Variability in the concentration of Lithium in the Indo-Pacific Ocean

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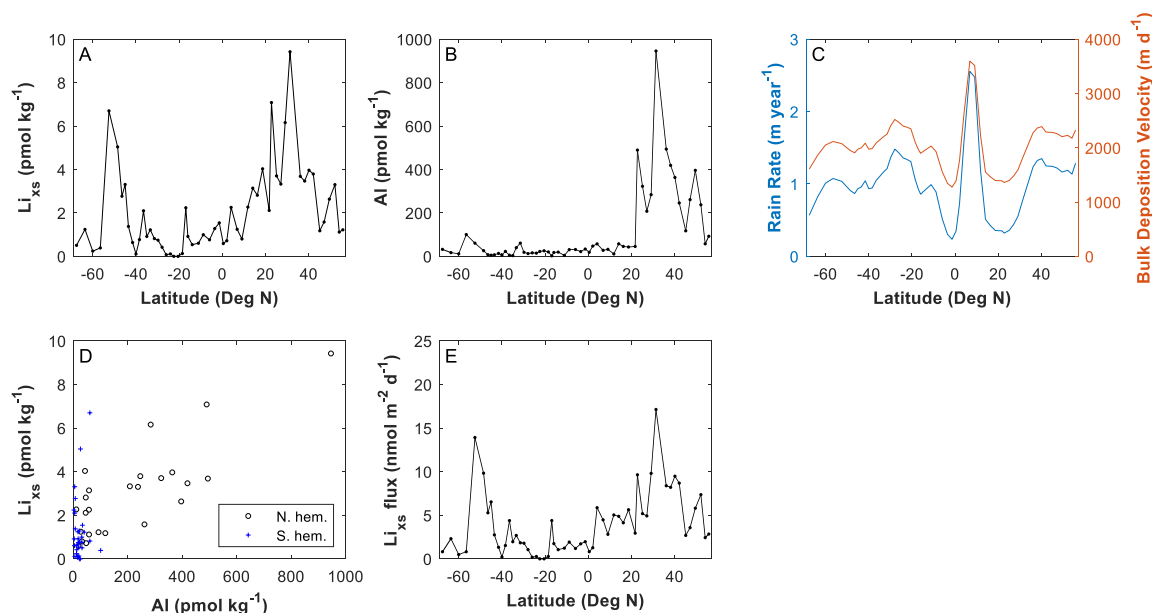
Fig. S1: De-ionised water-soluble aerosol lithium and aluminium data collected along the P16 section in the Pacific Ocean. A) Excess soluble lithium (Li_{xs}); B) Soluble aluminium; C) Calculated bulk deposition velocity as a function of the average rain rate, after Kadko et al. (2020). Rain rates were calculated from average monthly precipitation data downloaded from the Global Precipitation Climatology Project (GPCP; http://gpcp.umd.edu/) for the period April 2005 – March 2006; D) Excess soluble lithium vs. aluminium in the northern and southern hemispheres; E) Calculated excess soluble lithium flux to the surface Pacific Ocean. Li_{ex} is calculated by subtracting the sea-salt

contribution to the de-ionised water leach using measured magnesium concentrations and the Mg/Li of seawater.

After collection, the filter was placed sample side up in an acid washed polysulfone filter holder attached to an Air Cadet vacuum pump. Soluble aerosol lithium, magnesium and aluminium were extracted with ultrapure deionised water ($\geq$18 MΩ) by pulling 100 mL of deionised water within ten seconds through the filter. The samples were immediately frozen and kept in the dark. The samples were later acidified to 0.024 N Q-HNO$_3$ and analysed with HR-ICP-MS at the National High Magnetic Field Laboratory in Tallahassee, Florida, at least 30 days after acidification using multielement standards and 1 ppb Sc as an internal standard. This procedure separates the fraction of the aerosol that is instantaneously soluble in rain water. To eliminate the contribution of lithium from sea spray we define excess lithium (Li_{xs}) as:

$$Li_{xs} = [Li]_{measured} - [Mg]_{measured} \cdot \left(\frac{[Li]}{[Mg]}\right)_{seawater}$$

$[Li]_{measured}$ and $[Mg]_{measured}$ refer to the concentrations measured in the deionised water after leaching. $\left(\frac{[Li]}{[Mg]}\right)_{seawater}$ is the global average seawater ratio, 0.491 mmol mol^{-1}.
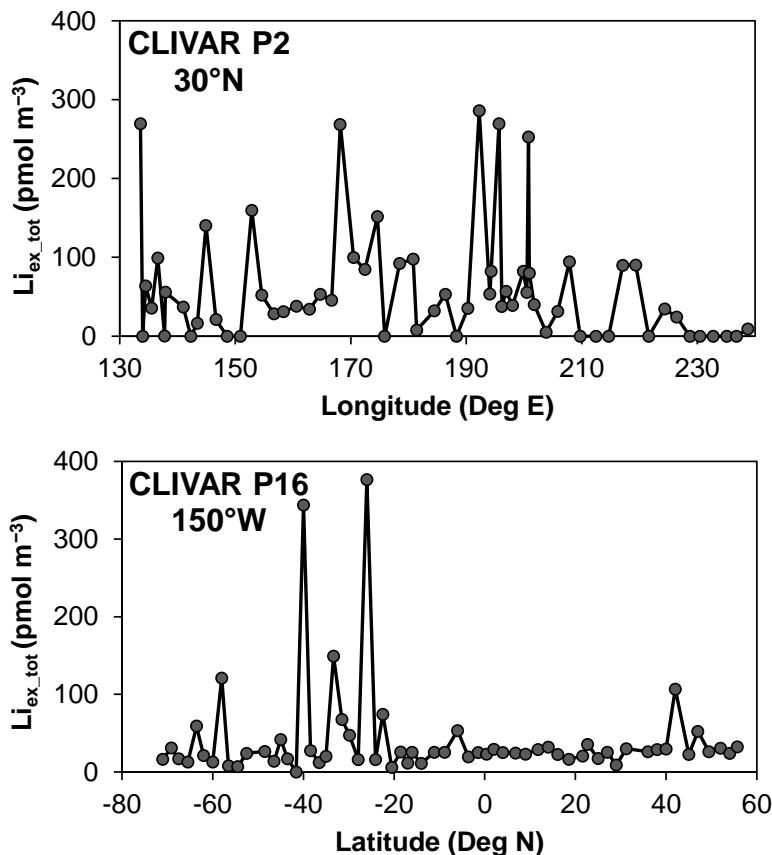
Fig. S2: Total aerosol lithium measured along the CLIVAR P2 transect that crossed the North Pacific Ocean along 30°N (June-August 2004) and CLIVAR P16 transect that crossed the Pacific Ocean from south-to-north along 150°W (southern section January-February 2005; northern section February-March 2006). Data were corrected for the contribution of sea-salt aerosols by subtracting lithium contribution calculated from the chlorine content of the aerosols. The highest lithium loads were measured in the southern hemisphere part of P16. A possible source for the southern hemisphere lithium is Australia, which is the global largest producer of lithium ore, however, the data coverage is not sufficient to determine if this is indeed the case.

Additional Supporting Information (Files uploaded separately)

Captions for Tables S1 to S2

Table S1. Salinity normalized dissolved lithium concentration of all seawater samples analyzed for the study.

Table S2. Pacific aerosol samples analyzed for the study. The Limit of detection for aerosol lithium analyses was 0.9 pmol m^{-3} for the MQ leaches and 7.2 pmol m^{-3} for the total leachates.