Coincident Optical Deviations and Geophysical Event

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Abstract

An optical deviations measurement setup in continuous operation since June 19th 2004 has shown unusual correlated deviations between December 25th and 27th for 3 independent orthogonal laser beams. Those deviations *occurred slightly before and coincident* with the December 26th earthquake near Sumatra and the consequent tsunami.

A first laser beam propagating North to South deviated sharply 30 µ-radians toward the vertical, starting around 16 UT on December 25th and reaching a plateau at 10 UT on the 26th.

A second independent orthogonal beam propagating East to West showed a 15 µ-radians spike towards the South, starting also about 16 UT on the 25th with a maximum at 21 UT the same day, and then showed a progressive 60 µ-radians reversion to the North , ending at 18 UT on December 27th.

A third independent orthogonal laser beam propagating vertically upwards showed a very similar 17 µ-radians spike-shaped deviation to the South and then a similar 60 µ-radians reversion, which was very well time- and shape- correlated with the deviation of the E-W beam.

As these observations relate only to a single occasion, the author simply notes the *coincidence*, and does not argue for a causal connection; but it was hardly possible to allow a veil of silence to remain over a fact which should strongly incite the scientific community to study the phenomenon of light deviations seriously. This phenomenon has been dismissed as non-existent for 80 years, mainly on theoretical grounds. Observations of the 25th to 27th December 2004 suggest that automatic monitoring of long term deviations of laser beams (a rather inexpensive activity) could have unexpectedly far-reaching practical applications.

Foreword

This short paper reports an observation considered potentially important. The experiment initially addresses the verification of a controversial phenomenon, and the experimental setup has been carefully designed and operated so that its behaviour is now well characterized. The December data presented here thus shows something which is not clearly reducible to an artefact, especially a temperature-related one.

Descriptions are here reduced to the bare minimum. Full details of the construction are available from the author on request, or from a website where technical reports have been published to allow for full and exact replication (see http://www.allais.info/morin/index.htm).

Brief description of the setup

The setup is composed of three beams each installed in an extruded polystyrene foam structure. Each beam has the following structure. In a 50 mm borosilicate glass tube, two 90 cm long Robax glass strips are installed in a L-configuration, in order to keep fixed 1) a laser module delivering a 1 mm parallel light beam mounted at one end, and 2) a CMOS USB webcam chip mounted at the other end. The laser beam is incident upon the CMOS chip which images the resultant spot. The whole arrangement is spring mounted with glass-to-glass contacts or invar-to-glass contacts. It is very rigid and acceptably temperature immune.

The three beams are arranged mutually orthogonally. One called “ns” has the laser beam directed horizontally North to South; another called “ew” is also horizontal and its beam runs East to West; and the beam of the third, called “gm”, is directed vertically upwards towards the zenith. The 2D CMOS imaging sensor chips are oriented so that their axes run along this coordinate system. Thus, deviations of the “ns” beam are measured to ground (the signal G_ns) and to East (E_ns); on “ew” deviations are measured to South (S_ew) and to the zenith (M_ew), and on “gm” deviations S_gm to South and W_gm to West are measured.

The positions of the three spots are monitored continuously, and 6 deviations are filed every 10 minutes along with internet-coordinated UT and the temperatures interior to each of the 3 beams.

The temperature variations at the beams are very slow and homogeneous, since the apparatus, inside its foam isolating structure, is housed in a cellar with no air or people circulation.

The thermal sensitivity coefficients are *negative* for all signals; that is, the raw signals always decrease as temperature increases. This is important for the interpretation of the observed facts reported below.

Note also that the signals are centered and corrected for temperature effects by estimating the linear thermal sensitivity coefficients and subtracting a quantity proportional to the temperature. This process is discussed at length in a preliminary report for the results of the first 6 months of operation, available upon the website cited above or from the author.

The graphs given below are the centered signals *without temperature effects*. They are noted with suffix “_cc” for centered corrected : G_ns_cc, E_ns_cc, and so on.

The observed facts

Graphs of the temperature-corrected deviations for December 2004 are shown in Figure 1.

The centered temperature graph T_ns_c is plotted only for the NS beam. It is identical for the other beams.

FIGURE 1

Consider the curves from the 25th to the 27th of December. The signals E_ns_cc and M_ew_cc have no specially unusual characteristics. The W_gm_cc has a small west deviation, a triangular spike of 10 µ-radians, but this is not really remarkable per se (however, note the time correlation with the following signals).

The interesting observations derive from the G_ns_cc, S_ew_cc and S_gm_cc signals.

S_ew_cc and S_gm_cc, both being South deviations, exhibit the same shape (starting to climb for 17 µ-radians at 16 UT on December 25th , reaching maxima at 21 UT on the same day, then decreasing 60 µ-radians until 18 UT on the afternoon of the 27th .

G_ns_cc has its own particular shape, climbing 30 µ-radians from 16 UT the 25th to 10 UT on the 26th, with another 7 µ-radians spike at 03 UT on the 27th, and then decreasing until the afternoon of the 27th at 18 UT.

The temperature graph shows a significant temperature drop-and-return excursion of 3°C between noon 25th and afternoon on 27th.

Remarks

First it should be noted that the 3 interesting signals are produced by 3 independent laser beams, enclosed in different foam cavities and having nothing in common but the environment of the cellar.

One could be tempted to say that the G_ns_cc excursion *towards the zenith* is a temperature effect. But remember that G_ns_cc is corrected for the temperature, and that the thermal sensitivity of G_ns is negative (-14.69 µ-rad/°C, the best for all of the signals). But the raw uncorrected G_ns exhibits the expected drop *downwards* due to temperature, that is, to the opposite of the corrected signal excursion. This proves that the G_ns_cc zenith excursion is *not* a temperature effect.

The similarity of S_ew_cc and S_gm_cc cannot be accounted for by temperature either; their shapes are completely different from that of the temperature excursion.

The S_ew_cc signal is produced by the positive V direction of the EW sensor. As the thermal coefficient is negative (-50.67 µ-rad/°C) on S_ew, rather than exhibiting a spike, the signal should have kept on increasing with decreasing temperature, which did not happen. The S_gm_cc signal is produced by the positive H direction of the GM sensor, so that the same reasoning holds. In addition the thermal coefficient of S_gm is different (-40.13 µ-rad/°C) so that the same 15 µ-rad increase and subsequent 60 µ-rad decrease on those signals surely originates from another cause which affects the ew and gm laser beams similarly.

Conclusion

The observation of correlated deviations with a carefully designed 3 independent laser light beams measurement setup strongly suggests there is a common cause acting upon the light beams, whose origin is at present unknown, but which is coincident with, or rather is slightly before, the cataclysmic December 26th, 2004 earthquake and the accompanying geophysical processes. Please note, to stress the point, at the moment we consider that this fact only has the status of a *coincidence*, and we do not assert any causal connection of any type; but neither do we say that this is only a random occurrence. Only future studies can provide an answer.

The experimental fact of the occurrence of this coincidence should motivate other laboratories to mount experiments to observe these light deviations in a coordinated manner. This entirely automated experiment is both easy and cheap to build, provided skilled and open minded people seriously address the question. The present apparatus cost 3K€, and was set up by one man in one month.

Only when several geographically scattered measurement stations have produced correlated data can this phenomenon be clearly assessed. Then global correlations will perhaps appear between light deviations and geophysical events. Considering the low cost and the great potential consequences, the investigation appears potentially very fruitful. Apart from the reports mentioned above and available on the website cited, the author may be contacted for full details.

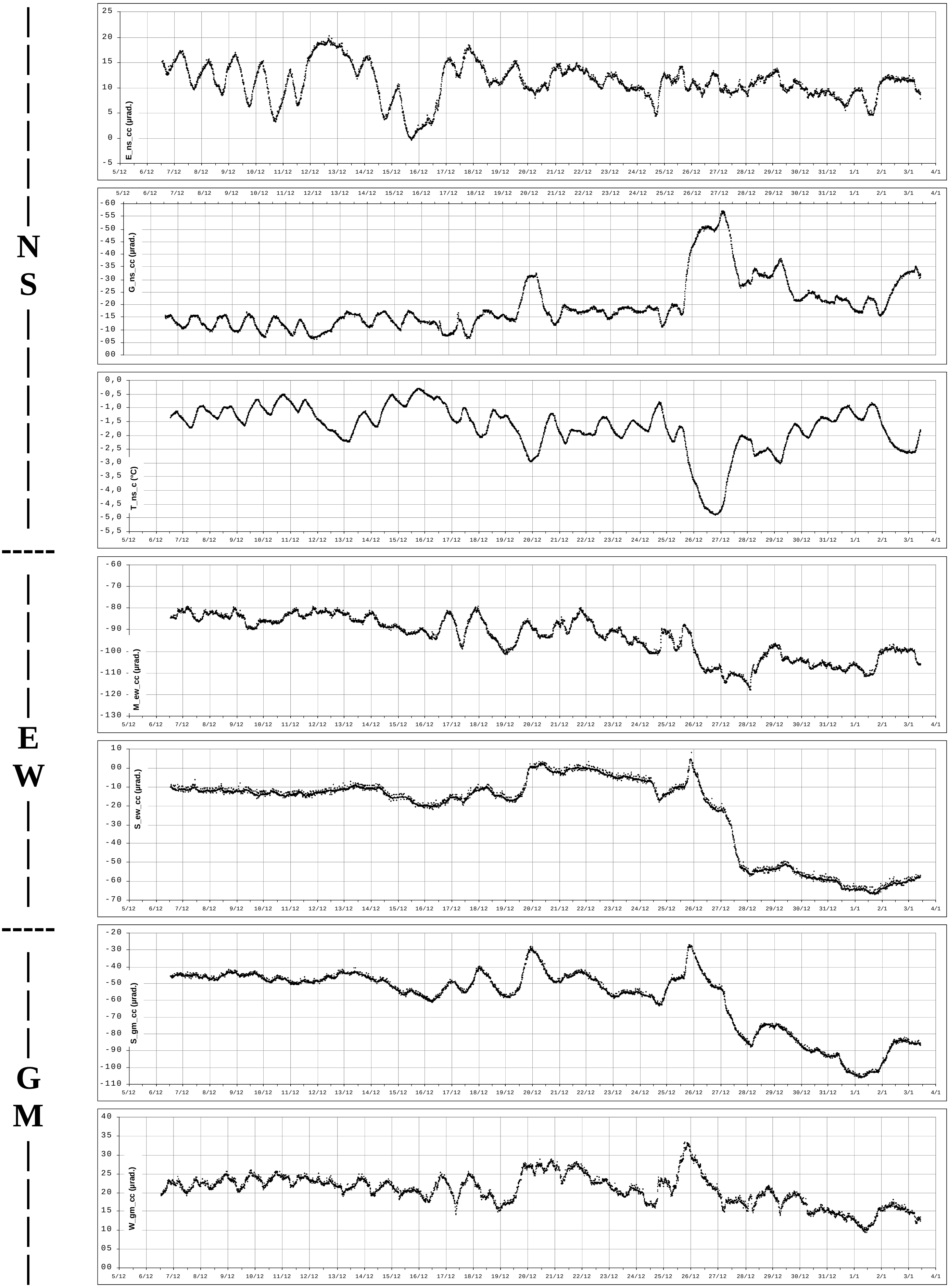

FIGURE 1. December 2004 light beam deviation data acquired by Vincent Morin in Brest (France) with a 3 orthogonal laser beam glass-mounted setup. The temperatures on the ew and gm beams were identical to the ns temperature. The deviations are corrected for temperature effects.