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Assessment of biogenic isoprene emission variations.

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Assessment of Volatile Organic Compound (VOC) emissions represents a key issue in atmospheric pollution and climatic change issues. 90% of those VOC emissions have a biogenic origin (BVOC), mainly from leaf trees, mainly as isoprene (C_5H_8). BVOC emissions were shown to be highly variable in time and space, reflecting, both, the immediate and long term plant adaptations to highly variable ambient environmental conditions. So far, only high frequency adaptations – minute to hour – are broadly described and taken into consideration by current biogenic emission models. However a number of field measurements showed that low frequency (LF) variations, mostly seasonal, can also account for several orders of magnitude in the overall emission variability. Using a statistical approach based on artificial neural networks, an emission algorithm (ISO_LF) which accounts for high (instantaneous) to low (seasonal) frequency variations was developed for isoprene. ISO_LF was optimised on an isoprene emission data base (ISO-DB) specifically designed for this work. ISO-DB consists of 1321 emission rates collected in the literature, together with 34 air and soil environmental regressors, measured or assessed using NCDC or NCEP meteorological databases. ISO-DB covers a large variety of emitters (25 species) and environmental conditions (10˚S to 60˚N). A maximum of 60% of the overall isoprene variability was found to be assessed when only instantaneous environmental regressors were used. Considering a total of 9 high (instantaneous) to low (up to 3 weeks) frequency regressors, ISO_LF accounted for up to 91% of the isoprene emission variability (40% for the G95 model), whatever the emission range, species or climate. ISO-LF was found to be mainly sensitive to air temperature cumulated over 3 weeks and to instantaneous light and air temperature variations. Validation of ISO-LF on non stored monoterpene emissions was shown to give poor results. Isoprene emissions calculated using ISO-LF are presented for different scenarios and compared with actual BVOC emission model assessments.