A hypothesis of earth quake
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Abstract
Without a model, it is impossible for a geophysicist to study the possibility of forecasting earth quakes. We will define a quantity, the event-degree, in this paper. The quantity plays an important role in the model of quakes forecasting. In order to make a simple model, we make a hypothesis of earth quakes. The hypothesis is: "(i) There are two kinds of earth quakes, one is the triggered breaking (earth quake), the other is spontaneous breaking (earth quake). (ii) Most major quakes in continental plates such as Eurasian Plate, North America Plate, South America Plate, Africa Plate and Australia Plate are triggered breaking. (iii) These triggered quakes are triggered by the evolution of high pressure centers and low pressure centers of the atmosphere on the plates. (iv) How can the evolution of the high pressure centers trigger a quake in quantitative sense? It depends on the event-degree, the extent of the high pressure center, the rate of evolution of event-degree and the degree of stored energy for reaching breaking point."

The scale of earth is so large that can not be obtained in the laboratory. Compare to a hurricane, the power of a tornado is very small though the surface force which is produced by a tornado on the ground is devastated. Compare to the high pressure of atmosphere, the surface force which is produced by a tornado is too tiny. Therefore, the surface force which is produced by a high pressure center of atmosphere might be the trigger of quake.

Introduction
Formosa, Taiwan, is located at the boundary of two plates, Eurasian plate and Philippine Plate. Therefore, the frequency of quake is very high. There are more than 4000 quakes in a year. Only few of them are felt quakes. Compare to the felt quakes, most of these quakes can be considered as noises in the sense of signal processing. From the view-point of the weather map, Formosa is located in the subtropical zone. Roughly speaking, there are only two seasons: one is dry season and the other is rainy season. From February to October is rainy season and hence the other period is dry season. Strictly speaking, the rainy season is from February to July. In this period, Pacific high pressure center is comparable to Mongolia high pressure center. These two high pressure centers confront each other and the boundary of these two centers passes through the region near by Formosa. The boundary is
called front. During the rainy season, there many fronts which are built and pushed to southeast and then the front will die out in several days. Usually, the last front will stay one, two, three or four weeks. The rainy days happen randomly from the middle of July to October because they are introduced by typhoons. Though the history of Taiwan is more than 8000 years, the data collected by residents is available in the nearest 400 years. People were not afraid of quake because they were used to the quakes and the houses were made of bamboos and grasses. The people cared about the weather because most Taywans were farmers 100 years ago. When dry season is too long it becomes draught. When rainy season is too long there will be no harvest and, even worse, it will flood. The starting point and the ending point of rainy season is not predictable. It might come earlier or later. There was not weather forecasting center at that time, 400 years ago. It seems that the quakes have nothing concern with the weather. Actually, it might not be true. From the experiences of Taywans, a connection between these two natural phenomena, quakes and weather.

A Controversial Issue

It is unbelievable that they can predicted the starting point and ending point of the rainy season one day before. Why and how can they predict these points one day before? We find that they have got a rule: if there is quake, then this quake is a turning point of of two seasons, changing rainy season to dry season or changing dry season to rainy season. The author have tested rule for 50 years. From the view-point of science or, more precisely, statistics, this is an empirical rule really. Here we should stress that these quakes are strong felt quakes. This shows the evidence that there is correlation between weather and quake. Since we have been confused by this rule, we analyze the data of weather carefully. We get a rough conclusion: On contrary, we can use this rule to predict the quake. Of course, this must be controversial issue. We think the conclusion is reasonable and it is harmless at least. So far, though there many methods for predicting quakes, none of them gives a scientific basis or model. What we mean science is a method or procedures which can be repeated or, more precisely, verified in any time and at any place. Since the quake recorders are so sensitive that we must ignore most of the collected data. It is impractical to predict such tiny quakes. The first step of our approach is to make a classification of quakes. Roughly, we classify the quakes two classes. One class is predictable and the other is unpredictable. This is not the key point because we think most, if not all, felt quakes such as the devastated quakes are in the predictable class.
A True Story

On April 13, 1999, the author gave a talk in press conference. Most audiences were professors except one or two reporters. The topics is "the empirical rule and the model of quake forecasting." At the end of the talk I gave a warning that there might be a major quake before the July or after the September because it was 64 year ago that there was a major quake in 1935. A reporter said that you must be jerking. All professors agreed that this was, so to speak, only a hypothesis. I was assigned the work to find or to collect enough data to verify the hypothesis. On one hand, it was not available for me to get the financial support for setting up a large set of global position systems. On the other hand, it was not easy work to process the data collected by GPS and the data from weather forecasting centers. What I could do was to read any related documents. Usually, the Mongolia high pressure center is not so strong and active in summer. In summer, the high pressure center is strong and dominates on the Pacific ocean. Since the water of ocean will balance itself, it will not disturb the boundary of plates too much. We found that the Mongolia high pressure center was strong and active in beginning of the September, 1999. From our experiences, it was unusual. In the afternoon of September 20, 1999, people were scared why the weather got worse suddenly, the sky was covered by thick clouds and it started to blow strong wind (gale). Usually, it must be a shining day in September except a typhoon near the region. But we did not know what would happen. Unfortunately, a major quake occurred at 1:47, local time, in the morning of September 21, 1999. At that moment I was reading the book "An Introduction to the theory of Seismology" written by K. E. Bullen, a text book of my second year course in graduate school. Since I was exhaustive and I was lying to read the book. I was almost killed by a falling book case. Fortunately, I was shocked and stood up. It was painful because one my leg was injured but not too serious. The distance between my house and the epicenter of that quake is about 40 kilometers. There were about 2000 people were killed in, the short time, 40 second quake. The death toll is about 3000 and tens of thousands were injured in that quake. The Central Weather Bureau announced that the depth of focus the quake is less than 9 kilometers. The density of distributed seismic data recorders in Taiwan is the highest one in the world. An officer of the Central Weather Bureau said very proudly that the system of data processing was very powerful. Since most recorders are connected to the computer center of Weather Central Bureau. The monitoring system of quakes was computerized completely. The response
time of computing system was less few seconds after the quake. Since the
people of Taiwan had realized that the damage of quakes might happen in
any time, the government spent a lot of money to set up the monitoring
system.

A Model for Predicting Quake

Most geophysicist agree with the plate tectonic theory. Therefore, we
will not repeat it in this paper. Though we know that the energy of quake
is supplied from the interior of the earth, we do not know when the energy
will release itself. By analogy, we construct a simple model or example: A
rubber is stretched by pulling the two ends of the rubber. The forces are large
enough but not too large to break the rubber. We can either increase the
forces slowly or keep the forces constantly. Finally, the rubber will break.
We call it spontaneous breaking (quake). By a finger, we can disturb or
exert a small force perpendicularly at the middle point of the rubber, then
the probability to break the rubber is very high. If the rubber break, then
we call it triggered breaking (quake). The situation is quite clear. (I) It
is doubtless that boundary of two plates store the energy for the breaking
(quake). But no one knows when breaking point is reached and then break.
(II) Since there are many forces exert on or inside the earth such as Newtonian
gravity, including celestial forces, current flow of mass and hence heat inside
the earth, the system of earth is dynamic not static. We can not take them
into account because most of them are unaccessible (III) There are two kinds
of forces: One is body force, like gravity force, the other is surface force, like
pressure force. All objects with mass, human’s cells, a stone, an egg etc.,
must be exerted by gravity force, the body force. (IV) From our experiences,
the surface force plays an important role in the triggered breaking. Now, we
try to expose the model for the triggered quake. When we pick up an egg
there are surface forces which exert on the egg. If we either hold it carelessly
or throw it on the ground, then the egg will be broken. If we put the egg
in the water deeply, the probability of breaking the egg is very low though
there are large surface forces exert on egg. It seems that the trigger force
neither very large nor random happening. Since it takes time to accumulate
the enough energy in the boundary of plates, there is long period that the
boundary of two plates near the breaking point. Like the rubber in the
example, the probability of being triggered to break is much higher than
that of breaking itself. Therefore, a small scale external force might be a
trigger of a devastated quake if it happens at right time and at right place.

The scale of earth is so large that can not be obtained in the laboratory.
Compare to a hurricane, the power of a tornado is very small though the surface force which is produced by a tornado on the ground is devastated. compare to the high pressure center of atmosphere, the surface force which is produced by tornado is too tiny. Therefore, the surface force which is produced by a high pressure center of atmosphere might be the trigger of quake.

In speaking of the triggers of the earth quakes, we assume that the tidal wave will not be the major trigger since the tidal wave is a balance dynamics, in some sense, and the earth is covered by water mostly. Likely, when a high pressure atmosphere exerts on the surface of ocean the water will balance itself automatically, redistributing the water by flowing. When the high pressure atmosphere force exerts on the continent, the situation is different. The growth and movement of high (low) pressure of the atmosphere on the continental plate will trigger a quake if the energy is stored enough. Of course, if it is necessary, then the tidal wave must be considered and this model will be more complicated and completed. First, in order to make a simple model, we have made a hypothesis. The force of tidal wave is excluded in this hypothesis. If it works, then we shall combine effects of these two forces, the force of tidal waves and the forces of atmosphere. In order to construct a simple practical model, we filter out most quakes by classifying them into noises. We hope or we assume these noise quakes are harmless. This assumption is reasonable. The reasons are: "(a) The damage of quake is not dependent on the magnitude of the quake only. Some quakes with magnitude more than 8 in Richter scale are harmless since the locations of their focuses are very deep below the ocean area. (b) Clearly, the deeper is the focus, the less is the probability of being triggered by the surface force on the ground. (c) Usually, The devastated quakes are shallow quakes. It is obvious that the shallow quakes are triggered by the forces of the atmosphere. (d) The depth of the focus of shallow quake might be less than 10 kilometers. Oil company can drill oil well more than 4 kilometers in depth. Clearly, the focus of the shallow quake is located at the region near the ground surface."

It is possible to watch the sky and find the following condition: there are two layers of clouds. One layer is higher and other layer is lower. Each layer consists many pieces of clouds. The clouds of upper layer are almost stationary while the clouds of lower layer are moving and changing their shapes. Some times one cloud of lower layer is almost congruent to one cloud of upper layer in size and shape and they overlap themselves completely. By analogy, We construct a model for quake prediction. On a globe, we
model two overlap maps. One is the map of the plate tectonic theory. There are many plates and their boundaries on this map. The other is the map of weather. There are many high pressure centers and their boundaries on the map. Usually, most, if not all, the low pressure can be consider as the boundaries of two high pressure. From the view-point of shapes and scales, we have a correspondence. The correspondence is that the plates are corresponding to the high pressure (centers) and the boundaries of the plates are corresponding to the boundaries of high pressure (centers). The region of this boundary consists of one, two or several small scale low pressure centers. Some time, the boundaries of two high pressure centers are called fronts. We can not expect the abstract correspondence being so nice that these two maps, the map of plates and the map high pressure centers, match perfectly, that is, each high pressure center is located on a plate and they are congruent to each other. We assume that the map of plates is fixed on the globe. The map of weather is changing in shapes since the weather is changing every moment. It is possible that some of the high pressure centers are located on some corresponding plates and they are almost congruent in geometry. For example, two high pressure centers are located on two adjacent plates and the geometry shapes of high pressure centers are almost, or partially, congruent to that of plates correspondingly. We call this event weather triggering event. In order to to measure the degree of congruence of the event, a calculated positive number can be assigned to the congruence. Since the set of positive number have their natural order. We call this positive number the degree of the weather trigger event or the event-degree briefly. Of course, the total force of the high pressure on the corresponding plate must be a factor of the event-degree. Therefore, we make the following hypothesis.

**The Hypothesis**

(i) There are two kinds of earth quakes, one is the triggered breaking (earth quake), the other is spontaneous breaking (earth quake). (ii) Most major quakes in continental plates such as Eurasian Plate, North America Plate, South America Plate, Africa Plate and Australia Plate are triggered breaking. (iii) These triggered quakes are triggered by the evolution of high pressure centers and low pressure centers of the atmosphere on the plates. (iv) How can the evolution of the high pressure centers trigger a quake in quantitative sense? It depends on the event-degree, the extent of the high pressure center, the rate of evolution of event-degree and the the degree of stored energy for reaching breaking point.”

**How to Test the Hypothesis**
In signal processing, most works are filtering the noises. In the hypothesis, we have separated the noise (spontaneous breaking) from the signal (the triggered breaking). Now, we have a simple model for testing. Since global position system is available, we can set up GPS regional widely and collecting data to compute deformation of plates which are effected by high (low) pressure atmosphere forces, including the rate of the evolution these high (low) centers. Both worldwide data of atmosphere pressure and quake are available. From the records of occurrence time of quakes, it is possible to test the hypothesis and to modify the model for forecasting the the earth quakes. Further more, we are able to find proper way for calculating the event-degree since we have not had the quantitative results of the event-degree.

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