Biomass burning as a major source of aerosols

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It has been know for decades that biomass burning is a major source of aerosols, but recent advancement in satellite fire detection and biogeochemical modeling enables us better to quantify fire aerosol emissions and resulting concentrations. Here we show recent emissions estimates based on the new version 4 of the Global Fire Emissions Database version (GFED4) modeling framework and explain how climate and humans have shaped spatial and interannual variability in emissions over the past 15 years. We specifically highlight the role of fires not detected by the burned area algorithms but which can be seen in active fire data and occur often close to areas with relatively high population densities. We then focus on Indonesia which has the highest fire emissions density close to populated areas and show the relative importance of secondary aerosol formation on regional air quality.

Assimilation of hydrothermally altered crust at slow spreading ridges

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The process of crustal assimilation at mid-ocean ridges is not always obvious as assimilant and assimilator have similar bulk compositions. Hydrothermal alteration of oceanic crust significantly increases its chlorine (Cl) content, making Cl a potentially sensitive assimilation tracer. Although at fast spreading ridges this process has previously been shown [e.g. 1, 2], the intrinsically lower, more constant Cl values (~50-200 ppm) in basalts from slow spreading ridges make the tracing of crustal assimilation more arduous there.

We performed high precision Cl measurements in basalts from 3 slowly spreading ridges: the Southern Mid Atlantic Ridge (SMAR) at 7-10 °S (~3 cm/yr), the Red Sea at 16.5-26.5 °N (max. 1.6 cm/yr) and the Gakkel Ridge at 6 °W - 85 °E (max. 1.5 cm/yr). Chlorine contents vary from 40 to 400, 700 and 1300 ppm respectively, suggesting assimilation is occurring. Generally our Cl contents are higher than for average slow spreading ridges, although the Cl concentrations are not always elevated relative to elements of similar mantle incompatibility (e.g. K, Nb).

In the Red Sea and partially in SMAR samples we see a clear relation between Cl/K (as indicator of assimilation) and the presence of hydrothermal vents sites or tectonic features associated to these. In contrast, the also hydrothermally active [3] Gakkel Ridge has much lower Cl/K values, suggesting that other factors besides hydrothermalism play a role in the visibility of assimilation. The Cl contents of trace-element-enriched magmas (higher primordial Cl) at Gakkel Ridge are less .sensitive to assimilation. In contrast, highly saline ocean water, brine pools and the presence of evaporites in the Red Sea make assimilation signals stronger there. Other influencing factors are the spreading rate and the type of rifting, i.e. volcanic or tectonically dominated. Through comparison of ridges with similar spreading rates and tectonic setting, we can examine the factors influencing the susceptibility of Cl concentrations to assimilation of altered oceanic crust.

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