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Environmental Remote Sensing by GPS -Section2- First Trial for Presumption of Concentration of Atmospheric Pollutants

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From the previous results of this study, the possibility to use GPS (Global positioning system) as an environmental remote sensor has been suggested on the basis of observation of geographical distribution of secondary correlations r (RA:RR) between running averages of air pollution (RA) and the running correlations (RR) between 1.atmospheric tide (tidal and centrifugal force), 2. atmospheric expansion by solar radiation 3.geomagnetism and GPS data, respectively.
The application of this theory could lead to presumption of the concentration of atmospheric pollutants from GPS observation and physical factors, theoretically.
This section includes the first trial.
The method is as follows:
A GARMIN GPS II and ProAtras2000 were used as a single frequency GPS receiver and a data logger, respectively. GPS data were taken at a fixed position in Odawara-city, Kanagawa Prefecture. The web-pages of GSI and SORAMAME-KUN of NIES were cited as geomagnetism (KANOZAN) and air pollution data, respectively.
Running correlations (RR) were gained when discontinuous time series (N=30) of GPS positioning data were correlated with the relevant physical factors such as 1.Tidal force and centrifugal force, 2.Solar energy radiated on ground, 3.Geomagnetism, and on the other hand the running averages (RA) of air pollutants concentration were taken in the corresponding period (N=30).
Linear polynomials were set up to presume RA after multivariant analysis (i.e. multiple regression) with RA as objective function between 9 RRs (3 GPS coordinates x (multiply) 3 physical factors) and 1 RA, so that running averages of atmospheric pollutants concentration were calculated from GPS observation. Moreover, the target value of atmospheric pollutants $C_x$was obtainable with a difference between two running averages (RA1, RA2) and a initial value of the concentration $C_{x-30}$from next formula:
$C_x = RA1*30 - RA2*30 + C_{x-30}$
The results of calculation by way of this method were as follows:
A fairly good approximation was available for RA for each observatory of atmospheric pollution, but scarcely good for original concentration data, which contained large errors. On the other hand, a relatively small error but scarcely good approximation was obtained for mean data within the prefecture.
These inaccuracies are probably due to the variety of atmospheric pollutants and the complexity of their chemical reactions, and are reducible by using more data or more continuous data.
However, fundamentally, if it is wrong to regard an atmospheric pollutant concentration as an independent variant, it may be necessary to settle statistically this analysis as a joint density function with numbers and mutual dependency of pollutants as variants.
In any case, the results indicate that it is possible to presume the level of wide-range atmospheric pollution only from single-point GPS observation and some physical factors. Further, analysis on the basis of each GPS satellite will lead to significant progress.

Keywords: GPS, atmospheric pollution, remote sensing, multivariant analysis, correlation coefficient, multiple regression