

ADDITIONS to the Article, Of Irregular Winds, Water-spouts, &c. vol. i. p. 386.

I.

Of the Violence of the South Winds in some Northern Countries.

THE Russian voyagers have remarked, that, in the entry to the territory of Milim, there is, on the left of the river Lena, a great plain entirely covered with overturned trees, and that all these trees lie in a direction from south to north for an extent of several leagues; so that the whole district, formerly covered with trees, is now strewn with dead trunks in the above direction from south to north. This effect of the south winds has likewise been observed in other northern regions.

In Greenland, and particularly in the autumn, the winds are so impetuous, that the houses are often shaken to pieces, and the boats and tents carried up into the air. The Greenlanders even assure us, that, when they go out to secure their boats, they are obliged to creep on their bellies,

bellies, lest they should become the sport of the winds. The most violent tempests come from the south, turn to the north, and then terminate in a calm. It is on these occasions that the ice in the bays is raised from its bed, and dispersed in small portions over the ocean*.

II.

Of Water-Spouts.

M. De la Nux, whom I have often quoted, and who lived forty years in the isle of Bourbon, has had an opportunity of seeing a great number of water-spouts, and he has communicated to me his observations, of which the following is an abridgment:

The water-spouts observed by M. de la Nux were formed, 1. In calm days, and in those intervals when the wind passes from the south to the north; though he saw one, which was formed previous to this passage of the wind from one quarter to another, and even in the current of a north wind, *i. e.* a pretty long time before this wind had ceased: The cloud from which this water-spout depended, and to which it was attached, was still violently driven to the south.

* Hist. Gen. des Voyages, tom. xviii. p. 22.

The sun, at the same time, was seen behind the cloud to the south. It happened on the 6th day of January, about eleven o'clock before noon.

2. These water-spouts are formed during the day in detached clouds, apparently very thick, much longer than broad, and well defined below in the direction of the horizon: The under part of these clouds is always very black.

3. All these water-spouts at first appear under the form of inverted cones, whose bases are more or less extensive.

4. Several of those water-spouts that appear under the figure of inverted cones, are sometimes attached to the same cloud; some are never entirely completed; some are dissipated at a small distance from the cloud; and others descend apparently very near to the surface of the sea, under the form of a long flat cone, which is narrow and pointed at the bottom. In the centre of this cone, and through its whole length, there is a whitish transparent canal, about one-third of the diameter of the cone, the two sides of which were very black, especially on their first appearance.

These water-spouts were observed from a point in the isle of Bourbon elevated 150 fathoms above the level of the sea, and they were generally three, four, or five leagues from the place of observation, which was the house of M. de la Nux.

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The following is a more particular description of these water-spouts:

When the end of the shaft, or top of the cone, which is then very sharp pointed, has descended about a fourth of the distance of the cloud from the sea, we begin to perceive on its surface, which is commonly calm and of a transparent whiteness, a small black circle, which is produced by the agitation and whirling of the water: In proportion as the point of this shaft descends, the water boils; this boiling increases in proportion as the point approaches toward the surface, and the water of the sea rises in successive whirlings to a greater or smaller height, which, in the largest water-spouts, is about twenty feet. The end of the shaft is always above this whirling, the size of which is proportioned to that of the water-spout, which puts it in motion. The end of the shaft seems not to touch the surface of the sea, otherwise than by joining itself to the boiling or whirling which rises to meet it.

We sometimes see larger and smaller cones of water-spouts proceeding from the same cloud; some of them have the appearance of threads, and others are much larger. We often see ten or a dozen of small but complete water-spouts issuing from the same cloud, most of which are dissipated near their exit, and visibly ascend to the cloud. In this last case, the shaft suddenly

swells as far as the inferior extremity, and appears like a cylinder suspended from the cloud, torn in pieces below, and of a small extent.

The water-spouts with broad bases gradually enlarge through their whole extent, and likewise in the under end, which seems to recede from the sea and to approach the cloud. The agitation and whirling they produce in the water gradually diminishes, and the under part of the shaft soon enlarges, and assumes nearly a cylindrical form. It is in this state that the two sides of the canal widen; and we then see the water rushing with rapidity, and in a spiral form, into the cloud. Lastly, the appearance of the water-spout terminates by the successive shortening of this species of cylinder.

The largest water-spouts remain longest without dissipating; and some of them continue more than half an hour.

A torrent of rain generally rushes out of the same part of the cloud from which the water-spouts issue, and some of them not unfrequently still adhere to the cloud; these torrents of rain often conceal water-spouts before they are dissipated. I perceived distinctly, M. de la Nux remarks, on the 26th of October 1755, a water-spout in the middle of one of these torrents, which became so great that it was soon concealed from my view.

The wind, or the agitation of the air below
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the cloud, breaks neither the large nor the small water-spouts; for this impulsion only declines them from the perpendicular. The smallest kinds form very remarkable curves, and even sinuosities. The extremity which terminates in the sea is often far removed from the direction of the other which is attached to the cloud.

We never see new water-spouts formed after rain has fallen from the clouds which produced them.

'On the 14th day of June 1756, about four o'clock afternoon, I was,' says M. de la Nux, 'on the margin of the sea, and above its level twenty or twenty-five feet. I saw twelve or fourteen water-spouts issue from the same cloud. Three of them only were considerable, and particularly the last. The canal in the middle of the cylinder was so transparent, that, as the sun shone, I saw the clouds behind it. The cloud which produced so many water-spouts extended nearly from south-east to south-west; and the large water-spout under consideration appeared in the south-south-west from my station. The sun was very low; for the days were then about the shortest. I saw no rain proceed from the cloud: Its height seemed to be from five to six hundred fathoms.'

The more the sky is obscured with clouds, water-spouts, and the phenomena which accompany them, are the more easily observed.

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M. de la Nux thinks, and perhaps with reason, that water-spouts are nothing but viscous portions of a cloud driven off by different whirlwinds, *i. e.* by the whirlings of the superior air sinking into the mass of vapours of which the whole cloud is composed.

What seems to prove that these water-spouts are composed of viscous parts, is the tenaciousness of their cohesion; for they make inflections and curvatures in every direction, without breaking: If the matter of water-spouts was not viscous, how can we conceive that they should, without breaking, bend and obey the motion of the winds? If all the parts did not firmly adhere, the wind would dissipate them, or, at least, make them change their form. But, as the form both of the large and small water-spouts is uniformly the same, this is almost a certain indication of the viscous tenacity of the matter of which they are composed.

Thus the basis of the matter of water-spouts is a viscous substance contained in the clouds, and every water-spout is formed by a whirlwind of air pressing through the mass of vapours, and, by blowing up the inferior part of the cloud, pierces it, and descends with its covering of viscous matter. And, as complete water-spouts descend from the cloud to the surface of the sea, the water must boil and whirl at the place to which the end of the water-spout is directed; because

because the air blows from the extremity of the water-spout like the tube of a pair of bellows. The effects of this blowing upon the sea will augment, in proportion as the cylinder approaches the surface of the water; and, when the orifice of the tube enlarges, a greater quantity of air is permitted to escape, and the agitation of the water is, of course, increased.

It has been imagined, that water-spouts carried off and contained great quantities of seawater: The rains, or rather the spray, which often fall in the neighbourhood of water-spouts, have strengthened this prejudice. The canal in the middle of every species of water-spout is always transparent, on whatever side it is viewed. If the water of the sea seems to rise, it is not in this canal, but only on its sides. Almost every water-spout suffers inflections, and often in opposite directions, in the form of an S, the one end of which is in the cloud, and the other in the sea. Hence these water-spouts of which we have been treating, cannot contain water either to be poured into the sea, or raised to the cloud. Of course, they can be attended with no danger, except what proceeds from the impetuosity of the air which escapes from their inferior orifice; for we are assured by every person who has had an opportunity of observing these water-spouts, that they are solely composed of air confined in a viscous cloud, and determined

terminated by its whirling to the surface of the sea.

M. de la Nux has seen water-spouts around the isle of Bourbon in the months of January, May, June, and October, *i. e.* in all seasons of the year. He has seen them in calm weather, and during the highest winds. These phenomena, however, may be said to be rare, and seldom appear but upon the sea; because the viscosity of the clouds can only proceed from the bituminous and greasy particles raised, by the heat of the sun and the winds, from the waters of the sea, and collected in the clouds near its surface. It is for this reason that water-spouts seldom appear on land, where there is not, as on the surface of the sea, a sufficient quantity of bituminous and oily particles to be exhaled by the action of the sun. They are sometimes, however, observed on land, and even at great distances from the sea; this effect may be produced, when viscous clouds have been rapidly driven by a violent wind from the sea toward the land. M. Grignon, in the month of June 1768, saw a well-formed water-spout in Lorrain, near Vauvillier, among the hills, which are a continuation of the Vosges. It was about fifty fathoms high. Its form was that of a column, and it communicated with a large thick cloud. It was impelled by one or several winds, which made the water-spout turn rapidly; and it produced lightning
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and thunder. This water-spout continued seven or eight minutes only, and broke upon the base of the hill, which is from five to six hundred feet high*.

Water-spouts have been mentioned by several voyagers; but no man has examined them with such accuracy as M. de la Nux. For example, these voyagers tell us, that, when water-spouts are forming, a black smoke rises on the surface of the sea: This appearance, we are certain, is deceitful, and proceeds solely from the situation of the observer. If he is placed on a situation so elevated that the distance of the whirling excited in the water by the spout, exceeds not his sensible horizon, he will see nothing but the water rising and falling back in rains, without any mixture of smoke. This fact is apparent when the sun shines on the place where the phenomenon happens.

These water-spouts have nothing in common with those agitations and smoke sometimes produced by submarine fires, and of which we have formerly treated. Water-spouts neither contain nor excite any smoke. They are every where rare: They are most frequent in the seas of warm climates, and where, at the same time, calms are common, and the winds are most inconstant. They are likewise more frequent, perhaps, near islands and coasts than in the open sea.

* Note communicated by M. Grignon to M. de Buffon, Aug. 6. 1777.