Supplementary Information

Global sensitivity and uncertainty analysis of an atmospheric chemistry transport model: the FRAME model (v. 9.15.0) as a case study

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Figure S1 shows annual average surface concentrations of particulate NH₄⁺, NO₃⁻, SO₄²⁻, and annual wet and dry deposition of SO₂ calculated by the FRAME model with baseline emissions for the year 2012.

Figures S2 and S3 show spatial distributions of regression coefficients for NH₃, NOₓ, SO₂, HNO₃ and wet and dry deposition of NHₓ and NOₓ with respect to input emissions of the pollutant in brackets.

Figure S4 shows spatial distributions of the relative uncertainties in surface concentrations of NH₃, NOₓ, SO₂ and HNO₃ and dry and wet deposition of NOy and NHx for uncertainties of ± 4 %, ± 10 %, and ± 20 % in emissions of SO₂, NOₓ and NH₃ respectively. The uncertainty values are represented as +/- range relative to the baseline value and with the full range represents the 95 % confidence interval.

Figures S5 and S6 show spatial distributions of the squared SRC values which represent the fractional contribution of the uncertainty in the input emissions given in brackets to the overall uncertainty in NH₃, NOₓ, SO₂, HNO₃ and dry and wet deposition of NOy and NHx.
SI Figure 1 Annual average surface concentrations of particulate NH$_4^+$, NO$_3^-$, SO$_4^{2-}$, and annual wet and dry deposition of SO$_y$ calculated by the FRAME model for 2012.
SI Figure 2 Spatial distributions (at the 5 km × 5 km model grid resolution) of RCs for NH₃, NOₓ, SO₂, and HNO₃ as a function of variation in input emissions of SO₂, NOₓ or NH₃. The model input emissions for which the RC quantifies the output variable sensitivity is given in the brackets in each panel.
SI Figure 3 Spatial distributions (at the 5 km × 5 km model grid resolution) of RCs for wet (w) and dry (d) deposition of NO\textsubscript{y} and NH\textsubscript{x} as a function of variation in input emissions of SO\textsubscript{2}, NO\textsubscript{x} or NH\textsubscript{3}. The model input emissions for which the RC quantifies the output variable sensitivity is given in the brackets in each panel.
SI Figure 4 Spatial distributions (at the 5 km × 5 km model grid resolution) of the relative uncertainties in surface concentrations of NH₃, NOₓ, SO₂ and HNO₃ and dry and wet deposition of NOₓ and NHₓ for uncertainties of ± 4%, ± 10%, ± 20% in emissions of SO₂, NOₓ and NH₃ respectively. The uncertainty values are represented as a range of +/- the baseline value and represent the 95% confidence interval.
SI Figure 5 Spatial distributions (at the 5 km × 5 km model grid resolution) of the squared SRC values which represent the fractional contribution of the uncertainty in the input emissions given in brackets to the overall uncertainty in NH₃, NOₓ, SO₂ and HNO₃. The uncertainties in the input emissions are ± 4 %, ± 10 % and ± 20 % for SO₂, NOₓ and NH₃ respectively.
SI Figure 6 Spatial distributions (at the 5 km × 5 km model grid resolution) of the squared SRC values which represent the fractional contribution of the uncertainty in the input emissions given in brackets to the overall uncertainty in the dry and wet deposition of NO$_y$ and NH$_x$. The uncertainties in the input emissions are ± 4 %, ± 10 % and ± 20 % for SO$_2$, NO$_x$ and NH$_3$ respectively.