Soluble Manganese(III) and a revised Sedimentary Redox Cycle

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Recent field studies have confirmed the presence of soluble manganese(III) or [Mn(III)]aq, which along with Mn(II) passes through a 0.2 μm filter, in natural waters of the Black Sea, the Baltic Sea and Chesapeake Bay. This species can account for a large fraction (up to 100%) of the dissolved Mn pool at the oxic/anoxic interface. We have applied a spectrophotometric method to determine the concentration and speciation of Mn in sediment porewaters of the St. Lawrence Estuary collected during cruises in 2009 and 2010. In all samples, [Mn(III)]aq accounts for up to 80% of the total dissolved Mn pool in the vicinity of the oxic-suboxic boundary, with concentrations ranging from the detection limit of 50 nM to 80 μM. We use flux calculations and a diagenetic model to explore the interaction of Mn(III) with other element cycles.

Data collected along the Laurentian Trough of the St. Lawrence Estuary demonstrate that the reduction-oxidation capacity of the soluble Mn pool has been underestimated since Mn(III) can act as either an electron acceptor or an electron donor during interactions with the C, N, S, O and Fe cycles. In these (hemi)pelagic sediments, our data suggest that a significant fraction of the porewater Mn(III) is produced through the oxidation of Mn(II) by O_2. Soluble Mn(III) intermediates are also produced during dissimilatory MnO_2 reduction upon organic matter mineralization and abiotic reduction of MnO_2 by reductants such as Fe(II), FeS and H_2S. Finally, our results reveal that soluble Mn(III) is likely ubiquitous in porewaters, and, as such, is a key redox species in the global sedimentary cycles of carbon, oxygen, iron and sulfur.

Study of droplet activation in thin broken clouds

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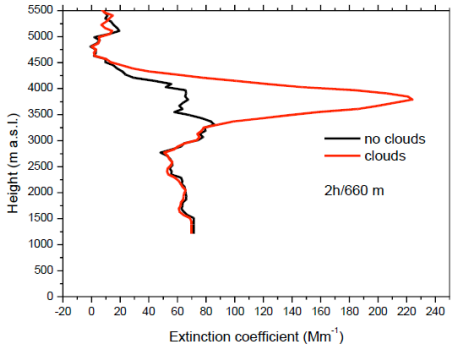
The impact on climate of thin clouds is one of the most uncertain. Their importance is related to their global mean cloud fractional coverage [1]. Moreover, they provide significant information about the mechanisms leading to clouds formation. Thin clouds are difficult to observe accurately and large discrepancies exist among different observation techniques [2]. A study to assess the behaviour of macrophysical and microphysical properties of thin clouds is proposed. The study takes advantage of multi-wavelenght lidar and microwave radiometer measurements performed at CIAO (CNR-IMAA Atmospheric Observatory), in Potenza, Italy. Particular attention has been paid to optically thin broken stratocumulus where it is possible to investigate the fast change between non-saturation and saturation conditions in an aerosol layer and the droplet activation.



In the plot, it is reported the profiles of aerosol exctinction coefficient integrated over 2 hours obtained including (black) or excluding (red) clouds. The plot shows the seperation between the region where droplets are activated from that where aerosol particles seems to be not affected by nucleation processes. The results of the mentioned study over two years of data, including aerosol, water vapour and liquid water measurements, will be presented.

[1] Rossow, W. B., and R. A. Schiffer (1999) ISCCP. Bull. Amer. Meteor. Soc., 80, 2261–2287. [2] Turner, D. D., and Coauthors (2007), Bull. Amer. Meteor. Soc., 88, 177–190.

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