

## The Nile Flood

By Dr. H. E. Hurst, C.M.G.

THE Nile flood of 1938 has been exceptionally high, and if we consider the Nile at Aswan, it was the highest since that of 1898 or perhaps 1892. Thanks to the protective measures carried out by the Ministry of Public Works, the water was passed through the whole length of Egypt to the sea (1,500 kilometres) without serious damage. Damage was limited to the loss of crops on islands and low lands lying inside the river banks and to infiltration, and this occurs in all years when the flood is fairly high. Among the protective measures was the use of the Aswan Reservoir to prevent the river-level passing the danger point, whereby the peak was lowered by about twenty centimetres, and the level of the river reduced during about twenty days.

The flood is produced by rainfall (not snow) on the Abyssinian Plateau, which causes the Blue Nile, Atbara and their tributaries to rise regularly each year beginning usually in May or June and reaching their maximum in August or September. The White Nile contributes, but its variation is much less than that of the Abyssinian tributaries, and it does not reach its maximum until some weeks after the peak on the Main Nile is past. This year the maximum discharge on the Blue Nile was about 730 millions of cubic metres per day on September 2 and on the River Atbara 310 millions of cubic metres per day on August 23, while the maximum on the Main Nile at Wadi Halfa was about 1,020 millions of cubic metres per day and occurred on August 31.

There is no doubt that the present flood is the highest for forty years, but an exact comparison with the high floods of last century is not easy. Previous to the present century there were few measurements of discharge and these were always made with floats, so that we cannot compare directly quantities of water which are the real measures of floods. Current meters were introduced by Sir Henry Lyons at the beginning of the present century. There are, however, records of the level on gauges which have been read regularly for the last seventy years. The difficulty with these is that changes of river bed affect their readings, so that it happens that with two floods of nearly equal maximum height one may appear higher on the first gauge and the other on the second. There is reason to suppose that even the Aswan Gauge at the foot of the first Cataract has changed relatively to other gauges since the Dam was built at

the beginning of this century. However, these variations are not as a rule large, and the gauges at some sites give a fair comparison of the heights and volumes of floods.

For more than thirty years there have been gauges on the tributaries of the Nile in the Sudan, the farthest south on the Blue Nile being at Roseires near the Abyssinian frontier, and thus warning of the rise of the river is obtained about ten days before its peak reaches Aswan. A similar warning is received from a gauge station on the Atbara, but the time interval is shorter.

The frequency distribution of floods is interesting. In addition to records of the level at Aswan which cover the last seventy years, there are records from the Roda Nilometer in Cairo which go back, although with large gaps, to A.D. 622, soon after the Arab conquest of Egypt. These records have not the precision of modern observations but are probably as reliable as present-day statistics about less well-defined phenomena such as health and social conditions, and they cover a very long period of the rise and fall of the Nile. They have been analysed for periodicities by the late Prof. H. H. Turner, Mr. J. I. Craig and Dr. C. E. P. Brooks, and periods varying from 2 to 240 years have been found. The period of greatest amplitude so far is one found by Prof. Turner of 240 years, with an amplitude of 15 cm. for the maxima and 46 cm. for the minima.

RECORDS OF ASWAN GAUGE

Description	1869-1898		1899-1938	
	Height (metres)	Year	Height (metres)	Year
Maximum gauge reading of highest flood	94.15	1878	93.50 (Corrected for effect of reservoir)	1938
Maximum gauge reading of lowest flood	91.40	1877	90.11	1913
Mean flood maximum for period	93.26		92.46	
Number of years with maximum greater than 93.30 m.	16		2	
Number of years with maximum less than 91.40 m.	0		2	

The analysis by Dr. Brooks does not extend to periods longer than 76.8 years, but he finds a number of periods of average amplitudes of the order of 10 cm. His best-defined periodicity is that of 76.8 years, with a mean amplitude of 17 cm. The average standard deviation of the flood-levels

is 56 cm., which makes apparent the relative smallness of any periodic effects, which although of theoretical interest, are of no use to the forecaster. A glance at the records when plotted on a fairly large scale shows that there is no period which is directly evident to the eye, and that the principal features are the existence of fairly long terms of years when, on the whole, the floods have been high and others when floods have been low. This fact is well illustrated by the Aswan gauge records for the period 1869–1938. By dividing this period into two parts, 1869–1898 and 1899–1938, an example is afforded of a high term of 30 years followed by a low term of 40 years, with the results shown in the preceding table.

The most striking feature of this table is that in the thirty-year high term one year in two was higher than all but one of the succeeding forty-year low term. The important question, which however we cannot answer, is, are we now entering on a term of high floods?

If flood heights are taken without regard to order, they give a frequency curve of normal form, but owing to the existence of high and low terms of years this frequency curve cannot be applied directly to give, for example, the chance of occurrence of a very high flood like that of 1878 in the next twenty years. Some work has recently been done on problems of this type which it is hoped to publish later.

## Obituary Notices

Prof. William McDougall, F.R.S.

**W**ILLIAM McDOUGALL, whose death was recently announced, was partly Scottish, partly Saxon; he came partly of industrial and partly of agricultural stock; he was in part scientist and in part philosopher. One side of him was intensely interested in social movements and social activities; another was reserved, contemplative, and, to use his own word "arrogant". He was probably the most widely studied, the most universally known and appreciated of all contemporary psychologists. Yet to the end he regarded himself as an upholder of lost causes, a rebel against current conventions, a voice crying in the wilderness with but few to listen and to pay attention. In 1930, he wrote a brief, charming and frank autobiography ("History of Psychology in Autobiography", edited by Carl Murchison, Clark University Press. Vol. 1, pp. 191–223), and there, if anywhere, the paradoxes of his life and work are clarified and interpreted.

McDougall's life was a varied one. After a private school and a year at Weimar he entered the University of Manchester, and though he was at first deeply attracted by geology, he graduated in 'general science'. In 1889, he won a scholarship at St. John's College, Cambridge. At that time physiology was developing rapidly in Cambridge, and soon McDougall decided to specialize in this direction and to qualify in medicine, not in order to practise, but to fit himself more fully for original research. He took his degree with the highest honours and went to St. Thomas's Hospital, where he worked in the Physiological Laboratory, then under the direction of C. S. Sherrington. His research, partly on muscle contraction and partly on psychophysical problems, brought him a fellowship at St. John's College, but soon after this, in 1899, he joined the Cambridge Expedition to the Torres Straits, where he collaborated with W. H. R. Rivers and C. S. Myers in a comparative

experimental study of native sensory reactions. He paid an extended visit to Borneo and saw something of China, Java and India before he returned to Cambridge.

For a day or two McDougall was an elected tutor of St. John's. But suddenly he flung aside one of his principles—"that a man whose chosen business in life was to develop to the utmost his intellectual powers should not marry before forty, if at all"—and married. For some time he combined a honeymoon and science at Göttingen, where he worked with G. E. Müller. Although he was somewhat out of sympathy with Müller himself, it was here that he began his experimental work on colour vision which many still think to be the best work he ever did. Characteristically he opposed Helmholtz, Hering and all his contemporaries who approved of their views. He said that he returned to Thomas Young, but it was a return with many differences. It was probably this work more than anything else which later won him his fellowship of the Royal Society.

Back in England, he taught experimental psychology for a few years at University College, London, and continued his own research on vision, on attention, and on general psychophysical problems. He also planned a book on social psychology.

In 1904, McDougall became Wilde reader in mental philosophy at Oxford, and he continued to hold this post until shortly after the Great War. He was, he says, happy enough with the Oxford people—he became in due course a fellow of Corpus Christi—but very restive and discontented with the Oxford atmosphere of those days. When the Great War came, he was for a short time a private in the French Army and for a longer time a major in the British. At the Netley Hospital he had charge of a great many nerve and 'shell shock' cases and became deeply interested in the psychological study of functional disorders of the central nervous system.