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Assessment of biogenic isoprene emission low frequency variations.

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Assessment of Volatile Organic Compound (VOC) emissions represents one the main uncertainties of atmospheric chemical transport models, dedicated to pollution or to global climatic changes. 90% of those VOC emissions have a biogenic origin (BVOC), mainly from leaf trees. BVOC emissions were shown to be highly variable in time and space. Such variations reflect, both, the immediate and long term plant adaptations to highly variable ambient environmental conditions. So far, only high frequency adaptations – minute to hour scale – 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. The aim of this present study is thus to assess a global BVOC emission parameterisation that covers high to low frequency variations of environmental conditions, in particular for isoprene (C_5H_8) which represents about half of these emissions. Further more, seasonal isoprene emission variations were observed worldwide and for a number of different emitters. Their variability was shown to result from a very complex set of numerous environmental parameters. Those which were previously shown to influence or which are believe to be active in isoprene LF variations, are briefly screened and discussed. A statistical approach, the artificial neuron network technique, was used in order to assess the best non linear regressions between isoprene emissions and environmental regressors. An appropriate set of 1332 isoprene emission rate data was thus specially built for this study, covering in-situ observations of 26 different species carried out worldwide. A total of 34 high to low frequency environmental parameters describing ambient air and soil conditions were tested. 19 of these regressors were eventually considered in the final isoprene emission algorithm, 2, 5 and 12 of them being, respectively high,

medium and low frequency regressors. Our parameterisation was found to significantly reduce the uncertainty of isoprene emission assessment since it was shown to explain more than 90% of the isoprene emission variability. The validation to other BVOC compounds, such as monoterpenes ($C_{10}H_{16}$), showed that these emissions are probably controlled by environmental parameters different than for isoprene. Some tests showed that our algorithm was mainly sensitive to low frequency regressors and in particular to cumulated ambient air temperature.