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Trace metal fluxes from the Congo River into the South Atlantic Ocean are supplemented by atmospheric inputs from gas flaring

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The Congo River in Africa has the second largest freshwater discharge volume globally and creates a near-equatorial river plume of up to 1000 km into the Atlantic Ocean[1]. The Congo constitutes a significant source of trace metals (TMs) to the ocean, and can stimulate primary productivity in the (sub)tropical ocean and impact marine ecosystems and ocean carbon uptake. The large and distal transport of TMs by Congo plume into the Atlantic is unique but also puzzling as TMs like iron (Fe) are considered to be largely removed (90-99%) during estuary mixing[2]. A recent study of ^{228}Ra indicated a discrepancy in the TM budget in the Congo plume, which pointed towards an unknown source other than the Congo River or preservation of TMs by organic matter complexation which buffers TM against scavenging[3]. To address this puzzle, we present here a dataset of TM concentrations in river, rain and seawater from the Congo shelf (near Congo River mouth, 12.6°E, -6°S) to open South Atlantic (to 0°E, -3°S) from GEOTRACES cruise GA08. We show that wet deposition (rainfall) was the "missing" source of TMs to the Congo plume, supplying some TMs to the South Atlantic Ocean at a similar order of magnitude to the river. Concentrations of TMs including zinc (Zn), lead (Pb), cadmium (Cd) and copper (Cu) in rainwater showed an anthropogenic source, which can be linked to the numerous gas flaring platforms along the coast. Our results demonstrate that TM fluxes in the Congo plume are augmented by rainfall, which results in an apparently small removal rate of Fe (~50%), likely because Fe from rainfall is more efficiently dispersed upon deposition in the ocean and less prone to flocculation then Fe delivered by the Congo River[4]. We anticipate our study to be a starting point for more studies into TM emissions from gas flaring and impacts on surface oceans carried by rainfall.

References

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