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Atmosphere-biosphere reactive trace gas exchanges in large-scale models: What experiments do we need?

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State-of-the-art Chemistry and Transport Models (CTM's) and coupled chemistry-climate models contain rather explicit representations of atmosphere-biosphere reactive trace gas exchanges including biogenic emissions and dry deposition. Several recent dry deposition model studies have focused on improved representations of the uptake by, for example, the dry and wet cuticle and soils. However, those efforts are not always supported by experimental evidence. On the other hand, studies that focus on the exchanges of biogenic VOC's, their oxidation products and peroxide exchanges indicate that a commonly applied approach to provide first-order estimates of surface removal does not result in a realistic simulation of the role of dry deposition for atmosphere-biosphere exchanges. There is a clear need for more experimental data to improve our understanding of exchanges at the substrate-scale, based on enclosure experiments in combination with mechanistic models of substrate exchanges. In addition, many studies have recently demonstrated the importance of nocturnal radical chemistry, also relevant to chemical destruction of emitted VOC's and their oxidation products. However, a main limitation in the assessment of the relevance of nocturnal chemistry for atmosphere-biosphere exchanges, is the representation of turbulent exchanges, which controls the mixing and residence time of reactive species inside the canopy and consequently the efficiency of chemical transformations and dry deposition. Nocturnal turbulent exchanges is also an important research theme of the FLUXNET community, which conducts micrometeorological measurements at more than 200 sites, and the GABLS (GEWEX Atmospheric Boundary Layer Study) project, which focuses on the representation of the stable atmospheric boundary layer in climate models. The combination of dedicated experiments and models to develop more mechanistic representations of substrate exchanges as well as an improved repre-

sentation of nocturnal turbulent exchanges, where collaborations with the FLUXNET and GABLS community should be pursued, would facilitate further improvements in the representation of dry deposition and atmosphere-biosphere reactive trace gas exchanges in large-scale models.