Tree-rings as recorders of tropical cyclones in Northeast Asia

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Tropical cyclones have significantly increased in both the frequency and intensity over recent decades in the western North Pacific Ocean basin. We aim to provide new insights into the long-term typhoon variations by using a combination of release detection, radial growth trends and oxygen isotope compositions of late-wood tree-ring cellulose. Long-term tree-ring records will enable us to determine the changes in frequency and intensity of tropical cyclones over a large area. Our preliminary results indicate the high potential of all three techniques as proxies for typhoon reconstruction. Comparison of latewood $\delta^{18}O$ residuals (deviations from the mean of 4 individual tree-ring series) with instrumental records of past typhoons showed that negative deviations of tree-ring $\delta^{18}O$ values from the long-term mean correspond with the occurrence of typhoons in the same year. We found that the most intensive typhoons are followed by a high proportion of trees showing a major release along a latitudinal gradient in South Korea (Altman et al., 2013) and in Hokkaido (Altman et al., 2016). Our long-term reconstructions of past disturbances based on 220 cores from Quercus mongolica South Korea revealed increasing typhoon intensity over recent decades (Altman et al., 2013). This was confirmed here by further extensive analyses of $>900$ cores from several species. In addition, we identified higher disturbance frequency in northern latitudes in the past hundred years whereas in southern latitudes disturbance frequency was stable before and after 1920, where most of the climatological studies detected poleward migration of tropical cyclones.

References
