### Proposed Co-operation Between United States and Germany In Study of Atmosphere About Tropics.

Boston, Jan. 10.—One of the greatest of the unsolved problems of meteorology is concerned with the permanent circulation of the atmosphere, especially in the higher reaches in altitudes greater than 15,000 feet. The surface currents, including the steady trade winds of the tropics, have been pretty thoroughly studied; but just what takes place in the upper air has still been rather guessed at than discovered. In the tropics on either side of the equator there are supposed to be great anti-trade currents flowing above the trade winds and in an opposite direction, while in the north temperate zone peculiar conditions of temperature and directions of air currents have been discovered that have led many scientists to conjecture that great masses of warm air rise about the equator and roll off in constantly descending and cooling streams toward the two poles.

In support of such a hypothesis the scientists bring forward the well established fact that the air does not grow steadily colder at the rate of one degree Fahrenheit for every 183 fect of vertical ascent, as we were taught in our physical geographies at school, but that there are warm strata even up in the region of, eternal cold. This phenomenon has been noted frequently in the kite-flying experiments at the Blue Hill observatory, the meteorological station of Harvard university, situated a mile Boston, Jan. 10 .- One of the greatest

region of eternal cold. This phenomenon has been noted frequently in the kite-flying experiments at the Blue Hill observatory, the meteorological station of Harvard university, situated a mile south of Boston. In the opinion of most authorities, however, the problem of such seeming irregularities can be settled only in a manner proposed by Mr. A. Lawrence Roth, the director at Blue Hill, who was able, moreover, at the recent meeting in Washington of the American Association for the Advancement of Science to present a definite proposition from the German government for international cooperation in study of meteoric conditions in the middel Atlantic about the equator.

The Germans, Mr. Roth then announced, have agreed to furnish a ship equipped for a three months' cruise in the tropks on condition that American scientific men provide the necessary apparatus and pay certain of the incidental expenses. The total cost to the people on this side of the water would notexceed \$10,000, and although Mr. Roth addmitted frankly that no one can foretell with assurance that the results of the expedition would be of commercial, or even scientific valuesince it is a case of venturing into an entierly unexplored field—hels personally confident that great benefit will come to the weather service of the whole world if it can be discovered accurately just what goes on above the tropical trade winds.

It is a theory of Mr. Rotch's that between the trade winds and the antitrade intervenes an interval of comparatively still air. This is by no means absolutely certain, but it is accordance with conditions discovered in the kite-flying experiments at Blue Hill observatory; and, if found, it will justify Mr. Rotch's contention that the most feasible means of exploring the higher atmospheric levels about the tropics is through use of kites flown from a movabel base.

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mospheric levels about the tropics is through use of kites flown from a movabel base.

It is indeed upon the kite that the American scientists will chiefly rely if the proposed expedition takes place; though the rubber balloon employed for similar research by Dr. Assman of Berlin will also undoubtedly be used. The limitations of the balloon, however, are so manifest that it will scarcely supplant the "Hargrave" and "Lansom" high fliers. It can be sent to great heights but it cannot be maintained there for purposes of continuous observation. Furthermore, theh unt for the meteorological instruments which are released from it by parachutes—over a circle of 20 or 30 miles radius—over a circle of 20 or 30 miles radius—is an annoying feature of the sport on land, and will be likely to constitute a very serious objection by sea. As for the paper balloons which the French meteorologists still use, their case is even worse; they do not burst, like the German balloon, on attaining a certain altitude, but drop slowly, drifting sometimes 100 miles before they reach earth.

Over both these methods, therefore,

Over both these methods, therefore, the kite has decided advantages. Kites have been sent to the height of three miles at the Blue Hill observatory, and by working from a movable base Mr. Rotch is confident that he can go higher yet, for the most serious drawback in flights from the land is that above the surface winds one ordinarily encounters deep strata of stagmant air above the surface winds one ordinarily encounters deep strata of stagnant air through which the kite will not rise. By utilizing the onward pull of a moving yessel it has been shown that the kite can be drawn through this quiescent layer into the next windy tract. A further advantage is that if the direction of this upper current proves to be opposite to that of the surface wind the ship can nake e turn to accommodate itself to thee harged conditions, and that if any preede proves too stiff for the kite the vessel can be steered slowly in the direction of the air current, thus virtually modifying its velocity.

rent, thus virtually modifying its velocity.

This use of kites on shipboard is not a matter of mere theory, however. It has already been pretty thoroughly tested on the sea route from Boston to Liverpool, on one of the Dominion Line steamships. The methods adopted and the results secured have been described in a paper by Mr. Rotch published in the recently issued report of the Smithsonian institution. The facts are certainly interesting enough to bear sumtainly interesting enough to bear sum-

Mr. Rotch and his assistant, Mr. Sweetland, installed a huge kite reel on the stern of the steamer Commonwealth on August 28, 1901, and made the wealth on August 28, 1901, and made the first recorded exploration of the mid-Atlantic atmosphere. On the five of the eight days occupied by the voyage they were able to raise the kites, though the breezes were so light that the ship's speed of 16 knots an hour had to be utilized to cretae an east wind sufficient to lift the kites to the height of 2,000 feet. With larger kites and stronger wire this could easily have been exceeded. Automatic records were taken of harmonic pressure, air temperature. of harmonic pressure, air temperature,





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continuously the velocity of the wind; an alcohol thermometer, the liquid of which as it contracts or expands con-stantly alters the curvature of the tube itself, and thus furnishes a second continuous record; a hygroscope, consist-ing in essence of a bunch of human hairs which lengthen in moist air and shorten in dry, thus revealing the rel-ative humidity of the atmosphere; and a tive humidity of the atmosphere; and a barometer which records the heights of Guinea to the Azores, avoiding proximations made trigonometrically at the sea level station. These last are, of course, performed with greatest accuracy, the error caused by sagging of the line having been calculated to a nicety. All changes in direction of the wind are also minutely recorded by the shift of the wire at the windlass. The deck of a vessel, it should be noted, offers especially good vantage ground for sea especially good vantage ground for sea level observations contemporaneous with tose of the instruments aloft in

wire this could easily have been exceeded. Automatic records were taken a vessalt in should be noted, ofter a contemporaneous ty. No especially noteworthy discovered to the flight and the emperature of the flight with the content and the region treversed is not especially interest to explore the upper currents and the region treversed is not especially interest to explore the upper currents and the region treversed is not especially interest to explore the upper currents and the region treversed is not especially interest to explore the upper currents and the region treversed is not especially interest to explore the upper currents and the region treversed is not especially interest to explore the upper currents and the region treversed is not especially interest the super current depths should not be made, it is pretty to the fights the air was found actually to be six degrees warm, and the pretty of the great equatorial air currents.

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Rerving as a leader followed by two or more of the steadier Hargraves.

The string employed in steel plano wire, which was long ago found in deep sea soundings to be of great strength and very slight liability to sagging. A steam winch, a modification of Lord Kelvin's steam power windlass for sea soundings, is placed on the stern of the vessel. This works almost automatically, for the pull of the kite suffices to unwind the drum; only when drawing the kite in does the observer have to resort to steam power. An automatic register keeps account of the length of the wire paid out and the pressure exerted, facts necessary to be known in order that the tandem may not break loose.

The self-recording instruments are all included in a so-called meteorograph, a compact lanter-shaped carrier which contains an anemometer that records continuously the velocity of the wing; and shelp thermometer that records angles to the southeast and southwest monsoons. As they turn again toward angles to the router of string forth, and would be inclined to follow the titner-ary suggested by Prof. H. H. Hildebrandson of Upsala, who would have him start from the Azores Islands of the randson of Upsala, who would have him start from the Azores Islands of the kite suffers observations of the clouds and for kite soundings. The party would proceed thence to Tenerliffe by way of Maderia, through an ocean tract where the anti-trade is always in evidence, since it dips in some places as low as 6,000 feet. After a stay in the neighborhood of Tenerliffe they will go south past the Cape Verde Islands to the doldrums, and thence westward to the southeast and southwest monsoons. As they turn again toward Africa some curious phenomena will demand their attention. South American coast, running at right angles to the southeast and southwest monsoons. As they turn again toward Africa some curious phenomena will demand their attention at Mauritius, where the upper winds are regularly from the northwest against the son heast trade. On Ascension Island they will send up a balloon without instruments to the greatest possible height, in order that its drift may be accurately observed. Thence return will be ly observed. Thence return will be made past the calms that lie southwest

Guesses at the world's age differ widely. Sir Edward Fry points out that the physicist, reasoning from the dissipation of the earth's heat, the con-





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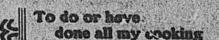
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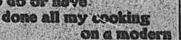
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