

JOINT COLLOQUIA

27 January 1965

WEATHER MODIFICATION BY MEANS OF ASPHALT COATINGS
IN SELECTED AREAS

by J.F. Black

Dr. James F. Black, Senior Research Associate of the Esso Research and Engineering Company, Linden, New Jersey, U.S.A., described the results of field tests in Arizona in which ground coated with a thin layer of black asphalt showed an increase of 19°F and ground coated with the same asphalt powdered with gypsum a decrease of 24°F compared with a control area at time of afternoon maximum $\frac{1}{2}$ inch below the surfaces. It has been suggested that an area of ground covered with asphalt near the shore line of a sea or large lake would induce convective lifting of a sea breeze circulation which would produce cloud and rain.

There have been several studies which support this suggestion. It has been noted that heat from factories and industrial areas increase the rainfall downwind from cities. Other natural heat sources such as grass fires act in the same way. The Caribbean Islands have been observed to act as heat sources, producing cloud streets and precipitation in the trade winds in the forenoon and afternoon.

The influence of mountains on rainfall is particularly striking on the Mediterranean coast of North Africa where a general rainfall of about 3 inches per annum increases to 20 to 30 inches in the neighbourhood of mountains. Calculations have been made of "thermal mountains" that would be produced by suitable asphalt coatings, which would be meteorologically equivalent to these actual physical mountains under typical meteorological conditions. From these calculations curves were drawn showing the proportion of arable land that would be made available by various lengths of asphalt coatings by the production of 20 inches and 30 inches of rain per annum in regions where the rainfall was normally only 10 inches. These curves indicated that the optimal length of the coating was about 35 miles inland from the shore, and the width $\frac{1}{10}$ to $\frac{1}{5}$ of the length to allow for variability in the prevailing wind direction. These calculations also showed that an acre of asphalt would provide about three acres of arable land.

Dr. Black indicated that from these calculations the investment cost would be about \$70 to provide a marginal water supply per acre of arable land. Also water would be obtained at only nine dollars per acre foot if the asphalt coating lasted for 5 years, a duration which present studies indicate is feasible.

It was now required, stated Dr. Black, to test the actual effectiveness of asphalt-covered strips in increasing rainfall. Suitable regions for carrying out these tests are Libya and Egypt on the coast of the Mediterranean and at Venezuela in South America. He was able to find a suitable site in Australia too, about 50 to 100 miles south of Broome, in Western Australia. Because of the higher cost of transport and other operations required, the total cost of the experiment would amount to about \$3,000,000. This experiment would indicate whether sufficient rainfall could be obtained at an estimated cost of about £4 per acre foot, which is considerably less than the cost of pipeline transport, desalting sea water or tank-car transport, which are increasingly costly in the order mentioned.

A film of trade wind clouds forming and giving rain over Anegada Island, as observed by Malkus and Ronne from a plane flying in the direction of the wind, was shown.

REFERENCES

- Black, J.E. 1963 Science, Vol. 139, No. 3551, pp. 226-227
- Black, J.F. and 1963 J. of App. Met., Vol. 2, No. 5, pp. 557-564
Tarmy, B.L.
- Malkus, J.S. 1963 J. of App. Met., Vol. 2, No. 5, pp. 547-556

Attention is drawn to "Comment on the Use of Asphalt Coatings to Increase Rainfall" by Wallace E. Howell and "Reply" by James F. Black and Barry L. Tarmy, appearing in J. of App. Met., Vol. 3, No. 5, October 1964, pp. 642-645 (Editor).

18 February 1965

METEOROLOGICAL ACTIVITIES OF THE UNITED STATES
IN THE ANTARCTIC

by M.J. Rubin

Mr. Morton J. Rubin, Assistant to the Director, Meteorological Research, U.S. Weather Bureau, described the overall U.S. activity as being on very broad lines covering many fields of geophysics and biology funded principally by the National Science Foundation. The meteorological program which now includes observations in connection with the IOSY is designed to provide data on the components of the heat, ice and water budgets of Antarctica.

During the IGY there were seven stations making observations, including Wilkes, Ellsworth and Little America V. At the present time, the principal meteorological programs are carried out at the South Pole and Byrd Station, with lesser programs at Eights and McMurdo. A new station, Palmer Station, is being established on Anvers Island in the region of the Antarctic Peninsula at the moment; its meteorological program will be minimal. It is expected that a temporary station will be established for two years on the high plateau of East Antarctica (80°S , 25°E), beginning in the 1965/1966 season, as part of the long traverse from the South Pole to the Roi Baudouin Base.

In addition to the standard surface and upper-air meteorological observations, the U.S. program includes observations of 1) the vertical distribution of net long wave radiation (radiometer sonde), 2) vertical distribution of ozone (ozonesonde), 3) surface ozone concentration, 4) total ozone content in a vertical column of atmosphere, 5) total, reflected and normal incidence solar radiation at the surface, 6) carbon-dioxide content at the surface, 7) atmospheric nuclear radiation, 8) vertical gradient of atmospheric electricity potential near the ground, 9) near-surface-level temperature profiles, and 10) sub-surface temperature profiles. In the recent past an airborne program of albedo observations of sea ice and continental ice was carried out. Studies of energy exchange between sea, ice and atmosphere have been the principle aim of the Weather Bureau's portion of the overall U.S. program in meteorology.

Mr. Rubin presented several diagrams in explaining results obtained in the research program of the Polar Meteorology Branch of the Weather Bureau as follows:-

- (i) The total annual sensible heat transfer between the air and sea or sea ice. In general this showed a transfer from the atmosphere to the sea between 45°S and 55°S over the South Atlantic and Indian Oceans, between about 50°S and 60°S over the Southeast Pacific Ocean, and between about 55°S and 60°S over the Ross Sea. At other latitudes over the same sections of these oceans the transfer was in the reverse direction.