Chemical characterization of atmospheric dust from a weekly time series in the north Red Sea between 2006-2010

NADYA TEUTSCH[1,#], ADI TORFSTEIN[2, 3,#], OFIR TIROSH[2], YEALA SHAKED[2, 3], TANYA RIVLIN[3], ASSAF ZIPORI[2], MORDECHAI STEIN[1], BOAZ LAZAR[2], YIGAL EREL[2]

[1] Geological Survey of Israel, Jerusalem, Israel (nadya.teutsch@gsi.gov.il)
[2] Institute of Earth Sciences, The Hebrew University of Jerusalem, Jerusalem, Israel (adi.torf@mail.huji.ac.il)
[3] Interuniversity Institute for Marine Sciences, Eilat, Israel
[#] Equal author contribution

Atmospheric dust loads and chemical compositions serve as a key link between global climate patterns and marine biogeochemical cycles. The primary source of atmospheric dust in the world today is the Saharo-Arabian desert belt. This study reports a multi-annual time series of atmospheric dust loads (2006 – 2016) and their chemical compositions (2006 – 2010) collected in the north Gulf of Aqaba (north Red Sea) at a weekly to bi-weekly resolution.

Dust loads vary seasonally from low values in late summer (~20-30 ug/m^3) to higher values in the fall, and highest values in late winter and early spring (~150-250 ug/m^3). Major and trace element abundances were measured for three fractions: water-soluble salts (L0), carbonates and oxides (weak acid leach; L1), and Al-silicates (L2). These allow to distinguish between the sources and chemical compositions that dominate high and low dust loads in each season. The L0 fraction is relatively enriched in Na, Ca, K and Mg, the L1 fraction is enriched in Ca as well as Na, Al, Mg, Zn, Cd and Pb, and the L2 fraction in Al and Fe.

High dust load intervals during winter months are characterized by low passing air masses originating from the Sahara, while the ambient winter dust (low dust load) is associated with proximal source regions from the East Sahara and Arabian Peninsula. Low dust loads characterize the summer with limited compositional variability relative to winter-spring months. However, anthropogenic fluxes remain higher during winter and spring, stemming from the overall significantly higher dust loads at this time.

Fluxes of Fe, Cd and othr micronutrients in the bio-available phases (L0, L1) are not correlated with major nutrients or Chlorophyll-a sea surface concentrations, suggesting that the atmospheric dust plays a limited role in driving primary productivity in the oligotrophic surface waters of the Gulf of Aqaba.