identical. The numbers we used were by Watson, and both spectra were measured from plates produced by the same instrument, and, of course, measured by the same person; thus experimental error was eliminated so far as possible. We were, however, in hope that possibly some similarity in atomic complexity might be argued from this "parallelism." But on talking the matter over with Prof. Fowler, whose knowledge of the subject is far greater than ours, we see that the evidence is not sufficient to justify any such assumption of similarity in the atomic complexity of these two elements, and we must therefore with regret abandon the idea.

J. NORMAN COLLIE.
HUBERT S. PATTERSON.

Mountain Stream Tadpoles in Natal.

SOME readers of NATURE will be interested to learn that tadpoles with large suctorial oral discs, enabling their possessors to adhere firmly to the rocks and boulders of mountain streams, have recently been discovered at Krantzkloop, in Natal, at an elevation of about 1500 to 1600 ft. They were found by the Rev. Fr. P. Boneberg, of Mariannhill, who kept them alive for some time, and observed their peculiar leech-like habit of sticking to one's fingers or to the sides of the vessel in which they were contained. Similar tadpoles have long been known from mountain streams in Borneo and other parts of the East, but so far as I can ascertain have not previously been recorded from Africa. However, the Natal tadpole belongs to the family Cystignathidæ (genus Heleophryne), whereas those of the Oriental region belong to the family Ranidæ, so that the adaptations are no doubt quite independently evolved. A description of this tadpole will be given in the next issue of the Annals of the Natal Museum. JOHN HEWITT.

Albany Museum, Grahamstown, South Africa,
February 1.

[IN his recently published account of the Batrachia of the Abor expedition, Dr. Nelson Annandale directs attention to some of the tadpoles (from Himalayan streams) which adhere to stones at the bottom or sides, and even in the vicinity of waterfalls. The majority adhere by their lips, which may be monstrously developed. In some other species a sucker, quite separate from the lips, and not homologous with the sucker that many young Batrachian larvæ possess, is found on the ventral surface, doubtless for the same purpose. It is interesting to note that some fishes have similar adaptations for adhesion.—Ed. NATURE.]

INTERNATIONAL TIME AND WEATHER RADIO-TELEGRAPHIC SIGNALS.

IT is to the French Government that the world is indebted for the institution of an international conference on the radio-telegraphic distribution of time and weather signals. So long ago as 1908 the Bureau des Longitudes suggested a series of hourly signals from the Eiffel Tower for the determination of longitudes, and this service was brought into active operation in 1910. The great success which the service met with called for a more universal use of it, and to this end the French Government invited a certain number of foreign Governments to send delegates who had studied the problem of radio-telegraphy from the point of view of time and the determination of longitudes.

In October of last year such a conference was assembled, and programmes were formulated and resolutions passed with the object of preparing the way for the distribution of time and weather signals at stated hours from numerous selected stations suitably situated over the globe.

The outcome of this, the first international conference convened for this purpose, was a series of very important resolutions, but reference will only be made here to those that deal with the international time and weather signals. It may be of interest briefly to describe in the first instance samples of two signals that are being daily distributed at the present time, in order that the reader may compare them with the full international system which will be brought into operation on July 1 next.

Our purpose will be served if those sent out from the Eiffel Tower, Paris, and from Norddeich-Wilhelmshaven be alone considered, as these will show the different procedures adopted. To take the French signals first as recorded by a receiver in London. From this station morning and evening signals are transmitted, and at each transmission three separate "minute" signals are sent. Thus in the morning the observer can hear the tap from the pendulum clock in Paris at 10h. 45m. 0s., 10h. 47m. 0s., and 10h. 49m. 0s., and in the evening at 23h. 45m. 0s., 23h. 47m. 0s., and 23h. 49m. 0s., the clock indicating Greenwich mean time. In order to warn those who intend to receive the signals wherever they may be, a certain procedure is adopted which is the same for both morning and evening transmissions. This procedure is as follows:—

Let us suppose that we wish to correct our watch and therefore require to hear the morning signals. At about 10h. 40m. one sits by the receiving apparatus with the telephone fixed on the head, the coils set for the wave-length in use (about 2000 metres) and the detector adjusted, and waits for the preliminary signals. It may be mentioned here that the noise heard is of a powerful medium note, and the operator transmits the individual signals quite slowly so that they are easy to decipher.

The first sounds to be heard are the signal ta-te-ta-te-ta (– . – . – repeated three times, which is a "call" signal in Morse preliminary to every transmission. Then follows – . . . –, which means (=), a signal to separate the "call" from that which follows. The operator transmitting then sends out the following in Morse:—

. – – . . – . . . . . – – – . . . . . – . . . . – . . . . – –
P A R I S O b s e r v a
– – – – . . – . .
t o i r e
– . . –
(double dash)
. . . . . – – . – . . – . . – – . . – . . . . – – – . – . . – . .
s i g n a u x h o r a i
. – . . . .
r e s
. – . . . . . – . . . . . – . . . . . – . . . .

The last four signals indicate "wait," repeated four times.

The foregoing announcement is the preamble preliminary to the time signals.

At 10h. 44m. 0s. a series of longs or – – – –, &c., are transmitted, ceasing at 10h. 44m. 55s.; then there is silence for some seconds, and *exactly* at 10h. 45m. 0s. a single "short" is heard.

A whole minute is then allowed to elapse with no signal at all, but at 10h. 46m. 0s. a new series of signals is commenced –.. –.. –.., &c., until 10h. 46m. 55s. is reached, when again there is silence for a few seconds, and then a short tap at *exactly* 10h. 47m. 0s. Another minute of silence is then allowed to pass, and at 10h. 48m. 0s. a different series of signals is commenced –.... –.... –...., &c., terminating about 10h. 48m. 55s., when after a few seconds' silence the single tap that follows indicates *exactly* 10h. 49m. 0s.

Thus it will be observed that the hearer has not only three opportunities of correcting his time-piece, but if by chance he missed the first signal at 10h. 45m. 0s. he can identify the other minutes by the different signals which precede them.

In the case of the German signals transmitted from Norddeich-Wilhelmshaven, at about 12 o'clock midday and 10 o'clock in the evening, the procedure is quite different. The first notification is the transmission of a series of V's thus, ...– ...– ...–, &c., to give the hearers a chance to tune their instruments to the wave-length in use (about 1750 metres) if not already in adjustment. The "call" signal –.–.– is then sent out, followed by the "call signal" of the station transmitting, namely, Norddeich, thus –.– –. –.. (K N D). The fact that Greenwich mean time is being sent is given in the next signal in the form – – – – . – –.. (M G Z), where MGZ indicate Mittel Greenwich Zeit. At 11h. 58m. 38s. the signal –.–.– or attention is repeated, and then follows the following series of signals:

Commencing at 11h. 58m. 46s., a tap is heard at *every second* until 11h. 58m. 50s. is reached; then a short pause is made, and another series of taps from 11h. 58m. 56s. to 11h. 59m. 0s.; again another pause, and a third series from 11h. 59m. 6s. to 11h. 59m. 10s. Then follows a longer pause, and a similar series of taps is heard for each of the intervals 11h. 59m. 36s. to 11h. 59m. 40s., 11h. 59m. 46s. to 11h. 59m. 50s., and 11h. 59m. 56s. to 12h. 0m. 0s. A few seconds after the last tap the signal –.–. indicating the end of transmission is given.

The above two examples show what very different systems are in use for the distribution of time by radio-telegraphy. They serve further to indicate that unless some international scheme is at once brought into operation, many other different systems may be added.

The Paris International Conference has thus stepped into the breach at the right moment and brought out a scheme which will be universally adopted and commenced on July 1 of the present year.

It is proposed for the international scheme that Greenwich time should be used throughout, and that the time signals should be transmitted at exact hours. It was further arranged that there should be no overlapping, *i.e.* that no two stations should send out signals at the same hour, and that the same wave-length (about 2500 metres) should be universally adopted.

A preliminary list of stations that will be in active operation by July 1 is as follows, and the times at which they will transmit their signals are added:

	Greenwich civil time. Hours
Paris	0 (midnight).
San Fernando (Brazil)	2
Arlington (U.S.A.)	3
Manilla	4 (provisionally).
Mogadiscio (Italian Somaliland)	4
Timbuctu	6
Paris	10
Norddeich-Wilhelmshaven ...	12 (midday).
San Fernando (Brazil)	16
Arlington (U.S.A.)	17
Massowah (Erythrea)	18
San Francisco	20
Norddeich-Wilhelmshaven ...	22

Since September 1, 1912, radio-telegraphic time signals have been daily sent out from Chōshi, on the eastern shore of Japan. They are transmitted at 9 p.m. Japanese standard time, *i.e.* at Greenwich noon. This station will no doubt adopt the international scheme.

An important part of the scheme that is desired, and will ultimately no doubt be accomplished, is that both a day and a night signal can be received at any point on the globe.

Now as to the method which will be adopted for distributing the exact time at all transmitting stations.

To make the system quite clear, the accompanying figure (Fig. 1), taken from the report of the conference as recorded in the *Comptes rendus* (November 4, 1912, No. 19, vol. clv., p. 872), is shown. The reader is supposed to commence the time reckoning from the innermost portion of the spiral.

At three minutes before the hour—that is, at any hour at which the signals are intended to distribute the time—the transmitting operator sends out a series of successive similar preliminary signals, a repetition of the letter X in Morse –..– –..– –..–, &c. These commence at the beginning of the 57th minute, and continue until 57m. 50s. has been reached. Then, beginning at the 55th second, three longs are given at intervals of one second, each long *lasting one second*. In the 58th minute a short (lasting for a *quarter* of a second), preceded by a long commencing two seconds before, heralds every tenth second, and at the 55th second three longs as before are signalled. During the 59th minute two longs, preceding the quarter-second tap at every tenth second, are transmitted, and this minute concludes as before with the three longs at seconds intervals.

By following the spiral outwards and noting the positions of the longs and shorts in relation to

the divisions in seconds on the outer circle, the system can be easily understood.

It will thus be seen that each short signal or tap will give the receiver a chance of comparing his clock, and the dissimilar preliminary signals will inform him whether the minute involved is the 58th or 59th.

When all stations bring this excellent and very simple system into operation, it will be most easy for anyone unacquainted even with the Morse alphabet to check their clocks correctly.

Now while the above arrangements as regards the distribution of time will come into force on July 1 next, the questions as regards the type of weather messages, which will be transmitted directly after the time signals have been sent out, are not yet settled.

There is little doubt, however, that each transmitting station will send out a general description of the air movements over a wide area of which the station is about a centre, and also some definite data as regards certain specified stations useful for that area.

At the present time both Paris and Norddeich send out such messages, and it may be of interest to describe the procedure now followed at the former station, for it is probable that little, if any, change will be made with regard to the system there in vogue.

Let us suppose that the time signals at 10h. 45m. 0s., 10h. 47m. 0s., and 10h. 49m. 0s. have just been transmitted from the Eiffel Tower, then there follow immediately after them the weather signals. It may be mentioned again that the signals are sent through quite slowly, so that with a little practice they can be easily recorded and deciphered.

A typical message received in London on January 28, 1913, ran as follows:

(*a*) =BCM=R.51000=V.491424=O.551633=
C.621812=H.653043=S.46207=
Pression basse ouest Europe élevée nord==

(*b*) R.51000=V.491424=O.551633=
C.621812=H.653043=S.46207=
Pression basse ouest Europe élevée nord=

(*c*) Paris=vent 9 mètres stationnaire sud croît pression 758 stationnaire ciel couvert==

(*d*) V. 9 m ss sud cc pp 758 ss ciel couvert

Then follow the signals:

.-.-. (end of transmission).

..-.. .-.. (FL repeated several times, which denote Eiffel Tower).

And lastly

...-.- (end of work).

The above message has been divided into four sections and marked (*a*) (*b*) (*c*) (*d*), in order to show that (*b*) is simply a repetition of (*a*), and that (*d*) is a repetition of (*c*), only sent in brief, *i.e.* "V" corresponds to "vent," "m" to "mètres," "ss" to "stationnaire," &c.

In deciphering the message only (*a*) has to be considered, because (*c*) explains itself, being the general weather conditions at Paris stating the velocity of the wind in metres per second, direction of wind, pressure in millimetres, and state of sky. At 3 p.m. each afternoon a similar message stating the meteorological conditions at Paris is transmitted from the Eiffel Tower.

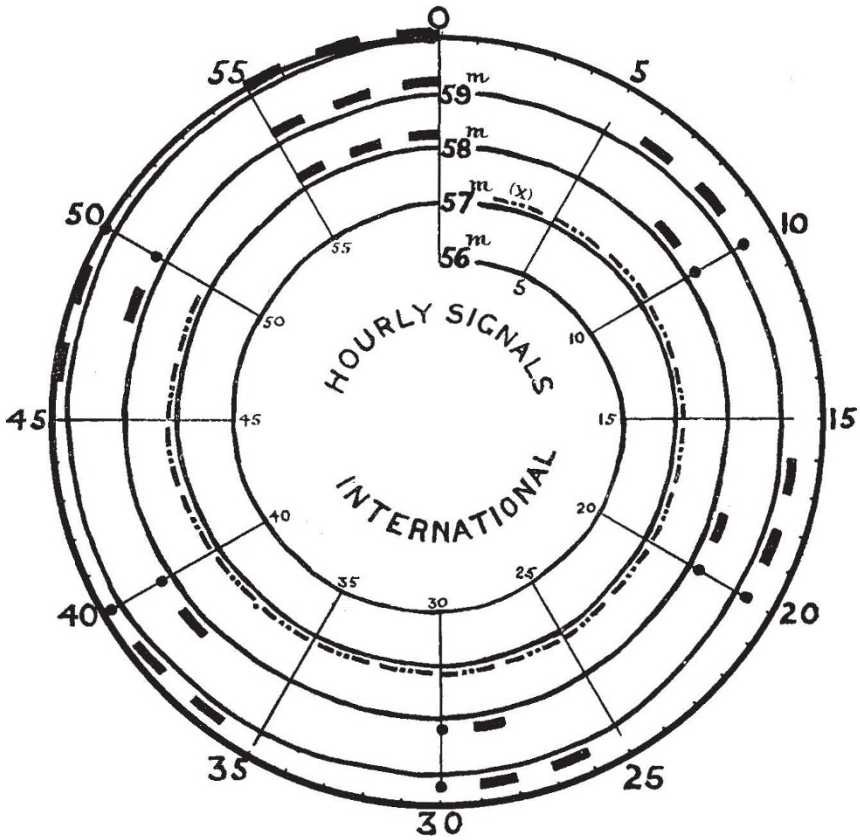

FIG. 1.—Diagram to illustrate the international system of radio-telegraphic time signals which will come into operation on July 1 of this year.

With reference to (*a*), then, the message contains information relating to (1) atmospheric pressure, (2) wind direction and force, (3) the state of the sea, *in code* from the following six stations: Reykjavik (R), Valencia (V), Ushant (Ouessant) (O), Corunna (C), Horta (H) (Azores), for 7 a.m.; and for St. Pierre (S) (Miquelon, Newfoundland) for the preceding 8 a.m. (see Fig. 2).

The coded part of the message is given in seven groups. The first group, BCM, stands for the Bureau Central Météorologique, and indicates the source of the information. The above-named stations are indicated by the single letters printed in brackets above.

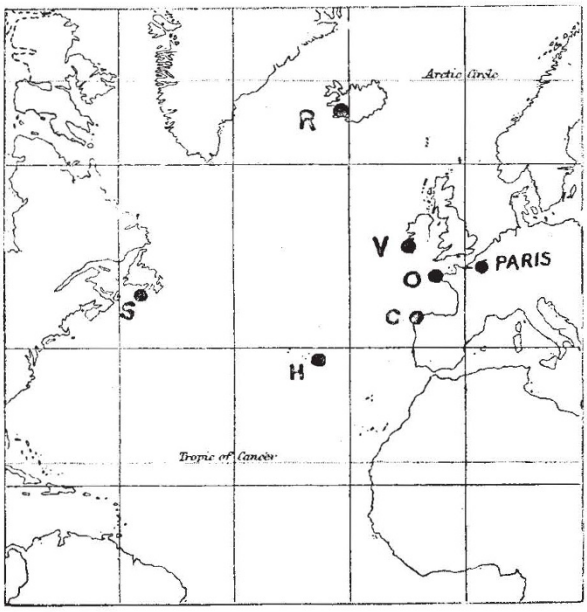

FIG. 2.—Chart showing the positions of the stations neighbouring the North Atlantic, the meteorological conditions at which are daily transmitted by radio-telegraphy from the Eiffel Tower. (See text for names of stations indicated.)

The first two figures in each group indicate the barometric pressure in millimetres, it being understood that 700 mm. should be added. The next two figures represent the wind direction in points of the compass as follows:—

Code No.	32	02	04	06	08	10	12	14	16	18	20	22	24	26	28	30
Direction	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW

The fifth figure denotes the wind force on a scale ranging from 0, a calm, to 9, a hurricane. The sixth and last figure shows the state of the sea, a "calm" being denoted by 0 and "tremendous" by 9.

In the case of Reykjavik and St. Pierre, the sixth figure is omitted, no reports for transmission being available.

It sometimes happens that when the messages are being sent out from the Eiffel Tower, some of the data for some of the stations have not been received by the Bureau Central Météorologique, and therefore cannot be transmitted. In these cases the signal -..- or X is substituted for any unknown figure.

The following statement gives a full translation of the message marked (*a*) given previously, the code letters and figures being given in the first, third, fifth, seventh, and eighth columns.

Bureau Central Météorologique.

Letter	Station	Barometer		Wind			Sea
			mm	Direction		Force Scale 0-9	Scale 0-9
R	Reykjavik	51	751	00	N	0	—
V	Valencia	49	749	14	SSE	2	4
O	Ouessant (Ushant)	55	755	16	S	3	3
C	Corunna	62	762	18	SSW	1	2
H	Horta (Azores)	65	765	30	NNW	4	3
S	St. Pierre	46	746	20	SW	7	—

Low pressure west Europe high to the north

It is impossible to overestimate the great value such messages can be to outward and homeward bound ships that receive them, for instead of having to gauge the approaching weather conditions from their own isolated observations they can form a far more accurate judgment by the deductions from the radio-telegraphic data.

While the distribution of time and weather signals will be of general utility, perhaps its most important value will be felt by sailors. Cut off from all shore communication with the exception of wireless, they will be put on nearly the same equality as land stations when the international system is in full swing.

WILLIAM J. S. LOCKYER.

NOTES.

IN the King's Speech at the opening of Parliament on Monday reference was made to the following matters, among others, to be brought forward during the session:—A guarantee from the Imperial Exchequer of a loan by the Government of the Sudan for the development therein of the industry of cotton-growing; proposals for the better care and control of the feeble-minded and for the further restriction of the industrial employment of children; proposals for the development of a national system of education. In the course of his comments upon the last-named subject, Lord Crewe remarked, in the House of Lords, that it is not the intention of the Government to endeavour to force through Parliament in this session a vast measure dealing with national education. "But in view of what has fallen from the Prime Minister, and also in view of the observations made by the noble and learned lord on the Woolsack at Manchester in the beginning of January, which were the sequel to a close inquiry into the subject, we think it is quite proper to place the country in possession of the general lines of our intentions during the coming session, although I do not suppose that we shall be able to proceed very far towards getting them