Hydroxy fatty acids as tracers of soil microbes and plant waxes in marine aerosols from Chichijima Island in the western North Pacific

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Hydroxy fatty acids (FAs) were measured in the aerosol samples collected from Chichijima Island in the western North Pacific from January 2001 to January 2003. These fatty acids are the structural components of bacterial membrane and plant waxes and thus can serve as such markers during the atmospheric transport over the Pacific.

We observed a clear seasonal variation with winter/spring maxima and summer/autumn minima along with an even C-number predominance. This seasonal pattern clearly indicates their atmospheric transport from the continents during winter/spring and from the ocean in summer/autumn. Furthermore, in winter/spring we found co-variability in their temporal trends between hydroxy FAs and biomass burning tracers such as levoglucosan and nss-K as well as with nss-SO_4 ions. This suggests that hydroxy FAs are co-transported with dust and biomass burning plumes from the Asian continent to the remote marine island via the westerlies during winter/spring. Moreover, cluster analysis showed that spring and winter seasons are characterized by the aeolian transport of hydroxy FAs from the arid regions in North China, Korea, Russia, and Mongolian.

Overall, continental sources overwhelm hydroxy FAs in the atmospheric particles over Chichijima Island than marine sources. These results have implications towards assessing the atmospheric transport of bacterial and plant lipids in the continental outflow over the open ocean. This chemical marker-based approach is a suitable tool for the rapid and comparative analysis of microbes in the particulate matter, which does not require the biological recovery and microbial cultivation.

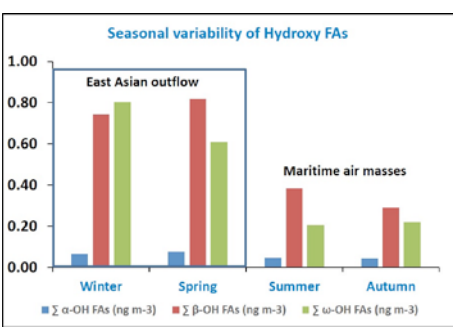

Figure 1. Seasonal variability of hydroxy FAs in marine aerosols.