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Dependencies of Polychlorinated Biphenyl Concentrations Measured at the Great Lakes on Climate Variables

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Polychlorinated biphenyls (PCBs) are persistent and hazardous chemicals that are still detected in the atmosphere and other environmental compartments although their production was banned several decades ago. At the Great Lakes region PCBs have been monitored via the IADN network since 1993. In this study, we report results from seven different PCB congeners measured at six different sites around the Great Lakes. The PCBs exhibit a strong seasonal cycle with highest concentrations in summer and lowest concentrations in winter. The concentrations measured in Chicago and Cleveland are higher compared to the concentrations reported from more remote stations. We evaluated the correlations for the seven PCB congeners at each station. PCB-53,-101,-118 and -138 are highly correlated at each of the six stations. PCB-180 is the least correlated with all the other PCBs. This is explicitly true for Eagle Harbor, where PCB-180 and -153 are not correlated with the other 6 PCBs. This may be explained by the less pronounced seasonal cycle of these heavier PCBs at Eagle Harbor. We observed significant correlations between PCB-28 concentrations at the remote stations, but PCB concentrations at the stations of Chicago and Cleveland are only poorly correlated with PCB concentrations at the other stations. The weak correlation of the PCB concentrations measured at the different stations and the relatively high concentrations of the PCB congeners at each station indicate that local conditions and small scale processes (sources, temperature, wind direction, wind speed) dictate the spatial distribution of the PCBs. We will feed available data on temperature, wind speed, wind direction, emissions, precipitation, ice cover of the Great Lakes and large scale atmospheric teleconnection patterns into a General Additive Model (GAM) to further investigate the relationships between the measured PCB concentrations and selected environmental conditions and atmospheric parameters.