THE FRACTIONAL SOLUBILITY OF IRON FROM ATMOSPHERIC AEROSOLS

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CHAPTER 1: INTRODUCTION

1.1 The Importance of Iron Relating to Climate

The importance of iron (Fe) as a limiting nutrient is gaining an increasing amount of attention from the scientific community. A substantial amount of this interest is centered on the possibility that the atmospheric and oceanic Fe cycle could potentially influence global climate. Many current theories involve the Fe cycle as a central component in a series of positive feedback loops to climate change (figure 1).

One of the main theories maintains that in certain regions of the ocean, which have high levels macronutrients and yet low chlorophyll levels (HNLC), an increase in Fe supply to the surface waters could potentially increase the uptake of photosynthetic reactants, such as carbon dioxide (CO_2) (Martin 1990). An increase in the uptake of CO_2 might increase the amount of CO_2 transported to the deep ocean through the carbon pump. The decrease in the partial pressure of CO_2 in the surface waters could allow more atmospheric CO_2 to be partitioned into the surface waters of the ocean. This decrease would influence the CO_2 pressure gradient at air-sea interface. Because CO_2 is a greenhouse gas in the atmosphere, an efficient absorber of radiation, a reduction in its atmospheric concentration could reduce global temperatures (Martin & Fitzwater 1988, Martin & Gordon 1988, Martin et al. 1989, Martin 1990, Martin et al. 1991, Watson et al. 1994).

The dominant source of Fe to the open ocean is continental dust transported within the atmosphere (hereafter also referred to as atmospheric mineral aerosols) (Duce & Tindale 1991). A change in the amount of atmospheric dust, and hence Fe transported to the open ocean could contribute to a network of positive feedback mechanisms