Subject: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Thu, 18 Mar 2010 02:37:47 GMT
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This is a small app that incorporates the Vincenty formulas, Inverse and Direct, to calculate the geodesic distance on the ellipsoidal Earth, WGS84. It also calculates the starting and ending angles. Or with a starting point, direction and distance it will calculate the end point and final angle.

Input/output can be in any of the commonly used formats.

This can be used alone but interacts with a NASA WorldWind application written in Java through a socket.

This was previously done with Python, Java and now with C++ using Upp, a very good IDE/application.

http://www.nlneilson.com/geocalc.html

edit: updated link

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 20 Mar 2010 01:24:59 GMT
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Here is a page with a better description of what the app does.
http://www.nlneilson.com/distance.html

And at the bottom of that page is a link to a few images.
http://www.nlneilson.com/distance_images.html

theIDE, Upp and the help on this forum was great.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Sat, 20 Mar 2010 07:23:33 GMT
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Hello nlneilson

It seems your program has to work over other one that shows a satellite image. Is not it?

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 20 Mar 2010 14:39:46 GMT

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No, this can be used separately.

The latlon for the points can be typed or pasted in (then push Enter) for the calculations (Calculate->Distance). Many web sites have locations in latlon that can be copied and pasted into the app. It should be comma delimited so that may need to be added. There have been a few instances with the upp app where the text format was a problem, pasting the latlon into notepad and then into the app removed the formatting.

It will take data in decimal degrees, degrees minutes, deg min sec. And for distance meters, km, feet, mi, nmi.
The app can be used to convert also, km->mi, dms->deg, etc., and all to 8 decimal places or whatever you change the settings to. The data is retained in the app to 9 decimal places (degrees,meters), the Settings just change how it is displayed.

It works in Linux (Ubuntu 9.10) with Wine.

In theIDE it was much easier to do this than it was in Java.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Sat, 20 Mar 2010 20:31:34 GMT
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It works in Linux (Ubuntu 9.10) with Wine.
Why does it not work directly without Wine?

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 20 Mar 2010 21:21:11 GMT
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In Ubuntu double clicking the file it tries to open with "Archive Manager". I don't know how to run it without Wine.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by Didier on Sat, 20 Mar 2010 21:29:33 GMT
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Hi Koldo,

Quote:Why does it not work directly without Wine?
The compiled app is a '.exe' (windows) so in linux => you need wine to execute it.

But I'm sure you already know that

But why not publish a linux version or even the source code ?
And this app could become a widget.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 20 Mar 2010 23:52:23 GMT
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Didier wrote on Sat, 20 March 2010 22:29But why not publish a linux version or even the source code ?
When I get Ubuntu up again on my main computer I will download upp for Linux and try making a .elf to run directly in Linux.

Just this morning I tried to update 9.10 to 10.04b2, that didn't work.
I downloaded and burned an ISO and it locks on boot, a known issue that was "fixed" a few days ago but have been unable to get the fix. Probably just install 9.10 until 10.04 release comes out, about 5 weeks.

Much of the code is proprietary, that is one reason it was never released in Java. The "decompiler" jad easily puts it back to source code. A Java .jar is not really compiled, it is an interpreted language that is "compiled" or turned into machine code, at run time by the jre.
At least in C++ that would be more work to decompile. It may be easier for someone to port the Vincenty code from Fortran to C++ than try to hack an .exe.
http://www.ngs.noaa.gov/PUBS_LIB/inverse.pdf
The rest of the code is mostly manual labor except for the parsing.

Does the Linux version of Upp come with or has links to the correct version of MinGW or whatever compiler will work?
I will probably need to read several threads to get that working.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Sun, 21 Mar 2010 06:57:59 GMT
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Hello nlneison

At least in C++ that would be more work to decompile. It may be easier for someone to port the Vincenty code from Fortran to C++ than try to hack an .exe.
Do you mean that you call a windows .exe that includes the Vincenty code?

If yes it seems the Chris Veness javascript LGPL code here
http://www.movable-type.co.uk/scripts/latlong-vincenty.html is easy to port to C.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by Mindtraveller on Sun, 21 Mar 2010 07:44:50 GMT
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Cool.
What is the accuracy/drift of your calculations?

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sun, 21 Mar 2010 09:12:59 GMT
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koldo wrote on Sun, 21 March 2010 07:57Hello nlneison

At least in C++ that would be more work to decompile. It may be easier for someone to port the Vincenty code from Fortran to C++ than try to hack an .exe.
Do you mean that you call a windows .exe that includes the Vincenty code?

If yes it seems the Chris Veness javascript LGPL code here
http://www.movable-type.co.uk/scripts/latlong-vincenty.html is easy to port to C.

I think that is pretty close to what I meant.

I have not tried to decompile an .exe or .dll file but know it can be done but it takes experience and work to do it. So what I was trying to say was the Distance app code was proprietary and that for someone to port the Fortran code would seem to be easier than decompiling a compiled .exe file.

Chris Veness's javascript code is just for the Inverse Formula and he has a copyright even though it is LGPL. Then you would need the Direct Formula.

There are examples on the web in different languages. I think a Govt. agency has code in another language, as well as the Fortran, where there would be no copyright.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sun, 21 Mar 2010 09:41:19 GMT
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Mindtraveller wrote on Sun, 21 March 2010 08:44Cool.
What is the accuracy/drift of your calculations?

The Vincenty formulas are VERY accurate. With the Python code running it through a series of locations using the
Inverse formula and the returned values input to the Direct formula the result coincided usually to 10 decimal places
but did not exceed +/- 1 in the 9th decimal place. 9 decimal places is one billionth of a meter.

The accuracy will not be
affected by the calculations. The accuracy of data input for locations, distance and starting angle, for all intent and
purposes, will determine the accuracy of the output.

The calculations are just math, no drift. Any "drift" would come from the input data.

Here is data on Tectonic Plate velocity or "drift"
http://hypertextbook.com/facts/ZhenHuang.shtml
using 5 cm per year
.05 / (365 * 24 * 60 * 60) = meters per second so the code
Distance<<=Format("m/sec %.9f", .05 / (365 * 24 * 60 * 60));
returns m/sec 0.000000002
2 in the 9th decimal place so it would take only 5 sec to make a
change in the 8th decimal place. 8 decimal places is the highest I have in the Distance app.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Sun, 21 Mar 2010 17:11:11 GMT
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Hello nlnelson

Here there is the Chris Veness Vicentry direct formula

http://www.movable-type.co.uk/scripts/latlong-vincenty-direc t.html

The LGPL javascript code is this:

```
function destVincenty(lat1, lon1, brng, dist) {
  var a = 6378137, b = 6356752.3142,  f = 1/298.257223563;  // WGS-84 ellipsiod
  var s = dist;
  var alpha1 = brng.toRad();
  var sinAlpha1 = Math.sin(alpha1);
  var cosAlpha1 = Math.cos(alpha1);

  var tanU1 = (1-f) * Math.tan(lat1.toRad());
  var cosU1 = 1 / Math.sqrt((1 + tanU1*tanU1)), sinU1 = tanU1*cosU1;
  var sigma1 = Math.atan2(tanU1, cosAlpha1);
  var sinAlpha = cosU1 * sinAlpha1;
  var cosSqAlpha = 1 - sinAlpha*sinAlpha;
  var uSq = cosSqAlpha * (a*a - b*b) / (b*b);
  var A = 1 + uSq/16384*(4096+uSq*(-768+uSq*(320-175*uSq)));
  var B = uSq/1024 * (256+uSq*(-128+uSq*(74-47*uSq)));

  var sigma = s / (b*A), sigmaP = 2*Math.PI;
  while (Math.abs(sigma-sigmaP) > 1e-12) {
```

```
    var cos2SigmaM = Math.cos(2*sigma1 + sigma);
    var sinSigma = Math.sin(sigma);
    var cosSigma = Math.cos(sigma);
    var deltaSigma =
B*sinSigma*(cos2SigmaM+B/4*(cosSigma*(-1+2*cos2SigmaM*cos2SigmaM)-
       B/6*cos2SigmaM*(-3+4*sinSigma*sinSigma)*(-3+4*cos2SigmaM*cos2SigmaM)));
    sigmaP = sigma;
    sigma = s / (b*A) + deltaSigma;
  }

  var tmp = sinU1*sinSigma - cosU1*cosSigma*cosAlpha1;
  var lat2 = Math.atan2(sinU1*cosSigma + cosU1*sinSigma*cosAlpha1,
     (1-f)*Math.sqrt(sinAlpha*sinAlpha + tmp*tmp));
  var lambda = Math.atan2(sinSigma*sinAlpha1, cosU1*cosSigma - sinU1*sinSigma*cosAlpha1);
  var C = f/16*cosSqAlpha*(4+f*(4-3*cosSqAlpha));
  var L = lambda - (1-C) * f * sinAlpha *
     (sigma + C*sinSigma*(cos2SigmaM+C*cosSigma*(-1+2*cos2SigmaM*cos2SigmaM)));

  var revAz = Math.atan2(sinAlpha, -tmp);  // final bearing

  return new LatLon(lat2.toDeg(), lon1+L.toDeg());
}
```

Like the inverse, it seems easy to convert to C and LGPL license is pretty open.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sun, 21 Mar 2010 19:22:42 GMT
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Yes, that is good.

It still may not be much more work to start with the Vincenty formula, especially in the .html format where you can copy and paste, and port the Fortran to C++ to avoid even the LGPL issue.

Also note that T. Vincenty was not responsible for the math for the formulas. He just took the formulas that could be done by hand and modified it to Fortran so it could be done on the early computers.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sun, 21 Mar 2010 21:10:54 GMT
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It may be 10+ years since I ported the Fortran to Python.
Then to C++ and later to Java, both are fast but I have the C++ optimized to run through the

Inverse code in 10.7 micro seconds on a single core 1.60 Ghz notebook.

When I used this in Upp I just made that into a header file.
I don't recall what changes were necessary there, I did that with Eclipse CDT first, maybe just copied the header file from Eclipse to Upp.

I like to tinker with numbers, my major in college was Physics.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Mon, 22 Mar 2010 21:20:59 GMT
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Didier wrote on Sat, 20 March 2010 22:29But why not publish a linux version ...?
I was able to get Upp/theIDE to run in Ubuntu 10.04b.
Trying to make a linux version of Distance.exe the first error was re #include <windows.h>, just commented that and here is an excerpt of the errors:

/usr/include/stdlib.h:766: note: candidates are: int abs(int)
/home/neil/upp/uppsrc/Core/Core.h:300: note: Upp::int64 abs(Upp::int64)
/usr/include/c++/4.4/cstdlib:170: note: long long int __gnu_cxx::abs(long long int)
/usr/include/c++/4.4/cstdlib:139: note: long int std::abs(long int)

It make take some time but I will try to get a Linux version that will run without Wine.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Mon, 22 Mar 2010 21:24:38 GMT
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nlneilson wrote on Mon, 22 March 2010 22:20Didier wrote on Sat, 20 March 2010 22:29But why not publish a linux version ...?
I was able to get Upp/theIDE to run in Ubuntu 10.04b.
Trying to make a linux version of Distance.exe the first error was re #include <windows.h>, just commented that and here is an excerpt of the errors:

biguous
/usr/include/stdlib.h:766: note: candidates are: int abs(int)
/home/neil/upp/uppsrc/Core/Core.h:300: note: Upp::int64 abs(Upp::int64)
/usr/include/c++/4.4/cstdlib:170: note: long long int __gnu_cxx::abs(long
long int)
/usr/include/c++/4.4/cstdlib:139: note: long int std::abs(long int)

It make take some time but I will try to get a Linux version that will run without Wine.
Hello nlnelson

In Gcc (linux and MinGW) you would have to use fabs() instead of abs() to avoid this error.

You can filter this errors compiling with MinGW in Windows.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Mon, 22 Mar 2010 21:57:57 GMT
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Thanks Koldo, the fabs took care of that error.

Now I get:

at this line:
bool MyApp::Key(dword key, int count){

edit: I deleted "MyApp::" and it works in debug.
I will make a few changes like the default dir for the file chooser, I had that as C:\ for win.

I changed it so it has a frame and can be dragged.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Mon, 22 Mar 2010 22:11:51 GMT
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nlneilson wrote on Mon, 22 March 2010 22:57Thanks Koldo, the fabs took care of that error.

Now I get:

at this line:
bool MyApp::Key(dword key, int count){

edit: I deleted "MyApp::" and it works in debug.
I will make a few changes like the default dir for the file chooser, I had that as C:\ for win.
Hello nlnelson

Very probably you have inserted the code inside a class.
That means that adding class name in function is useless, so you simply has to remove "MyApp::" in the left of function definition.

For example this will get the same error:

```
class EditFileFolder : public EditString {
typedef EditFileFolder CLASSNAME;
protected:
 bool EditFileFolder::Key(dword key, int rep) {     // EditFileFolder:: is useless
  if (key == K_ENTER) { // Catch the ENTER
   DoGo();
   return false;
  } else
   return EditField::Key(key, rep);
 }
```

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Mon, 22 Mar 2010 22:44:03 GMT
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Here is the Linux version.
edit: The link was removed, still have a glitch when downloaded.

I have not tried all the functions yet, what I have tried worked.
I will change the dir for the file chooser later, that is only used to interact with another app.

This can be used by itself.

Now the hard part, making a Help file to explain how it can be used. Since it is menu driven most functions are self explanatory.
One thing to remember is after typing or pasting in the latlon for a point (or distance,angle) press Enter, I forget sometimes.
The latlon should be comma separated.

Neil

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Tue, 23 Mar 2010 01:49:44 GMT
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Strange error.

I download the Linux Distance from the above link (1499004 bytes) and try and run it:
Could not display "/home/neil/Downloads/Distance".
There is no application installed for executable files

It runs fine from /upp.out/GCC.Force_size.Gui.Shared/
I copied it (1499004 bytes) from upp.out/... to another dir and it works fine.

I replaced the file in upp.out/... with the downloaded file, same error.

I deleted it from the website and uploaded it 3 times, same error.

This is with Ubuntu 10.04b on the same computer used with theIDE to compile it.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Tue, 23 Mar 2010 02:37:28 GMT
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I copied the file that works to a flash drive, booted into Win, made a .tar with 7z and uploaded it with FileZilla.
That worked!

edit: It ran but still has a glitch, will work on it in a few days when I get back.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Tue, 23 Mar 2010 10:57:54 GMT
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Hello nlneilson

What is the situation now?. Does Linux version work?

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Thu, 25 Mar 2010 09:35:18 GMT
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Just got back tonight. Had problems with that computer, Vista?, Ubuntu 10.04?, ??.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Fri, 26 Mar 2010 10:09:49 GMT
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I found where the glitch was. It had nothing to do with Ubuntu 10.04b (although I will drop that until the 10.04 release for other problems).

I ran some tests with the Linux version and found a problem.
The copy and paste from a web site for a location in deg,min,sec was not parsed correctly.

In another Java app, Location.jar, I spent a considerable amount of time parsing the different

ways the location in lat,lon format is specified on the web.
http://www.nlneilson.com/nww.html

For the Distance app, Java or C++, unless the latlon is in decimal degrees, the lat and lon should be comma delimited, this eliminated many problems with odd ball formats.

The format that was a problem in the C++ Linux version is also a problem in the Win .exe version, I just did not catch that. I will go back into the parsing code and correct that.

The Java version worked but there were two function there:
.replaceAll("\\s+", " "); // This replaces several spaces with a single space
.trim(); // this removes leading and trailing spaces

I did not know the corresponding functions in C++, my error as usual.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Fri, 26 Mar 2010 11:30:58 GMT
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Quote:.trim(); // this removes leading and trailing spaces

TrimBoth();

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Fri, 26 Mar 2010 12:08:43 GMT
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TrimBoth(); I will try that.

One thing I noticed that seemed odd in upp:

I thought that should be 176

I am handling it in upp with:

```
if (ic>122 || ic==-80 || ic==39 || ic==34) ic = 32;
```

That could have something to do with the problem.

To take care of some strange stuff I have:

```
if (ic < 0) continue;
```

I could change that to:

```
if (ic < 0) ic = 32;
```

and then a few lines of code in C++ to check/remove the consecutive space/s similar to

.replaceAll("\\s+", " "); in Java.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by koldo on Fri, 26 Mar 2010 19:07:31 GMT
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Hello Nlneilson

nlneilson wrote on Fri, 26 March 2010 13:08TrimBoth(); I will try that.

One thing I noticed that seemed odd in upp:

I thought that should be 176

I am handling it in upp with:

```
if (ic>122 || ic==-80 || ic==39 || ic==34) ic = 32;
```

That could have something to do with the problem.

To take care of some strange stuff I have:

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```

I could change that to:

```
if (ic < 0) ic = 32;
```

and then a few lines of code in C++ to check/remove the consecutive space/s similar to .replaceAll("\\s+", " "); in Java.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 27 Mar 2010 00:56:07 GMT
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Now I know where the problems could be I can easily correct them.

I didn't have problems with this in Java or C++ in Eclipse CDT.

I think Upp/theIDE is great, will stay with it.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 27 Mar 2010 04:31:41 GMT
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That glitch is fixed, not yet for all instances.

if (ic < 0) ic = 32;

And for the multiple spaces:
changed if (j==1) to if (j==1 && Dms!="")

I tried this and several others:

http://nlneilson.com/apps/Distance.exe

It still seems strange the integer representation of
any character would be less than 0.

edit: Still have a glitch, works fine in theIDE and then
when it is copied to a directory with other apps.
When I upload and then download the .exe has problems with the extra spaces.
With Build->clean, Build->Clean UPPOUT I could get the error re extra spaces
using Debug->Execute but Debug->Run(in debugger) only the break points in the main would work.
Downloaded 2272 and the break points work OK.
This is with Vista, I think I will try with XP, Vista has been a real pain.

I found the problem with the break points (it had nothing to do with theIDE)
and only some times with extra spaces.
It checks the latlon for decimal degrees first and I have a comment:
// with ',' ' ' '~' but only one
I will add a count for spaces and if >1 get out of that loop.

The code will also work with the input of a GGA GPS sentence so it gets a bit complicated.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sat, 27 Mar 2010 07:05:31 GMT
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Dumb mistake, I really mess up sometimes.
When I port from one language to another I copy and paste and if
several lines are nearly the same I paste that in more than once
and then change what is necessary.

In Java I used dLat for a double and sLat for a String.
In Upp I used lat for a double and Lat for a String.

In the parse decimal degrees loop:
if (lon<=180 && lat>=-180)
should be lon
if (lon<=180 && lon>=-180)

This catches most error that would be caused by more than one space.

If I ever get an error caused by multiple spaces, or a report of one
I will count the spaces in the code and kick it out.
In Java this took care of it: .replaceAll("\\s+", " ");

I uploaded the file with FileZilla, downloaded and tried it, works OK.

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by dolik.rce on Sat, 27 Mar 2010 09:23:49 GMT
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Hi nlneilson

I thought that should be 176
Quote:It still seems strange the integer representation of
 any character would be less than 0.
It is not that strange as it looks. Internally, only last byte of int is considered, that is like if you

agree, it is kind of obfuscating, maybe it should be changed.

Regards,
Honza

Subject: Re: Distance - geodesic - Vincenty - very accurate
Posted by nlneilson on Sun, 28 Mar 2010 12:25:07 GMT
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But I agree, it is kind of obfuscating, maybe it should be changed.

Thanks for the explanation, usually anything strange is from my code. A change for this in upp would be good.

Usually it is -80, only with Vista, and then rarely but enough to cause errors has it been -62, maybe the format of the character.
if (ic < 0) ic = 32; takes care of it.
