strange sights were revealed to the wondering fishermen who lived along that shore.

Wrecks of forgotten ships were to be seen half buried in the ooze and slime of a bottom which had remained sea-covered for cen turies. Old anchors were disclosed to view, with the broken cables attached to them, on which the lives of many gallant men had once depended, so that every parted strand seemed the record of a lost life. And crawling things and stranded fish showed how far the great sea had retreated within its ordinary bounds. We may, therefore, expect that results well worth noting will under any circumstances accompany the tidal action of October 6th, on which day the effects of the conjunction of the sun and moon on October 5th will be most strikingly manifested.

But our object at present is less to consider the effects of the great tidal wave of October 6th, than to dwell upon some interesting effects and peculiarities of tidal motion. When we learn that astronomers for the most part recognize in the tidal wave a cause which will one day reduce the earth's rotation so effectually that instead of twenty-four hours our day will last a lunar month—while many astronomers believe that the same wave will at a yet more distant day bring the moon into collision with our globe—it will be seen that the laws of the tides have a cosmical as well as a local interest. They involve more important considerations than whether the water in the Thames will rise a foot or two higher than usual at Vauxhall Bridge on any particular day. And though many thousands of years must elapse before either of the events looked forward to by astronomers shall have happened, yet we cannot but look with deep interest into the long vista of the coming centuries. To the astronomer, at any rate, the study of what will be, or of what has been, is as interesting even as the study of what is.

But at the very threshhold of the inquiry we are met by the question, "do any of us know the law of the tides?" The reader may be disposed to smile at such a question. Does not every book of geography, every popular treatise on astronomy teach us all about the tides? Cannot every person of average education and intelligence run through the simple explanation of the tidal wave?

Certainly it is so. Most of us suppose we know in a general way (and that is all that we at present want), how the moon or sun draws a tidal wave after it. The explanation which nine hundred and ninety-nine (at least) out of every thousand would give runs much in this wise. Being nearer to the water immediately under her than to the earth's centre the moon draws that water somewhat away from the earth; and again, being nearer to the earth's centre than to the water directly beyond, the moon draws the earth away from that water. Thus, underneath the moon a heap of water is *raised*, and at the directly opposite point a heap of water is left (so to speak). So that were it not for the effects of friction, the water would assume a sort of egg-shaped figure, whose longest diameter would point directly towards the moon.

And not only is this the explanation which is invariably given in popular treatises, but scientific men of the utmost eminence have adopted it, as correctly exhibiting the general facts of the case. Recently, for example, when Mr. Adams had published his proof that the moon's motion is gradually becoming accelerated in a way which the lunar theory cannot account for Mr. Delaunay, a leading French astronomer, endeavored to prove that in reality it is the earth's rotation which is diminishing instead of the moon's motion which is increasing. He thought the tidal wave, continually checked by the earth's friction as it travels against the direction of her rotation, would act as a sort of 'break,' since its friction must, in turn, check the earth. And in discussing this matter, he took, as his fundamental axioms, the law of tidal motion commonly given in our books of geography and astronomy. This presently called up the Astronomer Royal, who gave a very clear and convincing demonstration that there would always be *low* water under the moon, if there were no friction.

But this is not all, nor is it even the most remarkable part of the case. Eminent as the Astronomer Royal deservedly is, and especially skilful as we know him to be in questions such as the one we are considering, yet if he were *solus contra mundum*, we might readily believe that there was some flaw in his reasoning since, as every one knows, the most eminent mathematicians have sometimes misconceived the bearings of a perplexing problem.

But, as Mr. Airy himself pointed out, Newton and Laplace were both with him.

How is it that the views of Newton and Laplace, admittedly the very highest authorities which could be quoted, have found no place in our treatises of astronomy? Their views have never been disproved. In fact, as we have seen, one of the most eminent of our mathematicians, in re-examining the question, has come to precisely the same conclusion. Can it be that the explanation actually given is preferred on account of its greater smiplicity? That would be reasonable, if the two explanations were accordant, but they happen unfortunately to be wholly opposed to each other, and therefore one of them must be false. Those who teach us our geography and astronomy ought to look to this.

The worst of it is, that the most of consequences which astronomers ascribe to the action of the tidal wave depend on the choice we make between the rival theories. If the ordinary view is right, the moon's motion is continually being hastened by the attraction of the bulging tidal wave, and this hastening will bring the moon into a smaller and smaller orbit until at last she will be brought into contact with the earth, unless, as Professor Alexander Herschel suggests, she should crumble under the increased effects of the earth's action, and so come to form a ring of fragments around our globe. If, however the other view is right, the moon's motion will be continually retarded, her orbit will gradually widen out, and some day, presumably, we shall lose her altogether. This retarding and hastening refer to the rate at which the moon completes her revolutions round the earth. As a matter of fact, paradoxical as it sounds, it is a continual process of retarding which eventually hastens the moon's motion. Every check on the moon's motion gives the earth an increased pull on her, and this pull adds more to her velocity than she lost by the check. And *vice versa*.

Again, if the views commonly given are just, the earth's friction should cause the tidal wave to lag behind its true place. But if Newton, Laplace, and Airy are right, then, to use the words of the last-named astronomer, 'the effect of friction will be to accelerate the time of each individual tide.'

We apprehend that there is room for improvement in the current account of the tides. Many eminent men, as Whewell, Lubbock, and Haughton, have discussed in the most elaborate and skilful manner the laws according to which the actual tidal wave travels along the great sea-paths. But as yet no one has tried to reconcile the theory of Newton, which may be called the dynamical theory of the tides, with that commonly given in our books, which may be called the statical theory.—*London Spectator*.

Weather Wisdom.

The theory of the circulation of the atmosphere recognises two grand currents of air, blowing respectively from the equatorial and the polar regions of the earth. Hadley was the propounder of this theory, which has stood the test of all subsequent research and observation. It explains why equatorial winds come from the south-west, and polar winds from the south-east, in the northern hemisphere; why the equatorial come from north-west and the polar from south-south-east in the southern hemisphere. The polar current, having a region geographically cold, and advancing into warmer latitudes, always feels cold, and is usually dry and heavy; while the equatorial current, having a reverse course, is warm and often moist, and light with vapour. These characteristics of the two primary wind currents are experienced generally over all the world. In the temperate zones, sometimes called also the zones of variable winds, the polar current at times prevails at the earth's surface, and, at other times, the equatorial, and one or the other may be superposed at any given region. The place of contact, whither these currents flow side by side or one above the other, is not well defined, but is the seat of veering winds and the birthplace of storms. Regarding the north-east and the south-west as the normal winds of the north temperate zone, winds from all intermediate directions are found to bear characteristics more or less common to both normals. The place of contact or intermingling is usually marked by precipitation of rain, hail, fog or snow, resulting from the cold of the polar current condensing the vapour borne by the equatorial current. The weather features of the polar current are generally high barometer, low thermometer for the season, dryness and clear sky; those of the equatorial are a more frequent low state of the barometer, high thermometer, rain or humidity, and overcast sky. Thus Bacon's sayings—"Every wind has its weather," and "North wind cold, east wind dry, south wind warm and often wet, west wind generally rainy"—have been confirmed by subsequent philosophy. The chief motor of the air is undoubtedly heat, but it is not easy to trace its connection with the changes of wind in regard to direction and force, although a direct estimate of the statical forces which control the dynamical force of the wind is very much needed. Such an estimate in the present state of science is best obtained by means of barometers at places about 100 miles or so apart. Whenever, from any cause, a gradual lightening of the atmosphere occurs over an area of some hundreds or thousands of miles of the earth's surface, shown by barometers there falling gradually, an influx of air must of course take place to restore equilibrium. Now it is a remarkable fact that the direction of this flow is indicated by the motion of