1990-2010. The model estimates of annual deposition rates and their temporal trends were compared and evaluated for two ten year periods (1990-2000 and 2000-2010) using data from EMEP background measurement stations. Model estimates of wet deposition differ greatly for all species and all models tended to underestimate the observed values, apart from one model that tended to overestimate sulphur deposition. Most of the observed and modelled trends of reduced nitrogen are not significant, reflecting the smaller emission changes for ammonia compared with those of nitrogen oxides and sulphur dioxide. Observed and modelled trends of wet deposition of oxidised nitrogen were more significant, with decreasing trends at most of the measurement stations. The most significant observed and modelled trends were found for sulphur wet deposition, the majority of which were decreasing trends, reflecting the

reported European sulphur dioxide emission reductions of approximately 70% for the modelling period. Most of the models underestimated the trends in wet deposition of sulphur and oxidised nitrogen over the two ten year periods, although model performance differed greatly. Model performance was better and less variable for the relative trends (trends with respect to the values at the beginning of the period) than for the absolute trends. This suggests that relative trends could be used to produce more reliable deposition estimates for future scenarios.

Key words: *Air quality modelling, chemistry and transport model, wet deposition, sulphur, nitrogen, trends*