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Mirror image hydrocarbons from Tropical and Boreal forests

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Monoterpenes and isoprene react rapidly with the atmosphere's primary oxidant OH, and are known to impact ozone and produce secondary organic aerosol, thereby affecting the Earth's radiative budget. The global effect of these gases on atmospheric chemistry has been assessed by models, however, such work is crucially dependent on emission algorithms which are uncertain, particularly in the case of monoterpenes. Leaf scale studies have established that isoprene emissions can be parameterized as a function of light and temperature. Unlike isoprene, monoterpenes may be stored in the leaf rather than emitted directly and recently it has been a moot point whether the monoterpene emissions are light dependent or not. Monoterpenes, emitted in large quantities by trees to attract pollinators and repel herbivores, can exist in mirror image forms called enantiomers. In this study such enantiomeric pairs have been measured in ambient air over extensive forest ecosystems in South America and northern Europe. For the dominant monoterpene, alpha-pinene, the (-)-form was measured in large excess over the (+)-form over the Tropical rainforest, whereas the reverse was observed over the Boreal forest. Interestingly, over the Tropical forest (-)-alpha-pinene did not correlate with its own enantiomer, but correlated well with isoprene. The results indicate a remarkable ecosystem scale enantiomeric fingerprint and a nexus between the biosphere and atmosphere.