# Drifting Clock and Lunar Cycle

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**Abstract:** An experiment is proposed, consisting of a Java UDP program that performs simple tests using two different servers connect by the internet. These tests can be repeated using the source code provided in the paper. The test results conclude that the two clocks, in different geographical locations, are drifting throughout the twenty four hour day.

***Keywords:*** *Atomic Clock, GPS, Gravity, Unified Field Theory, Relativity*

## 1. Introduction

The Unified Field Theory (e.g. [1],[2]) proposes that space-time distortion due to the existence of celestial bodies causes gravity. The General Theory of Relativity (e.g. [3],[4]-[13]) predicts that the clocks can be changed when the gravity field varies; this explanation is the opposite, with the cause and effect reversed. A simple repeatable test was conducted for a few months in order to prove the Unified Field Theory. The complex clock drifting patterns that emerged mainly coincide with Lunar cycles.

The GPS (e.g. [14],[15]-[53]) system needs clocks accurate to the nanosecond. The existing network infrastructure can be used to study the behavior of computer clocks in two different locations. Since communication between the two locations takes time, clock drifting can be measured based on data collected over a twenty four hour period. This paper uses UDP as its data collection mechanism. The collected data is processed to remove linear clock drifting and faulty data. Instead of raw data, maximums, minimums, and arithmetic means of the collected data are used to prevent data overload on drawing software. The clock drifting can be explained with Unified Field Theory's time-space distortion compounding during the lunar cycle and complication of tide interferences.

## 2. UDP Experiment

### 2.1. UDP Program

In this experiment, there are two servers, one in New York, the other in Chicago. They are 1145 kilometers apart. The long distance introduced a delay of at least 3.3ms when going in one direction. The loop back delay will be 6.6ms.

A UDP program is implemented in Java to collect data. There is a server component and a client component. The client sends its time in nanoseconds to server. The server simply sends back its time in nanoseconds upon receiving the request.

For the main tests, the client ran in Chicago while the server ran in New York. Many tests were completed over a period of one month. One of the tests ran for 36 hours between July 2 and July 3, 2013. The following chart (fig. 1) displays the test result.

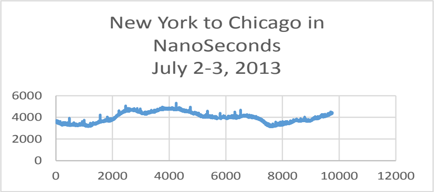

**Fig. 1**. One Day Clock Drifting Chart

There is noticeable clock drifting in the Fig. 1 chart. Coincidently, the drifting cycle mostly follow the phases (fig. 2) of the Moon and hours.

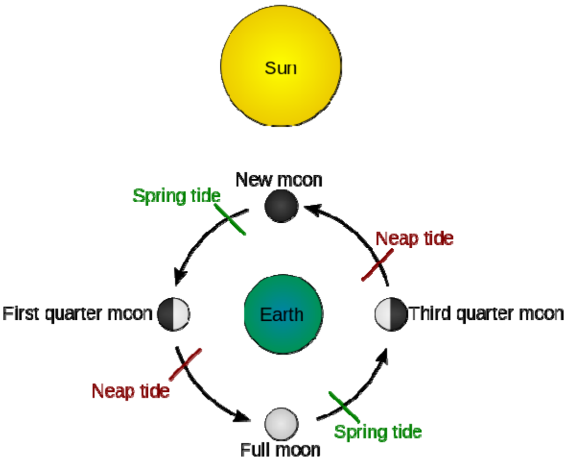

**Fig. 2**. Sun / Moon Cycle and Tide

A simple clock drifting distortion scenario would be a day with a New Moon. During a New Moon, the Sun and Moon are almost aligned. The layout in this scenario will be less complicated. It has a simple wave.

In the day of New Moon, the wave reaches to its top at 6PM and falls back to the bottom at 6AM. During the first quarter Moon phase, the clock drifting has no clear pattern. Even though the Sun only has 3% of Moon's tidal force, it can alter the clock drifting cycle due to the dissonance between Sun and Moon cycles.

## 3. Spacetime Distortion

### 3.1. Laplace's Tidal Equations

in 1776, Pierre-Simon Laplace formulated a single set of linear partial differential equations for a tidal flow described as a barotropic two-dimensional sheet flow. Coriolis effects are introduced as well as lateral forcing by gravity. Laplace obtained these equations by simplifying the fluid dynamic equations (e.g. [54],[55]-[76]).

## 3.2. Time Based Sea Level Prediction

Unified Field Theory (e.g. [1]) provides a simple explanation on the relationship between space time and energy. In this case, the Moon introduces compound distortions on Earth's gravity and rotational kinetic energy. If we know the relative clock speed of each location and Sun/Moon cycles, then, we can make Tidal Phases' (fig. 2) Prediction.

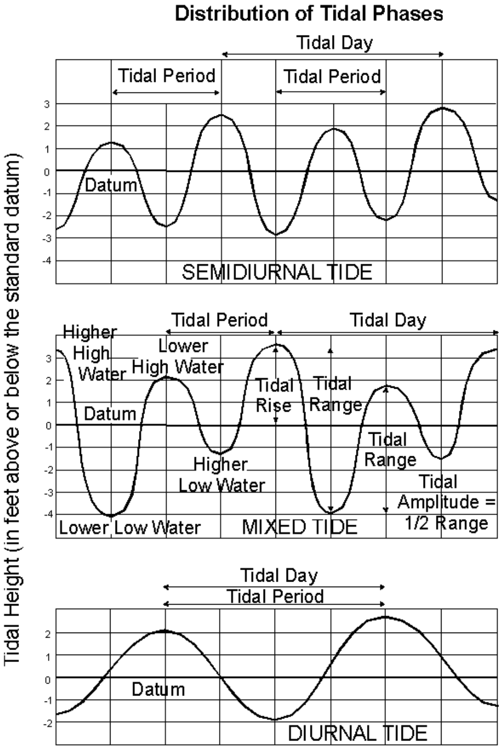

**Fig. 3**. One Day Tide Chart

Based on the Unified Field Theory, the energy E, force F (ma) and clock speed D are related.

$F = ma = dE/ds = mc^2\, dD/ds$

s: Distance of two points on the earth

a: Gravitational acceleration by Sun, Moon and Tide

For a unit mass, m = 1:

$a = c^2\, dD/ds$

The above force is along the earth surface. For a given time, the clock rate difference between New York and Chicago is:

$$\int_{s1}^{s2} ads = c^2 \Delta D$$

Over the time, the clock will have observable drifting τ (t):

$$\tau(t) = \frac{1}{c^2}\int_0^t \int_{s1}^{s2} adsdt = \int_0^t \Delta D dt \qquad (1)$$

Given that the Moon is at the East horizon and only the Moon gravity is considered:

$a = 1.1 \times 10^{-7}\, g$

The distance between Chicago and New York is 1145km. The clock drifting after one hour is:

$$\tau(t) = \frac{1.1*10^{-7}*9.8*1145000*3600}{299752458^2} = 495ns$$

The result above and the test result match very closely.

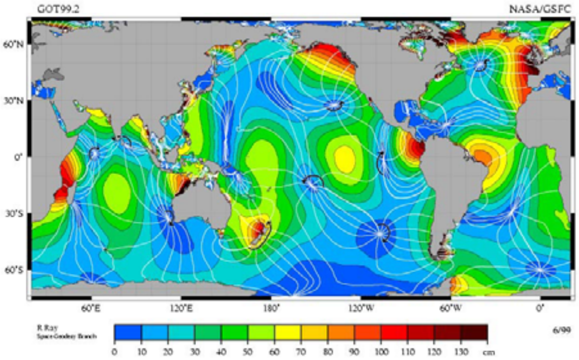

**Fig. 4**. $M_2$ tidal constituent

The gravity change due to the tide cycle can be calculated based on the $M_2$ tidal constituent (fig. 4), which is well studied (e.g. [77], [78]-[133]) and largely determined by ocean currents and the shape of the continents.

The clock drifting data are collected over a period of time (fig. 1). The removal of the average photon loop back time from chart provides clock drifting (1) chart for two cities. The gravitational acceleration a is:

$a = a_{moon} + a_{sun} + a_{tide}$

Or,

$a_{tide} = a - a_{moon} - a_{sun}$ (2)

The Sun and Moon cycles are consistent and predictable. If we know the time drifting function τ (t) for unit distance, (1) can be simplified to:

$$\frac{d\tau(t)}{dt} = \frac{a}{c^2} \qquad (3)$$

The tide level M is related to the gravity acceleration introduced by tide:

$M = k * a_{tide}$ (4)

Or,

$a_{tide} = c^2\, d\, \tau\, (t)/dt - a_{moon} - a_{sun}$ (5)

## 3.3. Earthquake Gauging

Before a major Earthquake, abnormal changes of clock speed can be detected due to the gravity changes introduced by gradual deep earth mass movements close to the epicenter. The gradual gravity changes are related to the damages on the Crust and potential energy to be released during the Earthquake.

The continental drifting (fig. 5) helps to balance the mass distribution on the sphere by providing evenly distributed bodies of water for tide. We consider tide cycles to be main reason (e.g. [133]) behind continental drifting which is the source of Earthquake.

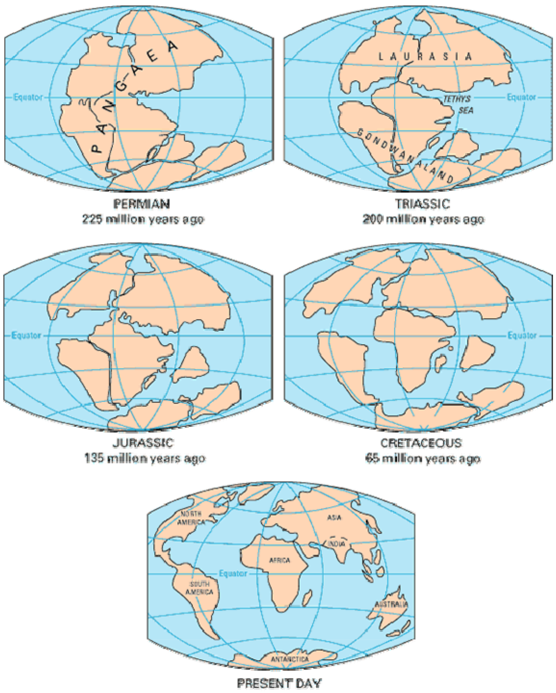

**Fig. 5**. Continental Drifting

## 4. Accurate Global Time

The atomic clock is one of the most accurate clocks. Subtle change in the gravity field causes variations (e.g. [134], [135]) in time locally. An accurate global time can be defined as the average atomic clock readings of clocks that are spatially evenly distributed.

### 4.1. Global Time

A dedicated network that links spatially evenly distributed atomic clocks across the world can provide a time relation table. The average times of the symmetrical locations in nanoseconds is the Global time. Two locations, Chicago and New York, can also provide reasonable accurate Global time using the average historic data.

Each city has a time drift. The accurate global time is:

$$G(t) = t - \tau(t) \qquad (3)$$

$G(t) = t - \Delta(t)$

$G(t)$: Global time

$t$: Local Atomic time

$\tau(t)$: Drifted time

The Drifted time is a function of local Atomic time. The accurate time provides important reference time for GPS (fig. 6).

**Fig. 6**. GPS Satellite

### 4.2. GPS with Less Satellites

GPS needs to get many visible Satellites (fig. 7) to make sure the time is accurate. The accurate global time is a drifted time G(t). If we know G(t), then, only three visible satellites are needs to determine a time and location accurately instead of eight satellites.

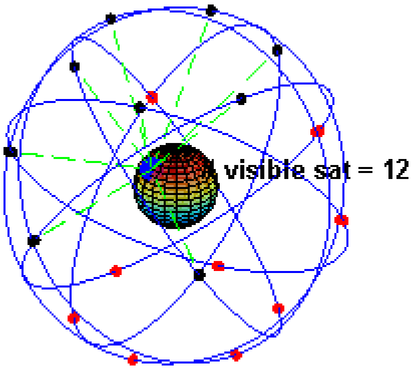

**Fig. 7**. GPS Satellites

## 5. Source Code for Data Collection

To collect data for this paper, the server was running at New York with the following command:

```
java DataGramLoop 9999
```

The client at Chicago was started after the server as follow:

```
java DataGramLoop <hostname> 9999 0 31 > result
```

The collected data will be saved to file result. Ideally, if there are two dedicated server with dedicated net work, the data can be cleaner.

Following is a Java class DataGramLoop used to collect our test data:

```
import java.net.DatagramPacket;
import java.net.DatagramSocket;
import java.net.InetAddress;
import java.util.Date;

public class DataGramLoop {
  static final long K = 1000L;
  static final long M = 1000000L;
  static final long B = 1000000000L;
  static long drift = 30L;
  static long lAdjust = 0L;
  public static void main
    (String args[]) throws Exception {
    if (args.length == 1) {
      server(args[0]);
    }
    else if (args.length == 2) {
      client(args[0], args[1]);
    }
    else if (args.length == 3) {
      lAdjust = Integer.parseInt(args[2]);
      client(args[0], args[1]);
    }
    else if (args.length == 4) {
      lAdjust = Integer.parseInt(args[2]);
      drift = Integer.parseInt(args[3]);
      client(args[0], args[1]);
    }
    else {
      System.out.println(
        "Command line format for server: " +
                "java DataGramLoop port");
```

```
    System.out.println(
      "Command line format for client: " +
                "java DataGramLoop IP port " +
                "<adjust micro seconds> " +
                "<drift micro seconds per second>");
  }
}
private static void server
  (String port_in)
      throws Exception {
  DatagramSocket serverSocket =
       new  DatagramSocket(Integer.parseInt(port_in));
  byte[] receiveData = new byte[20];
  byte[] sendData = new byte[20];
  while (true) {
    DatagramPacket receivePacket =
         new DatagramPacket(receiveData,
      receiveData.length);
    serverSocket.receive(receivePacket);
    InetAddress IPAddress =
         receivePacket.getAddress();
    int port = receivePacket.getPort();
    long lNow = (long)(System.nanoTime() % B)/K;
    sendData = l2b(lNow);
    DatagramPacket sendPacket =
         new DatagramPacket(sendData,
      sendData.length, IPAddress, port);
    serverSocket.send(sendPacket);
    long lServerReceived =
         b2l(receivePacket.getData());
  }
}
private static void client
  (String IP_in, String port_in)
      throws Exception {
  DatagramSocket clientSocket =
        new DatagramSocket();
  InetAddress IPAddress =
        InetAddress.getByName(IP_in);
  byte[] sendData = null;
  byte[] receiveData = new byte[20];
  long lNow = System.nanoTime();
  try {
    long count_out = 0L;
    while (true) {
      int count_in = 5;
      while (count_in -- > 0) {
        lNow = now(count_out);
        sendData = l2b(lNow);
        DatagramPacket sendPacket =
                new DatagramPacket(sendData,
          sendData.length,
                      IPAddress,
                      Integer.parseInt(port_in));
        clientSocket.send(sendPacket);
        DatagramPacket receivePacket =
                new DatagramPacket(receiveData,
          receiveData.length);
        clientSocket.receive(receivePacket);
        long lReceived = now(count_out);
        long lServerReceived =
                b2l(receivePacket.getData());
        long c2c = lReceived - lNow;
        long c2s = lServerReceived - lNow;
        c2c = normalize(c2c);
        c2s = normalize(c2s);
        long s2c = c2c - c2s;

        Date now = new Date();
        System.out.println(now + ", " + 1 +
                  "," + c2s+ "," + s2c + "," + c2c);
        Thread.sleep(2);
      }
      Thread.sleep(K);
      count_out ++;
    }
  }
  catch (Exception e) {
    e.printStackTrace();
  }
  clientSocket.close();
}
private static long now(long seconds) {
  return (System.nanoTime()/K +
        lAdjust + seconds * drift) % M;
}
private static long normalize(long v) {
  if (v > M) {
    v = v - M;
  }
  else if (v < 0) {
    v = M + v;
  }
  return v;
}
private static byte[] l2b(long l) {
  String b = "" + l;
  return b.getBytes();
}
private static long b2l(byte[] b) {
  String string = "";
    for(int i = 0; i < b.length; i++) {
      string += (char)b[i];
    }
    return Long.parseLong(string.trim());
  }
}
```

## 6. Conclusion

Two clocks, in different geographical locations, are drifting throughout the twenty four hour day. The drifting is mainly determined by day and month cycles. The clock drifting data can be collected using a simple loopback UDP program with a dedicated communication line connecting two geographical locations with same latitude and different longitude.

The clock drifting data can be used to calculate sea level without expansive tide gauges.

A dedicated network that links spatially evenly distributed atomic clocks across the world can provide a clock drifting table for measured cities. The average times of the symmetrical locations in nanoseconds is the Global time.

Global time and drifted time can be used to provide better reference points for:

1. GPS with less Satellite;
2. Sea level calculation and prediction;
3. Earthquake Gauging.

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