deflexion experiments, while still explaining the observations of Sadeh, Ball⁸ and others.

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Mechanism for the Fixation of Nitrogen by Lightning

THE results of present studies directed towards the solution of the ion chemistry of the ionospheric D-region have interesting implications for the lower atmosphere as well. A major ion product of air ionization is NO⁺, which is a "terminal" ion because of its low energy content. Reactions which produce NO⁺ are¹

These reactions cause NO⁺ to be a dominant ion in the regions of the Earth's ionosphere where neutral NO is a minor constituent. The reaction

is exothermic, and while known to be slow¹, may still be of significance where N₂ densities are very high. The N₂⁺ produced in air rapidly produces O₂⁺ by charge-transfer

Finally, it is known^{2,3} that all of the atmospheric ions, N⁺, N₂⁺, O⁺, O₂⁺ and NO₂⁺, charge transfer rapidly to NO to produce NO⁺. Thus a large fraction of the positive ions produced in an atmospheric ionization event, such as a lightning stroke, can be expected to lead to NO⁺ production.

Recently it has been shown^{4,5} that in a wet atmosphere NO⁺ will hydrate with three waters of hydration, that is

Following the formation of NO⁺(H₂O)₃, a fast binary reaction occurs

These reactions are all known to be efficient: $k_7 = 1.5 \times 10^{-28}$ cm⁶ molecule⁻² s⁻¹ (ref. 5); k_8 and k_9 are roughly two and three times faster and $k_{10} \approx 10^{-9}$ cm³ mol⁻¹ s⁻¹.

The production of ionization in a wet atmosphere, therefore, leads with high efficiency to the fixation of nitrogen in the form of nitrous acid which, of course, may then react further.

The above reaction scheme and an analogous scheme starting with O₂⁺ are responsible for the dominance of water cluster ions, H₃O⁺(H₂O)_n, in the lower ionosphere of the Earth; that is, at altitudes below about 80 km^{4,6}. The production of HNO₂ has been verified by Puckett and Lineberger in negative ion studies of NO-H₂O afterglows⁷. The production of nitrous acid has been observed in irradiated air following nuclear tests⁸.

There seems to be little reason to doubt that the above reaction sequence will occur following lightning bursts (and other ionizing events) in the Earth's lower atmosphere with a high efficiency of nitrogen fixation; that is, a high ratio of nitrous acid produced to ion pairs produced.

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Carbon Dioxide in the Surface Water of the Ice-covered Bering Sea

DETERMINATION of the equilibrium concentration of CO₂ in the ocean surface with respect to air is necessary in order to understand the interaction of CO₂ between the atmosphere and the ocean. The concentration of CO₂ in water depends on its physical, chemical and biological properties. The oceans, therefore, act as both sources and sinks for CO₂ in the air. Keeling¹ reported that high concentrations of CO₂ in the ocean appeared near the equator and were lower in the sub-tropics of all oceans. Areas along the west coasts of continents where upwelling occurs have high CO₂ concentrations. In the polar regions, patterns are more complicated primarily because of a lack of seasonal data. Measurements of the equilibrium concentration of CO₂ with respect to air in the surface waters of the Kara and Barents Seas during the late summer showed that the surface waters were supersaturated with CO₂ near the mouths of the Ob and Yenisey Rivers and undersaturated in the Barents Sea². The present study was undertaken to measure the actual distribution of CO₂ between the atmosphere and the sea over open leads and polynyi in the ice-covered Bering Sea. Previous measurements of CO₂ in ice-covered seas were made by Kelley³ in the water under the Arctic Ocean pack ice near Ice Island T-3.

A recent cruise of the US Coast Guard ice breaker Northwind during February 1970 provided an opportunity to visit