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XXXII. *Observations on the relative Temperature of the Sea and Air, and on other Phænomena, made during a Voyage from England to India. By the Rev.* J. H. Pratt, *M.A., Member of the Asiatic Society of Bengal.*

To the Editors of the Philosophical Magazine and Journal.

Gentlemen,

I SEND you the accompanying observations on the relative temperature of the sea and the superincumbent air made at various latitudes and longitudes on a voyage from England to India, in case you should deem them of sufficient importance to give them a place in your valuable Magazine.

I regret that they do not extend through the whole voyage. It was not till after passing the Cape that I recorded any observations. I was anxious to see what effect the Mozambique Channel had upon the currents; and after that I continued my observations up to the Bay of Bengal.

I have also given the result of a few observations on the velocity of the waves of a swell in unfathomable water.

Once or twice I attempted to ascertain the temperature of the sea water at a considerable depth, such as 40 and 100 fathoms. The method I adopted was this: I sunk a quart bottle, full of sea-water and well-corked, by means of a line, and allowed it to remain a considerable time (as an hour or more), that the water within the bottle might attain the temperature of the surrounding water by conduction. I then drew it up with great rapidity (perhaps in 1½ minute), instantly uncorked the bottle, and tried the temperature. When I poured the water into a glass it would change its temperature very little in 5 or 10 minutes; so I felt assured that no *great* change could have taken place in its passage from its lowest depth. I should have made more of these observations, but the utter impracticability of sinking a bottle well, except in a dead calm, prevented this. One day I had a bottle 200 fathoms deep for one or two hours; a gentle breeze sprang up, my bottle towed astern, and in pulling it in the line broke!

A notice of my observations will be seen in the accompanying tables of temperature.

I am, Gentlemen, yours, &c.

Bishop's Palace, Calcutta,
March 22, 1839.

John Henry Pratt.

Results of a Series of Experiments on the Temperature of the Sea, made by J. H. Pratt, *M.A., on board the ship Duke of Buccleugh, bound for Calcutta.*

The experiments were begun on the east of the Cape.

Day.	Lat. at noon.	Long. at noon.	Hour.	Temperature. Sea.	Temperature. Air.	General Remarks.
1838.	° ′	° ′		°	°	
Nov. 17.	37 37 S.	20 40 E.	11 p.m.	69·25	66	
18.	37 40	24 14	10½	64·25	64·25	Clear sky.
19.	37 54	28 30	9 a.m.	65	68	Clear.
			10½ p.m.	69·25	64·50	Cloudy.
20.	37 46	33 42	8 a.m.	63·75	59	Clear.
			3 p.m.	64·75	61	
			11	69·75	62·50	Clear (starlight).
21.	38 11	37 51	7 a.m.	68·25	64	Clear.
			9	68·25	64·25	Clear.
			noon.	66·25	64	
			2 p.m.	64·50	64·50	Clear.
			5	62·50	62·50	Violent squall.
			7	62·50	57	Immediately after heavy rain.
			8½	62	58	☽ bet. squalls.
			10	62	58	Cloudy.
			midnight.	62	56	Starlight.
22.	37 55	42 20	5½ a.m.	67	58	Cloudy.
			7½	67·25	58	
			9	67·25	58	
			10½	68	59	
			noon.	67	59	Clear.
			2 p.m.	65½	59	
			5	59·75	61·50	— } Sea became remarkably *green*: passing through comp. shallow water.
			7	58	59	— }
			9	55·25	55·25	— }
			11	62	58	Clear.
23.	37 46	47 4	4 a.m.	65·25	59	Clear.
			7½	64·50	60	
			9	63·50	59·25	Cloudy.
			11	63	62	Clear.
			noon.	63·50	61·75	
			2½ p.m.	63·50	64·50	
			4½	63·50	64·50	
			7	63·50	64	
			8½	63	63·50	Cloudy.
			10¼	63	63·50	
			11½	63	62·50	
24.	38 14	51 50	7½ a.m.	64·75	64	Cloudy.
			9	63·25	64·50	
			10½	63·25	65	
			12½ p.m.	63	65·50	Clear.

Table *continued.*

Day.	Lat. at noon.	Long. at noon.	Hour.	Temperature. Sea.	Air.	Remarks.
1838. Nov. 24.	38° 14′ S.	51° 50′ E.	2 p.m.	63·50	66	Clear.
			5	64	67·50	
			8½	62	64	Cloudy.
			10½	61	63	
			12	62	64	
25.	37 55	57 20	12 p.m.	61·50	63·50	Clear.
26.	38 48	62 2	8 a.m.	60·25	60	Cloudy.
			10	60	61	Clear.
			2 p.m.	60·75	62·75	
			5	60·50	60·50	Cloudy.
			7	60·50	59·50	Clear.
			10	60·50	59	Cloudy.
			12	60·25	60	
27.	38 48	64 0	8 a.m.	60	55·75	Rain.
			noon.	60	56·50	
			10 p.m.	60·50	59	Cloudy.
			12 p.m.	60	56	
28.	38 21	67 50	7½ a.m.	59	55·50	
			2 p.m.	58·75	56	Clear.
			10½	59	56·50	Cloudy.
29.	37 2	70 35	8 a.m.	59·25	57	
			10½	59·25	57·75	Clear.
			1 p.m.	60	57	
			10	59	57	Cloudy.
30.	37 30	72 5	8 a.m.	58·50	59	
			2 p.m.	58	61·50	
			6	57·50	59	Rain.
			10½	57·75	59·25	Cloudy.
Dec. 1.	37 16	77 1	8 a.m.	57	60·75	
			2 p.m.	58·50	61	Clear.
			8	60	61	Cloudy.
			10½	59·25	61	
2.	36 12	81 8	10 p.m.	59	62·25	
3.	34 25	82 50	7½ a.m.	60	62	Fog.
			noon.	62·75	66	Cloudy.
			6 p.m.	63	65	
			10	63·50	64½	
4.	31 27	85 3	7½ a.m.	66·25	67	
			9	66·25	67.50	
			2½ p.m.	69	71.50	Clear.
			10	67·50	68	
			12	67·25	67·50	
5.	28 25	86 37	7 a.m.	68·25	68·50	Clear.
			9	68·50	69·50	
			11	69	71·25	
			1 p.m.	69·25	72	
			3	70·	73	
			5	71·	72	
			7	71·50	71·50	Cloudy.

TABLE *continued.*

Day.	Lat. at noon.	Long. at noon.	Hour.	Temperature. Sea.	Temperature. Air.	Remarks.
1838. Dec. 5.	28° 25′ S.	86° 37′ E.	9 a.m.	71·75	71·50	Clear.
			11	71·50	72	Cloudy.
6.	26 8	88 53	7 a.m.	72·25	71·25	
			9	72	71·50	Clear.
			11	73	73·75	Cloudy.
			2 p.m.	73·50	73·50	
			5	73·50	73·50	
			7	73·50	72·75	
			10	73	72	
7.	24 24	89 10	9 a.m.	73·75	73·25	
			1½ p.m.	74	74·50	
			5	74	75	Clear.
			7	73·50	73·50	
			10	74·75	73	
8.	21 2	89 12	7 a.m.	76·75	74	Cloudy.
			9	76·50	76	
			11	77·25	76	Clear.
			1½ p.m.	78	76·50	
			5	77·25	76·50	
			6½	76	76·50	
			10½	76	75·50	
			12	76	75	
9.	17 48	88 45	10 p.m.	79	78½	Cloudy.
10.	13 55	89 2	7 a.m.	80	80	
			9	80·25	79	—— } very squally
			11½	80·50	80·50	Clear. } very squally
			5 p.m.	80·50	79·50	Cloudy. } very squally
			10	80	79	—— } very squally
						Violent squalls at [night.
11.	10 55	88 30	6 a.m.	79·50	78	Clear. } Gale.
			8	80·25	80	—— } Gale.
			noon.	80·25	80	—— } Gale.
			10 p.m.	80·25	79	—— } Gale.
12.	11 35	88 4	7 a.m.	80	79	Rain and heavy squalls.
			10 p.m.	80	80	
13.	12 0	87 8	10 a.m.	79·75	81	} Rain, heavy squalls.
			10 p.m.	79·25	78	} Rain, heavy squalls.
14.	11 30	86 28	8 a.m.	80	70	} Rain, heavy squalls.
			2 p.m.	80	82	Clear.
			12	79·50	79·50	
15.	11 11	86 42	6 a.m.	80	79·50	
			9	80	79·50	
			12 p.m.	80	80	
16.	10 52	87 8	10 p.m.	80	80	
17.	10 8	85 47	7 a.m.	80·75	81	
			2½ p.m.	81·75	82·50	
			1 0	81	81	
18.	9 43	85 13	7½ a.m.	81	81·50	
			noon.	81	82	
			12 p.m.	81	80·50	

TABLE *continued.*

Day.	Lat. at noon.	Long. at noon.	Hour.	Temperature.		Remarks.
				Sea.	Air.	
1838. Dec. 19.	° ′ 8 21 S.	° ′ 85 0 E.	7 a.m.	81·25	81·25	Clear.
			noon.	82·50	84	— A bottle was sunk for an hour or so; 40 fathoms (about noon), when brought up 81°·50 temp. of water.
20.	7 54	85 20	9 a.m.	82·50	82	—
			noon.	84	82·50	—
			2 p.m.	84	84	—
			10½	81·75	84	—
21.	7 29	85 18	9 a.m.	82·50	82	— Bottle sunk 100 fathoms. Temp. 78°.
			noon.	83	82·50	—
			2 p.m.	85	83·50	—
25.	1 56	87 0	10 p.m.	83·50	81·25	Clear.
26.	1 6	87 0	7 a.m.	84	81	
			2 p.m.	85	84	
			10	84	79	Rain and squalls.
27.	29′ S.	87 20	7½ a.m.	84·25	82·25	Clear.
			2½ p.m.	85	85·25	
			10	84	83	
28.	24′ N.	88 25	7½ a.m.	84	82½	
			2½ p.m.	84	83	
			10	83½	82	
29.	1 30	89 16	7½ a.m.	83·50	82	
			10½ p.m.	83·25	82	
30.	4 14	91 8	noon.	83	84·50	
			12 p.m.	82·50	82	Cloudy; bottle sunk 100 f. 70°. exp. *well* made.
1839. Jan. 1.	4 10	91 28	7 a.m.	82·50	82	
			10	83	83	
7.	11 50	88 50	2 p.m.	80·50	80	Clear.
			10	80	80	
8.	13 2	88 57	8 a.m.	80	79	
			1 p.m.	80·50	81	
			10	80	79	
9.	13 54	88 9	8 a.m.	80	79	
			noon.	80	79	
			6 p.m.	80·50	78·50	
			10	80	78	
10.	14 22	88 35	8 a.m.	81	78·50	
			noon.	81·25	80	
			10 p.m.	80·50	78	
11.	14 59	88 23	noon.	80·50	81	
			10 p.m.	80·50	78	
12.	15 57	88 5	8 a.m.	80	79	
			noon.	80	81	
			10 p.m.	78	78	
14.	17 20	88 10	9 a.m.	77·75	77·75	
			2½ p.m.	78·50	81·50	
			10	77·75	77·75	
15.	18 15	88 55	8 a.m.	77·50	78	
16.	20 49	88 47	noon.	77·50	76	
			10 p.m.	76·50	73	
17.	Mouth of	Hoogly.	8 a.m.	75	71·50	

I made the following experiment on the velocity of waves out at sea. Lat. 27° 2′ S. Long. 27° 25′ W.

There was a *swell* on the sea moving from fore aft; wind only sufficient to carry the vessel (all sails set) *steadily* two or three miles an hour. Two large floats were connected by a line forty fathoms in length, the line itself being supported on the surface of the water by smaller floats. This apparatus was towed astern by a long line connected with one of the large floats by one end, the other end being wound round a reel.

The chief officer watched the chronometer; the second officer held the reel fixed; and I observed the large floats.

A few seconds before the first float was raised to its greatest height by a given wave, I gave a signal to the second officer to let the reel run, and immediately the floats became stationary in the water.

At the instant the first float, and also at the instant the second float, was raised to its greatest height by the wave already mentioned, I gave audible signals to the chief officer, who marked the interval of time between the signals.

A very good average of many trials gave a trifle less than six seconds of time for the motion of the wave from float to float, i. e. over forty fathoms. This gives nearly $27\frac{1}{3}$ statute miles an hour.

The chief officer and I changed places, and came to the same result. Two days afterwards this was confirmed, though in rather a rough manner, by observing the motion of the vessel by a swell moving abaft.

Calcutta. J. H. P.

XXXIII. *Researches in the Undulatory Theory of Light continued: On the Absorption of Light.* By John Tovey, Esq.

(Continued from p. 455 of last Volume.)

To the Editors of the Philosophical Magazine and Journal.

Gentlemen,

YOU will have observed that the formulæ of my last communication are deduced from the fundamental principles of the undulatory theory without the aid of any assumption respecting the arrangement of the molecules, or the nature of the constant quantities, k, &c., which appear in the integration. Those formulæ indicate, as was shown, that the transmission of the light may be accompanied by an absorption, or diminution of its intensity, depending on the nature and thickness of the medium through which it is transmitted,