SEICHES OBSERVED IN LOCH NESS.

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The first observations on seiches in Scotland were made in 1902 by members of the Lake Survey, the differences in level having been measured by a foot-rule. A Sarasin limnograph was procured by the Survey, and was set up at Fort Augustus on Loch Ness in June, 1903, and has been recording since then, with only a few stoppages. The biggest seiche so far recorded had an amplitude of about 11 cms. The boat-house of St. Benedict's Abbey, kindly put at Sir John Murray's disposal by the Lord Abbot, gave shelter to the instrument both from wind and waves.

Three types of seiches are common on Loch Ness, with periods of approximately 31·5, 15·3, and 8·8 minutes. The first of these is probably the uninodal seiche. It seldom occurs pure, or of any considerable magnitude. This may be due to the influence of Loch Dochfour, which is a continuation of Loch Ness at the north-east end. The two lochs are connected by a narrow channel about 20 feet deep, through which a strong current sometimes flows, and for this reason, in calculating the theoretical period of the seiche, it was thought proper to omit Loch Dochfour.

The period was calculated in two ways. First, by the formula $t = 2\int dl \sqrt{\frac{b}{ag}}$, where b is the breadth and a the area of a cross-section at any particular point. This is the formula obtained by assuming the hypothesis of parallel sections. The value obtained was 42 minutes, which is considerably in excess of the observed value. The period was then calculated by the formula $t = 2\int \frac{dl}{\sqrt{gh}}$, and the value obtained for t was 30·9 minutes, which agrees very closely with the observed value. This method assumes that the period of the seiche would be the same if the shores of the loch rose perpendicularly instead of obliquely.

The binodal seiche, whose period is about 15·3 minutes, is usually very well marked. It is the commonest type, and lasts longer than the uninodal seiche. The node is probably somewhere in the neighbourhood of Inverfarigaig, but has not yet been accurately determined. It is also interesting because its period is less than half the period of the uninodal seiche, although, according to Du Boys, it ought always to be greater than half; and in most lochs it is so, the most notable exception being Lake Geneva. The basin of Loch Ness is so regular that it is difficult to explain it, as was attempted in the case of Lake Geneva, by assuming an oscillation of part of the loch.

The polynodal seiche, whose period is 8·8 minutes, is always of small amplitude, but sometimes very regular. There are also oscillations of shorter period, but they do not occur regularly enough to allow of their measurement with any degree of accuracy. On one or two occasions there were embroideries on the curve, which may have been due to transverse seiches. Owing to the narrowness of the loch, the period of such a seiche would only be about one minute. These embroideries may be due to a variety of causes, such as the wash of steamers, the opening of the lock-gates in the canal, etc. It will only be possible to determine whether they are vibrations or transverse seiches by simultaneous observations at the two sides of the loch.

The range of atmospheric conditions at Fort Augustus included thunderstorms, and earthquakes also occurred, but these had no very marked influence on the loch. It seems probable that the cause of seiches is sudden local variations of atmospheric pressure; and this view is supported by the records of a barograph at Fort Augustus. The polynodal seiches, and perhaps the uninodal and binodal seiches also, may be started by sudden gusts of wind. The wind blows down the various glens in strong, almost vertical gusts, and this may be sufficient to start the oscillation.

All the speculations, however, regarding the causes of seiches can only be satisfactorily tested by quantitative measurements of the forces at work, and it is hoped that something will be done in this direction in the summer of 1904.