SAHARA SAND/DUST COVER EQUATORIAL ATLANTIC

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1. Introduction

During most of June and the early part of July 1977, sand and dust from the Sahara Desert in Africa drifted across the equatorial regions of the Atlantic Ocean. Hermattan winds generated this blowing sand from the southwest Sahara. Hermattan winds are a fairly persistent summer phenomena but during this time frame they were especially strong and carried the African sand far out over the Atlantic Ocean. There, dominant easterly flow continually moved the sand cloud past the Lesser Antilles, the Caribbean Sea, Gulf of Mexico and into Mexico and Baja itself.

2. Discussion

Major Sahara Desert dust and sand outbreaks have been viewed by polar orbiting satellites such as ESSA–5 in 1967 (Prospero et al 1970), the geostationary satellite ATS–1 in 1969, as well as SMS–1 in July of the summers of 1974 and 1975.However, most of these previous dust clouds were just that—one very large dust mass that had a beginning and an end and was tracked by these weather satellites of the time. The 1977 Sahara Desert sand cloud was very persistent in that it was constantly replenished by sand that was then transported out over the Atlantic. The best viewing platform for this phenomena was the GOES–1, 22,300 mile high geostationary satellite located above the Amazon at 75°W longitude. The early morning, low sun angle photos were the best for viewing this sand/dust cloud which was thousands of miles in width.

The leading edge of the dust cloud reached Florida during the week of June 20th resulting in visibilities as low as four miles in haze along the southern half of Florida, in the Caribbean, and in the Lesser Antilles. These visibility restrictions compared favorably with the many ship reports received in the western Atlantic. Unfortunately, no one this far away from Africa reported sand which, in reality, it was—blowing sand carried aloft by the trade winds. The Cape Verde Islands and western African sites did report and forecast blowing sand.

Since this dust cloud was very persistent, it is not unreasonable to hypothesize that the lack of tropical storm and hurricane development in the Atlantic during these first two months of the hurricane season was, in part, caused by this huge but thin dust layer trapped in a subsidence inversion. More likely, it was the subsidence inversion suppressing the clouds as well as the haze cutting down the sun's rays.

Carlson and Prospero, 1972, suggested that in addition to modifying the radiation balance of the tropics, the dust might play some secondary role in water vapor and ice nucleating processes. Those two authors have documented large-scale movements of similar Sahara dust outbreaks over the north equatorial Atlantic. The dust laden heated air emerges from west Africa and moves westward across the Atlantic above the moist trade wind layer, mainly between 5,000 and 15,000 feet. Their measurments indicated that the dust concentration is greater at 10,000′ than at the surface; but a sufficient amount of dust can be transferred to the lower levels by fallout of particulate matter and mixing at the base of the dust layer thus producing a dense haze at the surface. Along the same line, Lushine (1975) has discussed a satellite picture of a dust layer in the eastern Caribbean. Mayfield (1975) tracked a large dust cloud as far west as the Yucatan Channel using the SMS–1 photos. His article demonstrated the ability to track large scale areas of dust; he also offered the prospect of determining whether the dust has any affect on the development of tropical storms. Naturally, the subsidence that retained the dust could be argued as being more dominant than the sunlight effects of the dust cloud itself although Carlson et al (1973) did report that off the west coast of Africa the effect of the sand cloud cut off as much radiation as a cloud itself, 100 langleys per day.

Figure 1 shows the GOES–1 view of the Sahara Desert dust cloud on the 15th, 16th and 17th of June where it showed evidence of persistent movement of 5° a day, thus enabling forecasters to alert the news media to the dust reaching Florida during the week of the 20th. It arrived on schedule as forecast causing allergy problems for many people.

Figure 2 shows a local noon DMSP photo taken on the 17th that shows a sun glint located near and through the edge of the dust cloud. Here maximum scattering was occuring directly below the DMSP satellite as it travelled in a south to north 500 nautical mile high path over the Puerto Rican area.

3. Conclusion

Once again, the GOES–1 imagery contained accurate observations of a significant phenomena—the Sahara Desert sand outbreak. Extrapolation forecasting techniques proved to be very accurate. The effect of the dust clouds on people with respiratory and allergy problems was obvious. This latter fact, in itself, makes a dust cloud a newsworthy item. The lack of tropical storms and hurricanes was also evident during the period of this dust cloud.

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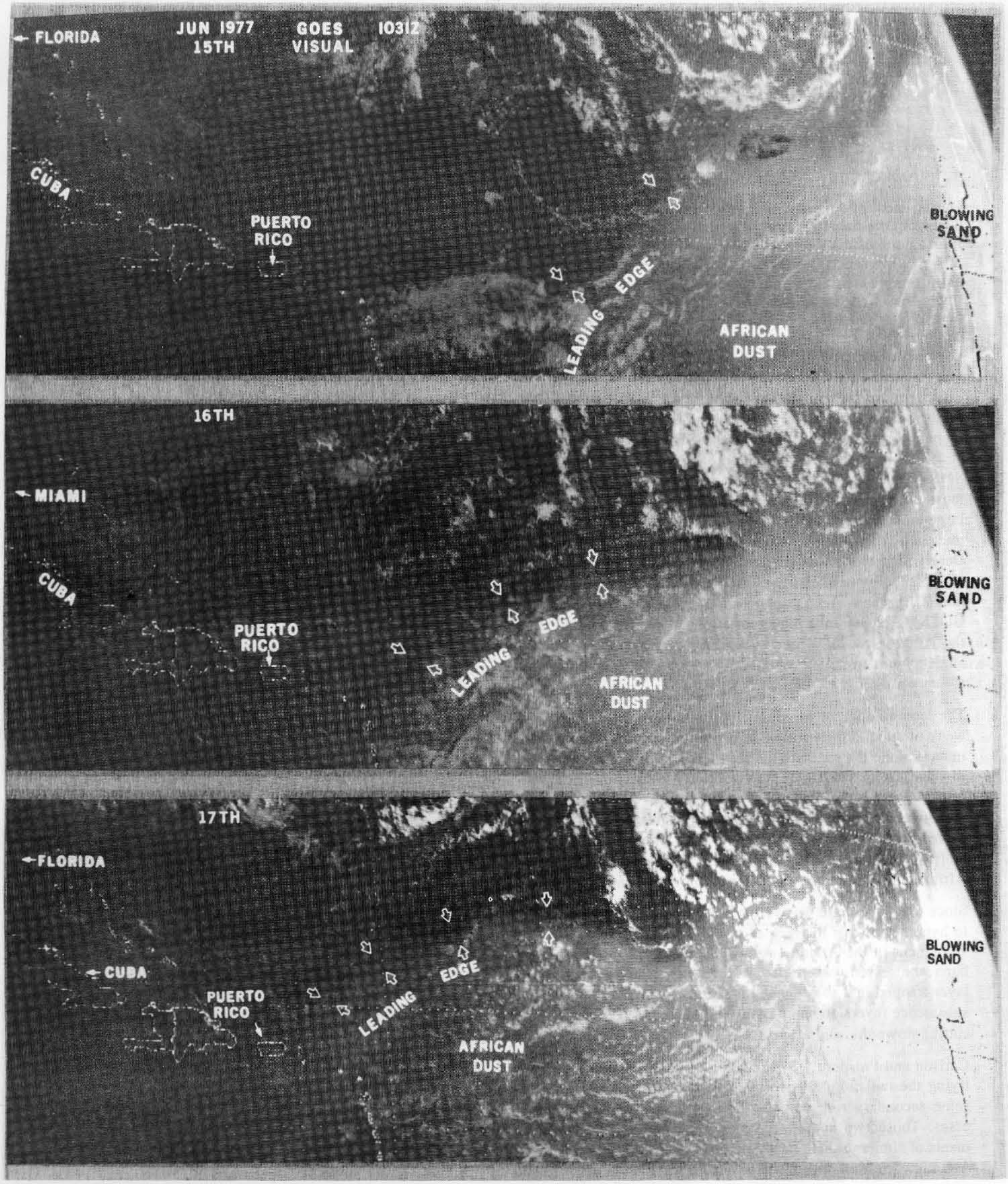

FIG. 1. GOES views of Sahara Desert dust cloud on 15, 16, and 17 June 1977.

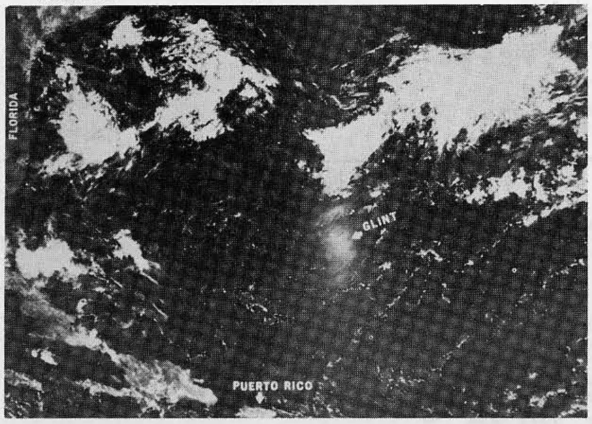

FIG. 2 . Defense Meterological Satellite Program (DMSP) photo of sun glint near Saharan dust cloud. The photo was taken on 17 June 1977, 1534 GMT.