June 1805.

Circulation between the Ocean, the Clouds & the Mountains.

It has always struck me as something strange, or in other words, it has impressed me with something bordering on wonder; that, during the long space of the seven & twenty centuries wherein the memory & learning of man-kind have been exercised, there has not been found one Secretary of Nature sufficiently instructed to give us a complete history of the "ascent of vapours from the Ocean, their suspension in the air, the "formation of clouds, — of snow — and of the descent of rain, with a con-"-nected chain of causes." Des Cartes, Nieuwentyte — Halley and Hunter & a few others, have amused the public with their hypothetical theories on this subject; but which of the theories is not encumbered with difficulties? What facts & reasonings we have on this sublime part of terra-queous nature, are mere fragments widely scattered. — The phe-nomena in these lofty regions of the air have been rather terrific objects to purblind superstition, yt. instructive appearances to sober philosophy.

The never ceasing circulation of water between the ocean and dry ground has been contemplated from the earliest ages with grateful admiration; but not being altogether an object of sight, has been ranked among the inexplicable works of Deity —

The clouds dispensing refreshing showers of rain on the dry and thirsty ground; the flow of rivers, with their long train of beneficial consequences, could hardly escape the notice of any thinking being in every age of the world.

WE

We accordingly find the supply of water frequently mentioned, in the oldest book we have, among the most wonderful, as well as valuable of Heaven's blessings.

Seeing the earth covered annually with a rich & beautiful carpet of vegetables, and these surprizingly diversified & variegated, & gradually developing "between from seed time to harvest time", must have led those of antient days, to recognize the proximate cause, the warmth of the Sun, and the moisture from the clouds; and these again to ~~the~~ an acquaintance with that perpetual circulation, between the ocean & the mountains, through the instrumentality of the ~~mountains~~ atmosphere, air and by the medium of rivers to the ocean again. But the philosophy, or explanation of this vivifying phe-nomenon is spoken of as past finding out. They did then, as we do now, carry our investigations as high as we can, as in the case of gravitation, and beyond that principle say, with them, "it "is the hand of God;" an expression denoting only the last term of our analytical results. Unable to investigate the essence of light and of fire, the Deity was called by the name of these inexplicable agents.

In those early days, when the knowledge of Nature was confined to narrow limits, they like our Indians,

"Saw God in clouds, and heard him in the winds."

Hence they stiled the Deity "the father of the rain", and represented Him as "calling forth the waters of the sea, & pouring them down according "to the vapour thereof." whence we infer, they believed the water rose in the form of vapour from the ocean; and that it became freshened

in its passage through the air: and it moreover appears, that they were sensible that this process was regularly & perpetually performing, for they remarked that "altho' all the rivers run into the sea, yet
" was the sea not full; unto the place whence the rivers came, thi-
" -ther they return again." They seem also to have known that Mountains made a part of this Grand Apparatus, and to have believed that it was not a fortuitous or casual process, but regulated, as we now find it, by weight & measure. — May not this be inferred from that sublime question of Isaiah — "who
" hath measured the waters in the hollow of his hand, and the
" mountains in scales?" — This is an allusion to the balancing of the clouds —

altho' the antients discovered this magnificent ap-
-paratus, and saw its effects, yet were they restrained by a re-
-ligious awe from attempting the investigation of it; because storms, lightning & hail were conceived to be the precursors of the chariot of the Deity! — "who maketh the clouds his chariot — "who walketh on the wings of the wind," — accompanied with "hail stones" and "fire!". — For this reason probably, the ori-
-gin & course of the winds, "whence they go, come, and whither
" they go", were deemed mysterious. Hence, instead of investigating the cause, their pious minds, overwhelmed with awe, sunk into undiscerning amazement! Under such impressions, I cease to wonder that he who wrote that antient Drama, the book of Job,

puts

puts among the most difficult of his questions that which demands an ex-
-planation of "the balancing of the clouds". But shall not we, who are happily freed from the terrors of the Mosaic as well as Pagan systems; and who enjoy the encouraging intellectual scheme of Christianity, which, never forgetting Deity, postpones every thing corporeal to the primary mental cause, — shall we not, I say unite our efforts to fill up that blank left in the Science of Nature by the antients? And as man, who is the servant and interpreter of nature, can act & understand no farther than he has, either in operation, or in contemplation, observed of the order of Nature, let us commence a patient observation of the ordinary & extraordinary phenomena that occur in this scene of wonders, the atmosphere; and then collect those fragments of knowledge, widely scattered through the world, on the same subject.

Some men seem destined to observe & record insolated, or naked facts; while others, of a superior genius follow after & apply them. Some future genius Franklin may do with these desiderated facts what Newton did with those collected by Kepler & Galileo, and therewith form a system, which may teach us to bridle even the winds & render them farther subservient to human uses. (May we not hope that — 2 leaves forward

[Altho' many of the operations going forward in the Atmos-
-phere may have some links that have hitherto escaped the most inquisitive eyes, and others, though seen, may not be fully understood, still we ought not to be discouraged. These detached links will one day be united, and form a part of the great chain of natural causes, adding still stronger proofs of that Unity of design wc pervades the great Temple of Nature.] Transcribed 3 pages forward —)

We mentioned in our last the theory of Dr Halley and related the experiments on which he grounds it. Upon his calculation we found that the Mediterranean would afford in one Summer's day five thousand two hundred & eighty millions of tons of water in the form of vapour. This suppose that the water of the ocean must be divided & raise by heat; and that the source of this heat must be the Sun. But this theory however plausible, does not seem adequate to explain the whole process. — We believe that it is in a great degree owing to a chemical process. as thus — This transparent fluid wc surrounds our globe is the most universal & most powerful menstruum in all nature ["menstruum", as a barbarous word introduced by the old Chemists, & means no more yn a solvent, or desolver] thus water desolves salt; water therefore is a menstruum to salt. It is a pretty general law in Chemistry that a thinner fluid desolves a thicker. Now air wc is the thinest and most sable of all fluids, except fire, will desolve every thing, and water among the rest.

Now water as well as air will desolve just so much of a thing and no more. [e.g. ℥vj of water will dissolve ℥j of Salts and no more. When the water has taken up as much salts as it can contain & remain transparent, it is then said to be saturated; but if you add more salt, it will not be able to hold it in

in solution, but it falls to the bottom of the vessel, and then the menstruum or liquid is said to be supersaturated — Now the waters of the Ocean being in contact with the air, and both constantly shook together by the winds, the air dissolves the water. But air like all other menstrua, can dissolve so much water & no more without being turbid, or what is called cloudy or foggy. If more & more water be added, that is more vapours crowded into it, the air becomes supersaturated — i.e more yr. enough, it lets go the superabundant water, in the same manner the salt did, & the water falls in drops from the clouds, in the form of rain. If this be true, cannot we account for the ascent of water from the ocean; its leaving the salt behind, its floating in the form of clouds, & its final seperation, or precipitation in the form of rain? Or cannot we mix both hypotheses together? for we know that heat encreases the solvent power of every menstruum. The three elements fire - air & water are nearer allied than is commonly imagined. We have seen in the early part of our course that the whole mass of waters in the sea, was in fact an ocean of fire, seeing there are not two distinct drops of water w.c do not owe their fluidity to fire; because it looses its fluidity & returns to ice when fire leaves it. If water cannot exist, as it certainly cannot, without fire; - fire cannot exist without air. I am of opinion that

they

they are modifications of the same element. I believe that air is the offspring of water – fire of air – and from these last springs light. If this be true, it strengthens the antient doctrine of Thales; and reflects fresh glory on the father of poetry, who calls Oceanus the visible parent of Nature. It appears however that the Sun is the Rector, or Moderator of the whole.

We have taken some pains to explain this grand circulation between the Ocean & vegetation. It is an unceasing process, but passes without notice, because it is not an object of sight. We have been long collecting arranging and applying these facts, because we could refer you to no book, containing this System. You may find the scattered fragments, the links, but not the chain. Not that we would insinuate that we have exhibited one connected chain. We discern some links connected here & there, & we guess at the rest. Altho' many of the operations going forward in the atmosphere may have some links that have hitherto escaped the most inquisitive eye, & others tho' seen, may not be fully understood, still we ought not to be discouraged. These detached links will one day be united & form a part of the great chain of natural causes, adding still stronger proofs of that Unity of Design, w.h connects the Great Temple of Nature, forming altogether a beautiful & harmonious whole. Before we quit

Before we quit entirely this scene of wonders, the Atmosphere, we must add one remark — When we consider the innumerable animals, small & great, that are every moment dying on the face of the earth, it would naturally lead us to conclude that the putrid particles flying off from these rotten bodies would render the air of our Atmosphere unfit for the purposes of breathing, & that plagues & other mortal diseases must follow; and that the older the world grew, the air surrounding it, would become more & more putrid & offensive to life; and that it must of course shorten the period of animal existence, and that mankind must finally be exterpated, by this cause, from the face of the earth; and I wonder this has not been more insisted on by antient theorists, as the mean of shortening the life of man in these latter days.

But if you bear in mind what has been said in the course of these Lectures, you will see that the Parent of Universal Nature has provided a constant remedy against this encreasing evil; and this remedy is growing vegetables, and the agitation of the Ocean by winds. These afford a constant supply of dephlogisticated, empyreal, or vital air; or oxygen gas — for they all mean the same thing. A growing vegetable, while the Sun shines on it distils this salutiferous air from the upper or varnished side of the leaf; while the under or rough side imbibes the putrid matters, in the Shade. The

the great fountain of all the waters of the globe & its atmosphere, the Ocean is kept sweet by a process that is in most respects similar. With what different eyes & feelings do differently informed youths view the ~~magnificent Temple of Nature~~! Great Book of Nature.

Nature with open volume stands
To spread her Maker's name abroad,
And every product of her hands
Shews something worthy of a God!

May we not hope that ~~future industry~~ some distinguished genius, may enable future industry to erect a solid & beautiful edifice, eminent both for its simplicity and utility, as well as for the permanency of its materials, — which may not moulder, like the structures already erected, into the sand of which they were composed; but which may stand unimpaired, like the writings of ~~Aristotle~~ the holy scriptures, a rock amid the waste of ages. (See Preface to American Ed. of Dadson),