

Public (1898) Department.

ORDINARY MS.

G.O., No. 1075-6

Dated 24-8-88

INDEXED.

[Despatch Abstract.]

Forwarding to the Secy of I  
Copies of certain Communications  
from the Govt Astronomer regarding  
the proposal that certain observations  
which are required by the Great  
Trigonometrical survey for geodetical  
purposes should be undertaken  
by him

26/8

# BACK PAPERS.

| G.O. | No. | Department. | Date. | G.O. | No. | Department. | Date. |
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## FURTHER PAPERS.

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[ Pub. ]  
29  
500-22-2-98.

Public (1898) Department.

CURRENT No.

C.S.

Order Indorsement. No. 1364

Referred to the Govt.  
Astronomer for remarks.

From  
The Govt. of India  
P. & A. Depts.

No. 1087/68-2.

Dated 6 June '98

Received

Registered

Enclosures 1

Spare copies 15 of Enclosure.

Attn: Secy.

By Under Secretary

Ann  
68

11/19/98  
Cottacamund  
78 June 1898

## SUBJECT.

For ordering for information copy  
of letter from the Surveyor General of India  
-1.114.2-3 dated 11 May 98 in which it is  
suggested that certain observations required  
by the Great Trigonometrical Survey for  
geodetical purposes should be undertaken  
by the Govt. Astronomer, Madras requesting the  
local Govt. opinion after consulting Mr.  
Michie Smith as to the practicability of  
the Surveyor General's suggestion & the best  
method of carrying it out.

# BACK PAPERS.

| G.O. | No. | Department. | Date. |
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# FURTHER PAPERS.

| G.O. | No. | Department. | Date. |
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DIARY NO. 832.

No. 114-S.S., dated Simla, the 11th May 1898.

From—MAJOR-GENERAL C. STRAHAN, R.E., Surveyor General of India,

To—The Secretary to the Government of India, Department of Revenue and Agriculture.

File No. 68 of  
1898.  
Serial No. 1.

I have the honour to forward a copy of letter No. 1124, dated 29th April 1898, from the Superintendent, Trigonometrical Surveys, to my address on the subject of certain observations that are required by the Great Trigonometrical Survey for geodetical purposes and which can only be taken at a fixed astronomical observatory such as that at Madras.

2. In his letter Major Burrard refers to the variation of latitude due to the change in the position of the axis of rotation of the earth and a change which has of late years been clearly proved by long series of observations in Europe and America, though the exact amount of the variation and the period of revolution have not yet been determined with final accuracy, this can only be done satisfactorily by increasing the number of observations at different places on the face of the globe.

The correct determination of this variation is of great importance from a geodetical point of view and will in all probability throw light on some of the hitherto inexplicable differences in the different determinations of latitude in India, which seem to be too large to be due to incorrect observations, but which at present are otherwise unaccountable. Major Burrard gives one instance of this in paragraph 2 of his letter and in his postscript points out that the immense number of latitude and azimuth observations which have been taken by the Great Trigonometrical Survey cannot be considered finally correct, until the amount of this periodic revolution of the pole has been correctly ascertained and the variations caused by it applied to the observed values.

3. As we possess no fixed observatory and no post of astronomer attached to the Department, Major Burrard suggests that the Government Astronomer at Madras be directed to undertake the necessary observations. This may well be considered part of his duties as in 1869, at the suggestion of Sir George Airy, the Astronomer Royal, Colonel Walker, the Superintendent of the Great Trigonometrical Survey, drew up with the assistance and concurrence of Mr. Pogson, the Madras Astronomer, a "Code of Instructions to define the future operations of the Madras Observatory." This code was amended in February 1870 and received the approval of the Government of India. It is in nine sections and a copy of them is enclosed. There is no doubt that had this variation of latitude been suspected at that time a prolonged series of observations for latitude to determine its amount would have formed one of the sections. I would ask that in the interests of science generally and more especially in the interests of Indian Geodesy, the Government Astronomer be now directed to commence such a series.

No. 1124, dated 29th April 1898.

From—MAJOR S. G. BURRARD, R.E., Officiating Superintendent, Trigonometrical Surveys,

To—The Surveyor General of India.

I have the honour to bring to your notice the effect on the Indian Survey of the progressive change in the position of the axis of rotation of the earth. This change is now no longer suspected but proved, and the variation of latitude is such an established fact, that I do not think that we can any longer afford to ignore it.

2. Many astronomical latitudes have now been observed in all parts of India, and their results are being utilized to determine the attraction of the Himalayas, to check the absolute position and the orientation of the Indian

Survey on the globe to test the correctness of the values of the Earth's axis, which have been used in all our calculations, and to verify our triangulation when it reaches great distances from our origin. The probable error of our observed latitudes is as a rule about  $0.07''$ , and is occasionally as small as  $0.03''$ . Such admirable results can only be obtained by skilled observers, working with extreme care. But the question now arises as to whether all this refinement in observations is not wasted, as long as we ignore the variation in latitude. The latitude of any place may change as much as  $0.90''$  in 6 months, and if we neglect such a comparatively large amount, it seems to me that we have no right to continue giving our astronomical latitude to two places of decimals: as an actual example, the latitude of Kalianpur may be taken; it is the origin of the Indian Survey and the position of India on the globe depends on it. This latitude has been obtained as follows:—

|                            |     |      |                |                    |
|----------------------------|-----|------|----------------|--------------------|
| By 388 observations in ... | ... | 1825 | $24^{\circ}7'$ | $11^{\circ}8370''$ |
| " 1811 " " ...             | ... | 1839 | $24^{\circ}7'$ | $11^{\circ}0928''$ |
| " 1529 " " ...             | ... | 1840 | $24^{\circ}7'$ | $11^{\circ}3175''$ |

Colonel Everest and General Walker regarded the discrepancies between these three results as due to errors in observation, and they obtained a mean value of  $24^{\circ}7' 11.262''$ . But by the light of modern discoveries it is now apparent that the above three observed values may all have been correct at different dates, that the differences between them may have been real, and thus it is insufficient to give the latitude of any place to three places of decimals, unless the exact date for that particular value of latitude is also stated.

3. The change in the position of the axis of the earth affects also all our observed azimuths and longitudes. We calculate and publish our rigorous azimuths to three places of decimals of a second, whereas the azimuth of any mark may vary almost a whole second between June and December, and this variation we ignore.

4. Professor Darwin has asked us to evaluate the tide, which is produced in the ocean by the movement of the rotation axis of the earth, and this calculation is now being taken up in the Tidal party.

5. Though the variation of latitude has been clearly established by long series of observations in Europe and America, the exact amount of the variation, and the period of a complete revolution have not been determined yet with sufficient accuracy to finally settle the question. I therefore do not think that we ought to accept the formulae which have been constructed from the results of the American and the Prussian observations until they have been confirmed by observations actually taken in India. To observe for the variation in latitude it will be necessary to take accurate observations at one spot almost nightly for about two years: this is the work for a fixed observatory, and our field methods with our observatory tents and portable instruments would not be suitable. There is no astronomical observatory at Dehra Dun, and no astronomer, and the only suggestion that I can venture to make is that the Government Astronomer at Madras be asked, if he could kindly help us by undertaking the necessary series of observations.

P.S.—The enormous mass of latitude and azimuth observations, that have been accumulated in India, will not be really available for final use, until they have been corrected for the pole's movement. The dates of all these observations are of course known, and therefore their correction will be possible as soon as a formulae is approved.

#### *Code of Instructions to define the future operations of the Madras Observatory.*

- 1st.—Meridian observations to be taken of a certain number of standard stars in the Northern and Southern Hemispheres, for the purpose of harmonizing and connecting together the positive determinations of

the Greenwich, Madras, Cape of Good Hope, and Australian observations, with a view to the eventual preparation of an accurate catalogue of star's places, from the combined operations of all these observatories.

- 2nd.—Meridian observations to be taken of all stars, down to the sixth magnitude, between North Polar Distance 60 and North Polar Distance 110.
- 3rd.—Meridian observations to be taken of all stars used for geodetical purposes in the course of the operations of the Great Trigonometrical Survey
- 4th.—Meridian observations to be taken of all minor planets within range of the instrument ( $10.5$  magnitude), whenever they are in opposition south of the equator.
- 5th.—Equatorial observations to be taken of the planet Mars at every successive opposition, in continuation of the observations which have already been made by Mr. Pogson for the investigation of the constant of solar parallax.
- 6th.—Magnetic and meteorological observations to be continued on the system introduced by Mr. Pogson in 1861.
- 7th.—Provision for time determinations for shipping, and for notices of approaching stormy weather, &c.
- 8th.—The publications should be issued in annual volumes, and annual reports should be submitted to the Government of Madras, and sent to the Astronomer Royal, whose criticisms should be invited. Monthly tabular statements of arrears of reduction and publication should also be submitted.
- 9th.—Special investigations may be undertaken by the Astronomer, but they should not interfere with the regular routine of the observations, nor retard the work of reduction and publication.

Current No 1920

No. 1087-68-2.

FROM

E. MACONOCHE, Esq., I.C.S.,  
Under-Secretary to the Government of India,

TO

The Chief Secretary to the  
Government of Madras.



Simla, the 6<sup>th</sup> June 1898.

Department of Revenue  
and Agriculture.

Land-Surveys.

SIR,

I am directed to forward for the information  
of the Governor-in-Council a copy of a letter from

No. 114 S-S. dated the 11th May 1898  
and enclosures.

the Surveyor-General  
of India\* in which it

is suggested that certain observations that are re-  
quired by the Great Trigonometrical Survey for geode-  
tical purposes should be undertaken by the Government  
Astronomer at Madras, and to say that the Government  
of India will be glad if the Local Government will  
favour them with their opinion after consulting Mr.  
Michie-Smith, as to the practicability of the Surveyor-  
General's suggestion and the best method of carrying  
it out.

I have the honour to be,

Sir,

Your most obedient servant,

*E. Macnochie*

Under-Secretary.

*Received 11th June 1898*  
*No 1920 978*

# Public (1898) Department.

CURRENT No.

CHIEF SECRETARY  
-2 JUL 1898  
GOVERNMENT OF

From

The Govt. Astronomer  
Madras.

Order

No. 123

Dated 29<sup>th</sup> June 1898.

Received 2<sup>nd</sup> July '98

Registered 4.

Enclosures Two. (C. H. 1920 Enclos. no. 1)

Spare copies -

## SUBJECT.

Forwarding with remarks.  
the endorsement of Govt. no 1864  
18.6.98 on  
the letter of the Govt. of India R. & A.  
drying forwarding a letter from the Survey  
General of India suggesting that some  
observations that are required by the  
C. I. Survey for Geodetical purposes  
should be undertaken by the Govt.  
of Madras.

# BACK PAPERS.

| G.O. | No. | Department. | Date.     |
|------|-----|-------------|-----------|
|      | 725 | Lib.        | 21. 21    |
|      | 769 | -           | 11. 6. 98 |
|      | 657 | -           | 14. 5. 98 |
|      | 607 | -           | 27. 4. 98 |

# FURTHER PAPERS.

| G.O. | No. | Department. | Date. |
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No. 123.

THE OBSERVATORY,

NUNGUMBAUKUM.

Kodakamal

Madras,

29. VI. - 1898.

FROM

THE GOVERNMENT ASTRONOMER,

Madras.

TO

C. Stokes Esq

Chief Secy. to Govt.

SIR,

With reference to endorsement No 1364 dated 18th June 1898 (Public) I have the honor to make the following remarks.

2. The subject of the variation of latitude is one of great interest + importance + might certainly be taken up with advantage at the Kodakamal Observatory if circumstances made ever possible. At the same time, writing at a distance from all books of reference, I am unable to understand Major Surrard's contention that it is necessary to confirm the observations made in Europe and America by observations made in India before accepting the conclusions drawn from these observations.

3. The motion of the earth's pole is a complicated one + I entirely agree that the data hitherto obtained is not sufficient to justify the use of the formulae deduced by Chandler for dates very far distant from the present + hence I think that additional stations for latitude observations would be useful.

4. At present, however, in view of the

recent correspondence with the Government of India regarding the Kodaikanal Observatory. It is not possible for me to express any opinion as to the probability of my being able to take up the work there.

It appears from that correspondence that changes in the scheme of work proposed to be done at the Observatory are in contemplation, but what the nature of these changes is has never been intimated to me & I am entirely in the dark as to their nature regarding them.

5. In any case it may be well to point out that there is no instrument suitable for the work either at Madras or at Kodaikanal & that the observations are of such a kind that I would be unwilling to entrust them to anyone except a trained European observer. The cost of a suitable instrument would not be great & perhaps it would be possible to depute some member of the Survey Dept. to undertake the actual observations either at Madras or at Kodaikanal where ~~the~~ he would have the use of all the facilities afforded by a fixed Observatory. It is evident that it would be quite impossible for the Govt. Astronomer personally to take

up this investigation while engaged in setting up & starting the new Solar Physics Observatory, though he would most willingly give any help he could to anyone engaged in the work.

I have the honor to be

Sr

Your most Obedient Servant

Christie Smith  
Govt. Astronomer

C. Nos. 1920 & 2127.

(V) ~~HIS EXCELLENCY THE GOVERNOR.~~ *Plt.*  
(H) ~~THE HONBLE SIR HENRY BLISS, K.C.I.E.~~  
~~THE HONBLE MR. GROSE, C.I.E.~~

SUBJECT.

Proposal that certain observations re-  
quired by the G.T. Survey for Geodeti-  
cal purposes should be undertaken by  
the Govt. Astronomer, Madras.

FOR ORDERS.

*Resubmitted to the  
Hon. Mr. Henry Bliss  
with ref. to H.E. his former  
order.  
HX  
15/8/28*

In current No. 1920 (flag Z)  
India asked us to report on the practi-  
cability of certain observations for  
latitude being undertaken by the Govt.  
Astronomer, Madras, and the best method  
of making them. Mr. Michie Smith in cur-  
rent No. 2127 (flag Y) says that no  
instrument suitable for the work is  
available either at Madras or at Kodai-  
kanal and that the observations should  
be undertaken by a trained European  
observer. He does not anticipate that  
the necessary instrument will cost  
much and suggests that deputation of  
some member of the Survey Department to  
undertake the observations. He adds  
that the Govt. Astronomer cannot per-  
sonally make the required observations  
as his time will be fully engaged in  
starting the new Solar Physics Obser-  
vatory at Kodaikanal.

2. The following disposal is sub-  
mitted for approval:-

Order:-  
Mis.

ORDER:-  
Mis.

The Government of India will be addressed.

To the Govt. Astronomer (C of current No. 2127)

LETTER:-

To

The Secretary to the Govt. of India,  
Dept. of Rev. & Agri. (Land Surveys)

Sir,

I am directed to acknowledge receipt of Mr. Macnochie's letter No. 1087-68-2, dated 6th June 1898, and to state that after consulting the Govt. Astronomer, His Excellency the Governor General in Council considers that the interesting subject of the variation of latitude at Madras, namely, might be taken up with considerable advantage in this Presidency, if a suitable instrument could be provided, and if some member of the Survey Dept. could be deputed to undertake the observations. His view is expressed by the Secy either at Madras or at Kodaikanal, where the use of a fixed observatory would be available. The Govt. Astronomer could not personally undertake the required observations as his time will be fully employed with the new observatory at Kodaikanal.

Who the letter being  
referred to him in the  
Mech. to arrange the same  
as per his follow

9/7/98  
Might it not be well to make the reply more  
concise by asking Mr. Smith, with  
reference to his para. 8: - (1) What instruments  
would be needed; (2) What they would cost; (3) How  
he thinks one of our own Survey Dept. could make  
the observations, or if a greater  
specialist from the Govt. of  
India, would be needed; and  
(4) whether a man would have  
to be retained specially for the duty, or could  
undertake it in addition to his own ordinary  
work.

A. H. 14.7.98

Very well  
H. H.  
18/7/98

[ 24. ]  
1,000-14-8-97.

Public DEPARTMENT.

Papers to be read in proceedings:-

Again G.O., No.

dated

189

Again G.O., No.

dated

189

Current No.

2127 of 1898, dated

24.6.98 from Govt. Astronomer

" "

" 189 , "

" "

" "

" 189 , "

" "

ORDER.

On No. 1610 of 22-7-98.

The Govt. Astronomer is requested to report with reference to para. 5 of his letter No. 122 of 24-6-98: -  
(1) what instruments would be needed;  
(2) cost of such instruments;  
(3) whether the required observations could be made by an officer of the Land Survey Dept., or if it would be necessary to send the Govt. of India for the services of a specialist;  
(4) whether the required observations could be conducted by an officer in addition to his own ordinary duties, or whether it would be necessary to depute an officer specially for the work.

to the Govt. Astronomer.

20/7/98.

Recd from  
M. P. 2/8/98

Public Current No. 24/18.

Revenue and Agricultural Department,

No. 1527.

( L.S. )  
Simla, The 27<sup>th</sup> July 1898.

To  
The Secretary to the  
Government of Madras.

SIR,

I AM directed to invite attention  
to the communication marginally noted,\*  
and to request the favour of an early reply  
thereto.

Subject.

Proposed conduct by the Government  
Astronomer at Madras of certain  
observations required by the Great  
Trigonometrical Survey for geodetical  
purposes.

*Where is this  
case?*



I have the honour to be,

SIR,

Your most obedient Servant,

*-Z*  
C.O. 1920/98

1087  
\* No. 68-2, dated the 6th June '98.  
subsequent reminder No.  
dated

*S. Maunochil*  
Under-Secretary to the Govt. of India.

Papers to be read in Proceedings:—

Again G.O., dated

189 , No.

Again G.O., dated

189 , No.

Current No. 2418 of 1898, dated

27.7.18, from

East of India

" "

" 189 , "

" "

" "

" 189 , "

" "

ORDER Letter

N

Dear Sir,  
East of India  
No. 1898, 2418.

Sir,

With reference to the letter  
reminiscent of the 24th of 1898  
directed to the East of India  
as a reply to the letter  
on the subject of the  
East of India  
East of India.

M.V. - copy  
4/8/98

3.8.18

No. 1639 of 4.8.98.

The East of India is requested  
to submit the information asked  
in the letter of 16th of 1898 at an  
early date.

4/8/98

East of India

Public (1898) Department.

CURRENT No.



E

From

The Govt. Astronomer,  
Madras.

Order

No. 147

Dated 10<sup>th</sup> August 1898

Received

Registered

Enclosures —

Spare copies —

SUBJECT.

Submitting his reply  
with regard to some points  
connected with the instruments  
for Latitude work.

next smaller size with an aperture of 3 inches and costing £189 would probably be sufficient so far as the special latitude work is concerned but the difference in cost is so small that I would recommend the larger instrument, as it is one with which certain other very important observations (for which Kodaikanal is specially well placed geographically) could be made.

I am informed that no British instrument makes at present supplies a suitable instrument of this class.

3. The third question as to "whether the observations could be made by an officer of the Madras Survey Department" is one which I naturally hesitate to answer. I am not aware of any officer in that department who has had any training in Astronomical work and the observations in question are amongst those requiring the most minute accuracy of eye and hand - an accuracy which can be attained only by long <sup>practice</sup> ~~practice~~ in this or similar work. The observations would be quite valueless if made by an amateur and I do not think it likely that any man in the Madras Survey Department has either the necessary knowledge of theoretical astronomy or the training in refined observations to fit him for the duty. The only men in India, so far as I know, who could take up the work without preliminary training are some of the officers of the G. I. Survey.

4. Question 4. There can be no doubt that the work would take up the whole of an officer's time and it is doubtful if one man could bear the strain of the whole work. The observations necessary would probably occupy 3 or 4 hours at least every five nights while the reductions of the observations would take a still longer time. At the same time if the observations were made at Kodaikanal where the climate is bracing and where the clearness of the nights would greatly facilitate the observations I think one officer with the help of a computer and with such assistance as he could get from the observatory staff would be able to carry out the work.

5. In this connexion it may not be out of place to point out the special advantages which would be obtained by observing at Kodaikanal instead of at Madras. The advantage of climate though great is of less importance than the advantage due to elevation. One of the most serious difficulties met with in observations for variation of latitude arises from uncertainties in the refraction effects. It must be remembered that the extreme range of the quantity to be measured is less than one second of arc and the variations in the refraction at a low level station not infrequently exceed this amount. At an elevation of 7700 feet which is the approximate height of the Kodaikanal

Kodairanal Observatory the total amount of refraction is greatly reduced whilst the variations in the refraction nearly vanish. The low latitude of - Kodairanal is another very important feature as it will permit of the stars used north and south being connected together by a series of independent observations in a way that will add greatly to the final value of the work. There is I believe no observatory in the world at which this particular work of coordinating the observations of northern and southern stars could be equally well carried out.

b. There is one other question which might fairly be considered in this connexion. In the ordinary course of affairs I will wish to proceed on for long within the next 18 months and the question will arise as to getting some one to look after the Observatory in my absence. It has occurred to me that it would be possible to combine the supervision of the Observatory and the latitude variation work. Of course the officer carrying on the latter work could not take up my special work but he could give that general supervision which would be necessary and he would be at hand for reference in cases of difficulty.

I have the honor to be,

Sir, your most obedient servant.

Charles Smith

PUBLIC DEPARTMENT.

Papers to be read in Proceedings:-

Again G.O., dated

189 , No.

Again G.O., dated

189 , No.

Current No. 1920 of 1898, dated 4/6

from the first of the year.

" " 2127 " 1898, " 29/6

" " 2418 " 1898, " 27/7

" " 2509 " 1898, " 19/8

1. The Honble Sir Henry Bliss K.C.S.I.

ORDER. No 1075, D 24<sup>th</sup> August '98.

2. H.E. the Governor.

Mis.

Letter to Indians.  
Proposal that certain observations which are required by the G. Trigonometrical Survey should be undertaken by the Govt. Astronomer.

The Govt. of India will be addressed.

To The Govt. Astronomer (C of Nos. 2127 & 2509)

from Madras

LETTER:- No 1076, D 24/8/98

To The Secretary to the Govt. of India, Dept. of Rev. & Agri. (Land Surveys)

Sir,

I am directed to acknowledge receipt of Mr. Maconochie's letter No. 1087-68-2, dated 6th June 1898 in which it is proposed that certain observations which are required by the Great Trigonometrical Survey should be undertaken by the Govt. Astronomer at Madras.

2. In reply I am to enclose copies of two communications on the subject

Current Nos. 2127 & 2509 1898.

subject received from the Govt. Astronomer,  
 Jan to say that H.E. the Governor in  
 Council concurs generally in the views  
 expressed by that officer in his  
 Astronomer.

in which that officer discusses,  
 (1) the practicability of the proposal,  
 (2) the instruments which need be  
 purchased, & (3) the establishment  
 which need be required.

FROM ORDERS.

8 0591  
 8 7512  
 8 0142  
 8 9911

C. S.

entirely not needed in the  
 instrument which is to be  
 used in the establishment

given for copying  
 copied 26/8/1908  
 examined  
 signed  
 back, dated

AGAIN G.O., No.  
 189

CURRENT No.

ENCLOSURES TO G. No

ORDER OF GOVERNMENT .. .. A A A A A A A

LETTER OF GOVERNMENT.

STATEMENT WITH DETTO.

PAPERS NOT FILED UP, BRING WANT FOR DISPATCH  
 IN ORIGINAL.

N.B.—

A = Copy in full.  
 B = Not to be copied.  
 P = Copy abstract only.  
 Q = Copy heading only.