ant at Penewawa ferry, as the stage-driver testifies, between one and two o'clock P. M., when he left the hotel and drove up the canyon. Suddenly the sky clouded over, and the storm burst on the hills soon after he passed. The ocean wind from the west, laden with its invisible vapor, met the mountain winds sweeping down from their cold, snow-clad summits, into the warmer basin below, forming circuits of greater or less extent, cooling air and vapor, producing mists and cloud masses, rolling them onward in vast whirls, growing colder and colder, until the air, unable to hold up its enormous burden of vapors rushing together like waters in a funnel, let the mighty mass drop upon the nearest and coldest hills.

A very intelligent gentleman, who was traveling in Southern California, near Arizona, in 1878, describes a water-spout which he witnessed about mid-day in that hot and treeless desert. It was in early summer. The mercury stood over 100° Fahrenheit. Not a cloud or wisp of vapor visible. The ground was parched. The air was sultry and oppressive. The first notice of change was a cloud-speck moving rapidly, enlarging, overcasting the sky, whirling in great volume until it poured an immense quantity of water from its inverted, cone-shaped reservoir, scattering and almost drowning a camp of Indians in its path, and filling the valley with its torrent. In an hour it was all gone. The sun shone out again, and soon the earth became dry and parched as before.

Its phenomena is explained by the sea wind and cold mountain wind rushing towards the same heated basin, like cold air from various quarters into a hot room, forming a circuit, converging to a focus, condensing the invisible vapor into cloud mists, and then into torrents of rain.

This result is liable to occur in every heated basin, rimmed by a chain of high, cold mountains. On broad plains or prairies like those of the Mississippi and Missouri valleys, the rushing air currents take the form of tornadoes. On the ocean they appear in the vaster sweep of hurricanes, with winds converging to the center of the storm, rolling up the mountain waves, amid the wildest gleams of lightning and crash of thunders, and downpour of torrents of condensed vapors. Heat is the one cause of the ascent of those invisible vapors, and heat is the one cause of the rush of winds from all directions to the heated centre, cooling and condensing those vapor-laden winds, producing dews, fogs, gentle rains, violent storms, tornadoes, water-spouts and hurricanes.

Prof. Brocklesby remarks that, "It is by no means uncommon for several water-spouts to appear at the same time. In May, 1820, Lieutenant Ogden beheld, on the edge of the Gulf Stream, no less than seven in the course of half an hour; varying in their distance from the ship from two hundred yards to two miles."

He adds: "It is a common belief, *that water is drawn up by the action of the spout into the clouds;* but there is no proof whatever, of a continuous column within the whirling pillar, and the fact that the water which sometimes falls from a spout upon the deck of a vessel at sea, is always fresh, sufficiently refutes the idea. The torrents of rain, by which this phenomena is often accompanied, can be fully accounted for by the rapid condensation of vapor that occurs when the warm humid air of the sea flows inward to the vortex of the whirl, and there combines with the cold air of the upper regions of the atmosphere, which descends to fill the partial void."

Prof. B. also remarks that: "*Rain is produced by the rapid union of two or more volumes of humid air, differing considerably in temperature;* the several portions *in union* being incapable of holding the same amount of moisture that each can *separately* retain. This circumstance results from the law, that the capacity of the air for moisture decreases at a faster rate than the temperature.

"This effect may be thus illustrated: 4,000 cubic inches of air, at the temperature of 86° Fah., can contain no more than 31½ grains of moisture, and an equal volume, at 32° Fah., only 7⅞ grains. Now, if the two volumes are mingled together, their average temperature will be 59° Fahrenheit, and the weight of moisture they unitedly possess will be 39⅜ grains. But, at this temperature, 31½ grains is all the moisture that 8,000 cubic inches of air can *possibly* retain; since the *first portion*, by its union with the *second*, diminished its capacity *one-half*, while that of the latter was only *doubled*. The excess, therefore, of 7⅞ grains, will be condensed, and descend in the form of water."

This plain statement of the examples and the law of the condensation of vapors in the air, found in Prof. Brocklesby's Elements of Meteorology, (A. D. 1849,) pages 71-2-4, agree with the facts which we see in the dews, fogs, clouds, showers, storms, and water-spouts.

His estimates of the power of the air to hold invisible vapor, and of the law of condensation, published in 1849, agree with the tables published by Dr. E. Smith, of London, published in 1873, and re-published in New York in 1876.

EXAMPLE.

The following example of the effect of a water spout in Los Angeles county, Southern California, is given by O. F. Sites, Esq.:

In the San Fernanda valley—about twenty miles long and ten miles wide—the torrent of water from one water-spout, or cloud-burst, as it is often called, tore a channel, or ravine, about twenty or thirty feet deep and one hundred feet wide nearly the whole length of the valley. Dr. Burbank, who had a sheep ranche covering a portion of the valley, could not cross to his nearest flock for several days, on account of this torrent. It soon ran dry as before, leaving this long deep gulch as witness of its force in cutting away the valley. This vast amount of waterfall upon that dry plain is proof of the greater amount suspended in that heated air, and liable to be condensed at any time by the chilly mountain winds meeting the vapor laden ocean winds.

Such an example is also in proof of the value of grain fields, vineyards, orchards, shade trees and timber groves as slow condensers of moisture, producing dews, mists, showers and regular annual harvests.

AMOUNT OF WATER HELD IN VAPOR AND LIABLE TO CONDENSATION.

According to these tables a column of air ten feet square, 1,000 feet high, saturated at 32° Fahrenheit, contains 3⅛ gallons. The same column, 5,000 feet high, contains 18 gallons. A column covering an acre, 1,000 feet high, at 32°, holds, if saturated, 1,568 gallons; and the same column, 5,000 feet high, holds 7,940 gallons. A column ten feet square and 1,000 feet high,