Palm Globe

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Palm Globe – 1.10

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Palm Globe

Palm Globe is a program which displays the Earth as a globe on a PalmPilot™, Palm III™, or IBM Workpad™. You can choose to view the globe from any direction, or select one of a number of "standard" views.

In addition to simply displaying a picture of the world, Palm Globe will also let you light the globe as though by sunlight – so you can see at a glance those areas of the globe where the sun has risen, and where it is night. Optionally, the direction of the sun can be shown for any viewpoint, so you can use Palm Globe as a sun compass.

Further options add shading to the globe for a three-dimensional effect, rotate the globe with the sun, and let you measure distances between two points on the globe. Other features are described in detail below.

This document includes:

- an introduction to Palm Globe (this section)
- installation instructions
- a guide to using Palm Globe
- background and other details.

The algorithms, data, and code for Palm Globe were first developed for PMGlobe, a programmable globe application for OS/2. The current releases of both Palm Globe and PMGlobe are available from:

```
http://www2.hursley.ibm.com
```

Installation

System requirements

Palm Globe should run correctly on devices whose operating system is Palm OS™ version 2.0 or later. This includes:

- The PalmPilot and PalmPilot Professional
- The Palm III
- The IBM Workpad and IBM Workpad 2
- A Palm OS Emulator, with version 2 or version 3 ROM image.

50 KiloBytes (50K) of free memory is recommended (Palm Globe uses about 36K).

You will also need a desktop or other suitable computer to install the software.

Installing Palm Globe

Before installing this (or any other) software onto your Palm OS computer, it is recommended that you back up your current data by running HotSync.

The Palm Globe code is distributed as a compressed `pglobe.zip` file which includes the software license (`license.txt`), the Palm Globe program (`pglobe.prc`), and this document (`pglobe.pdf`). To install the program:

1. Download the `pglobe.zip` file to your desktop machine (that is, the machine you HotSync with).
2. Extract the files from the `pglobe.zip` file using a tool such as WinZip or UnZip.
3. On your desktop machine, start the Palm or Workpad Install tool.
4. Click on the **Browse** button and select the `pglobe.prc` file which you just extracted.
5. Click on the **Install** button and confirm if requested.
6. Place your Palm or Workpad device in its cradle and press the HotSync button. The program will then be installed near the end of the HotSync process.

Note: If you unzipped the program using a command prompt window, then it may be convenient to start the installer with a command. For example, for a typical Workpad installation on Windows, the command might be:

```
c:\workpad\instapp pglobe.prc
```

which will start the installer with the `pglobe.prc` file already selected.

Using Palm Globe

Starting to use Palm Globe

When you first start Palm Globe, you will be shown the *Time Zone* dialog (see page 11). Palm Globe needs to know your time zone so it can calculate the sun's position. In the dialog, enter your winter time zone offset in hours ahead of Greenwich Mean Time (GMT) and also check that the daylight savings adjustment is set correctly.

For example, New York is –5 hours, and Paris is +1 hour, both with a one hour adjustment in the summer.

Once you have set your time zone, tap the **Done** button; Palm Globe will then proceed to show you the globe with your time zone facing you, and lit as though by the sun. On the dark (night) side of the globe, land masses are indicated by lightly dotted areas; in sunlight they are solid bright areas.

Using the stylus with Palm Globe

You use the stylus with Palm Globe just as with other applications; in addition, Palm Globe allows direct navigation using the stylus:

- Tap **on** the globe (that is, within the circle where the globe is drawn) to select a point on the surface. The globe is then redrawn with the selected point at the center of the circle.

- Tap **off** the globe, or in the title bar area, or on the **Menu** button at the bottom left of the screen, to bring up the menu bar for Palm Globe choices.

Menu bar choices

The Palm Globe menu choices can be selected from the menu bar in the usual way, or they may all be selected by the Graffiti short cut shown next to the choice. They fall into three groups:

View
> is used to select a fixed viewpoint from which the globe is seen, change movement settings, or to enter or select a custom viewpoint.

Effects
> is used to choose the lighting effects (sunlight or not), shading, and twilight setting.

Options
> lets you change the title bar (for example, to show distance calculations), time zone, and other settings, and also offers tips (help) and the *About* choice.

These groups are described in the three following sections.

The View menu

The *View* menu is used to select a standard viewpoint from which the globe is seen, change movement settings, or to enter or select a custom viewpoint. It lists the following choices:

Set viewpoint...
Opens the *Viewpoint* dialog (see page 5) which lets you select a particular point on the globe's surface.

Find viewpoint
Places the custom viewpoint at the center of view.

Movement settings...
Opens the *Movement settings* dialog (see page 6) which lets you change settings that affect movement of the view of the globe.

Europe & Africa (0°)
Places the Intersection of the Equator and the Greenwich Meridian (0°N, 0°E) at the center of view.

Americas (90°W)
Places 0°N, 90°W at the center of view.

India & Asia (90°E)
Places 0°N, 90°E at the center of view.

Pacific (180°)
Places the Pacific ocean (0°N, 180°E) at the center of view.

North Pole
Places 90°N, 0°E at the center of view.

South Pole
Places 90°S, 0°E at the center of view.

Snap to equator
Centers the view at latitude 0°N and leaves the longitude at the center of view unchanged.

Snap to Greenwich
Centers the view at longitude 0°E and leaves the latitude at the center of view unchanged.

All menu choices may be selected by the Graffiti short cut shown next to the choice.

The Viewpoint dialog

The *Viewpoint* dialog lets you enter the coordinates (latitude and longitude) of a point on the surface of the globe. If a valid point is entered, the **Done** and **Tap** buttons will be visible and you can then save the point (by tapping **Done**) or both save and select the point by tapping **Tap**. The latter has the same effect as tapping the globe directly with the stylus, with the advantages that:

- the entry can be more precise than when using the stylus

- you can "tap" on points that cannot be seen (for example, in darkness, or on the other side of the globe).

A coordinate may be specified in `degree°minutes'seconds"` format, or in `degree.decimal` format, as described in detail in *Formats for specifying degrees* (see page 15).

The **Paste** button is used for directly pasting coordinates into the dialog. For instance, if you had a list of cities and their coordinates in a Memo Pad document you could use the Palm **Find** button (at the bottom right of the screen) to find the line:

```
37°48N  122°24W  San Francisco
```

The two coordinates (or the whole line) can then be selected by dragging the stylus across the line, and then copied to the clipboard using the Copy function from the Edit menu (command /**C**).

On returning to Palm Globe and the Viewpoint dialog, the coordinates can simply be entered by tapping the **Paste** button. This special paste button takes the first two candidate words (words that start with a sign or a digit) and puts the first into the latitude field and the second (if any) into the longitude field.

At any time, the **Undo** button may be used to revert the fields to the values they had when the dialog was entered.

Like all the Palm Globe dialogs, tapping on the "**i**" icon on the title bar of the dialog gives tips on using the dialog.

The Movement settings dialog

The *Movement settings* dialog lets you change settings that affect movement of the view of the globe. Any changes take effect when the **Done** button is tapped. The settings are:

Move globe to tapped point
> When this setting is checked, tapping on the globe (whether by using the stylus directly, or using the **Tap** button of the *Viewpoint* dialog) will cause the view to be changed so the tapped point becomes the center of the view. It is useful to uncheck this setting when measuring distances (see page 10).

Rotate with sun
> When this setting is checked, the view of the globe will rotate in synchronization with the sun. That is, when the globe is refreshed automatically the longitude of the current viewpoint is adjusted by the amount that the longitude of the sun has moved. The latitude of the current viewpoint is not changed.

At any time, the **Undo** button may be used to revert the settings to the values they had when the dialog was entered.

The Effects menu

The *View* menu is used to choose the lighting effects (sunlight or not), shading, and the twilight setting. It lists the following choices:

Set lighting...
> Opens the *Lighting* dialog (this page) which lets you choose how the globe is lit.

Set twilight...
> Opens the *Twilight* dialog (see page 8) which lets you choose how the twilight band is shown. This dialog can also be opened directly from the *Lighting* dialog.

The Lighting dialog

The *Lighting* dialog lets you choose how the drawing of the globe is lit. It has three checkboxes, which take effect when the **Done** button is tapped:

Sunlight
> Chooses "sun lighting" of the globe. This lets you see at a glance which parts of the world are in daylight, and which are in the dark. This lighting is (of course) time dependent, so Palm Globe needs to know the correct time of day and your time zone in order to show the sunlight correctly.

> If *Sunlight* is selected, the globe will normally be redrawn at regular intervals, as selected from the *Other settings* dialog (see page 12), showing how the sunlight moves across the earth. The section on accuracy (see page 13) gives more details.

Starlight
> When *Sunlight* is selected, the dark side of the earth appears completely black. To make this more interesting, the *Starlight* choice makes the land masses on the dark side visible as a dark grey mottled pattern (if you cannot see them, try adjusting the contrast of your display).

> *Starlight* is only meaningful if *Sunlight* is selected, so the checkboxes are coupled (selecting *Starlight* will also select *Sunlight, etc.*).

3-D
> This choice adds shading, to give the globe a "three-dimensional" (3-D) appearance. On the low-resolution Palm screen, this inevitably gives a rather grainy and mottled appearance – in particular, the details of land and water boundaries may be obscured. However, the shading does convey the roundness of the earth better than the flat lighting, and the position of the sun becomes more obvious.

> If *3-D* is selected without selecting *Sunlight*, artificial lighting from the front and top left of the globe is supplied.

If none of the three choices are checked, then "flat" lighting, as though for a map, is used; all land masses are equally visible.

The **Twilight** button is available as a convenience; it opens the *Twilight* dialog (see page 8), which lets you choose how the twilight band is shown on the globe, without having to leave the *Lighting* dialog first.

At any time, the **Undo** button may be used to revert the checkboxes to the values they had when the dialog was entered.

The Twilight dialog

The *Twilight* dialog lets you choose how the twilight band is shown on the globe, when *Sunlight* is in effect.

The sun is not a point source of light, and the atmosphere scatters its light, too. Therefore, sunlight is seen on the dark side of the earth for some time before the sun rises and for some time after it sets. You can select to see all, part, or none of this twilight band on the globe.

The twilight band, when shown, is normally shown bright, or is shaded if *3-D* is selected.[1] Beyond the selected band, the earth is shown as dark.

You may choose any one of the twilight settings; the one chosen takes effect when the **Done** button is tapped:

Theoretical sunrise/set
> This setting lights the earth as though by a point source at the center of the sun; the sunrise/set line is shown as though light ceased when the center of the sun crossed the horizon, and so no twilight can be seen; exactly half the globe is lit.

Ideal sunrise/set
> This is a practical and generally accepted definition of sunrise and sunset (fifty minutes of angle after the theoretical sunrise/set) which allows for the diameter of the sun and common atmospheric effects. The line seen on the globe joins the points at which the disc of the sun will have just disappeared or be just about to appear, and encloses a very narrow band of twilight.

Civil twilight
> This setting marks the end of "civil twilight" – a convenient point used for legal purposes (for example, when it is too dark to carry out certain tasks). *Please note that Palm Globe's rendering of this line must not be used for any critical or legal decisions; errors and bugs are always possible, and the definition used by Palm Globe (six degrees after the theoretical sunrise/set) may not match the legal definition used in your country.*

Naval twilight
> This setting indicates the points where it is dark for all practical purposes: the center of the sun is twelve degrees below the horizon.

Astronomical twilight
> With this setting, there is no sharp boundary; with shading, light fades to zero, where it is perfectly dark. At this point on the surface no effects from sunlight can be detected, and the center of the sun is eighteen degrees below the horizon.

At any time, the **Undo** button may be used to revert the checkboxes to the values they had when the dialog was entered.

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[1]   Shading may appear mottled or granular on low-resolution devices.

The Options menu

The *Options* menu lets you change the title bar (for example, to show distance calculations), time zone, and other settings, and also offers tips (help) and other information. It lists the following choices:

Set title bar...
> Opens the *Title Bar* dialog (see page 10) which lets you choose whether the title bar is shown and what information is shown on it.

Set time zone...
> Opens the *Time Zone* dialog (see page 11), used for setting the Time Zone and daylight savings adjustment for the device.

Other settings...
> Opens the *Other settings* dialog (see page 12) which lets you change some miscellaneous settings.

ReDraw
> Forces the globe to be redrawn immediately.

Help
> Displays tips on using Palm Globe.

About
> Displays the version of Palm Globe and other information about the program.

The Title Bar dialog

The *Title Bar* dialog lets you choose whether the title bar is shown and what information is shown on it.

You may choose any one of the title bar settings; the one chosen takes effect when the **Done** button is tapped:

Distance from previous tap
> When this setting is chosen, the title bar displays the distance between two points tapped on the globe (whether by using the stylus directly, or using the **Tap** button of the *Viewpoint* dialog). After the first tap, each new tap shows the distance from the previous tapped point.
>
> When using this setting, it is helpful to uncheck *Move globe to tapped point* in the *Movement settings* dialog so the globe is not moved after each tap. You can use the standard view choices in the *View* menu to position the globe, instead.
>
> The distance shown is the great circle distance; that is, the shortest distance on the surface of the globe between the two points. This is the distance used for calculating air miles, *etc.* The section on accuracy (see page 13) gives some more details.

Coordinates of center point
> Displays the latitude and longitude of the point at the center of the view of the globe.

Coordinates of sun position
> Displays the latitude and longitude of the point at which the sun is directly overhead. These coordinates are updated whenever the globe is redrawn, to match the current view.

Coordinates last tapped
> Displays the latitude and longitude of the point last tapped on the globe (including points tapped using the **Tap** button of the *Viewpoint* dialog).

Local date and time
> Displays the current local date and time, updated every minute. The format used can be changed by using the Palm device's Preferences application.

Empty title bar
> Leaves the display area of the title bar empty (white).

No title bar (full screen)
> Choosing this removes the title bar; the globe is then redrawn, filling the screen. The Palm Globe menus are still accessible by tapping off the globe or on the **Menu** button, as usual.

At any time, the **Undo** button may be used to revert the checkboxes to the values they had when the dialog was entered.

The Time Zone dialog

The *Time Zone* dialog lets you set the Time Zone and daylight savings adjustment for the program. Palm Globe needs to know this information so it can calculate the sun's position, given the (local) date and time known to the Palm device. The time zone setting, therefore, should match the setting of the device's clock.[2]

The dialog has two adjustable settings, which take effect when the **Done** button is tapped:

Offset
> In this field enter the time zone offset in hours. This should be the offset from Greenwich Mean Time (GMT) as measured during the winter, and is positive for time zones east of Greenwich and negative for time zones west of Greenwich. If necessary you can also specify minutes and even seconds by separating these fields from each other using colons (with no blanks). Here are some valid offsets:

```
0 1 +5  −7  −7:00  9:30 −6:59:59
```

> The format, therefore, is one or more digits of hours (with optional preceding sign), followed by optional minutes and seconds fields (which may have leading zeros). No other characters are accepted; the **Done** button is only shown if the offset is valid.

> As examples, here is a selection of offsets with some places within each zone:

−9	Anchorage
−8	Vancouver, San Francisco
−7	Calgary, Denver
−6	Chicago, Dallas, Mexico City
−5	Ottawa, Washington D.C., Lima
−4	Caracas, Santiago
−3	Greenland, Rio de Janeiro
0	London, Greenwich, Casablanca
+1	Madrid, Paris, Frankfurt
+3	Moscow, Nairobi
+5:30	New Delhi
+8	Lhasa, Beijing, Singapore, Perth
+9	Tokyo
+10	Micronesia, Canberra, Sydney
+12	Kamchatka peninsula, Wellington

Daylight
> These pushbuttons let you choose the appropriate daylight savings adjustment, in hours. This is typically either zero (in the winter) or one (in the summer).

---

[2] This is not necessarily the time zone which you are in. If you leave the clock set to a different time zone, perhaps your home time zone, leave Palm Globe's setting at that time zone, too.

Palm Globe does not currently make this adjustment automatically, as the date and time of the change (if any) varies from country to country.

At any time, the **Undo** button may be used to revert the settings to the values they had when the dialog was entered.

The Other settings dialog

The *Other settings* dialog lets you change some miscellaneous settings. Any changes take effect when the **Done** button is tapped. The settings are:

Show sun direction (compass)
When this setting is checked, the direction of the sun from the center of the view (the current viewpoint) is shown as a line superimposed on the globe. This is shown even if the sun is not visible from the viewpoint.

If you set the viewpoint to be your actual position on the earth and then hold the Palm device horizontal and align it so the line points at the sun (assuming it's visible), then the top of the device will point to North.[3]

As well as acting as a sun compass, the aligned map of the globe will then show you which direction to travel to get to any point visible in the shortest distance.

Note that the sun direction line is not shown if the sun is directly overhead (or is directly under your feet).

Refresh automatically
When this setting is checked, the globe will be redrawn at the selected refresh interval. The interval is selected by tapping on one of the pushbuttons, which chooses a time in minutes. The time selected is the delay from when the globe finishes drawing to when the next draw is started. Choosing a short delay time may use more power than a longer time, depending on the device.

Click when tapped
When this setting is checked, a click will be heard whenever the globe is successfully tapped (whether by using the stylus directly, or using the **Tap** button of the *Viewpoint* dialog), provided that System sounds are switched on for the device as a whole.

At any time, the **Undo** button may be used to revert the settings to the values they had when the dialog was entered.

---

[3] Unless the viewpoint is the North or South pole, in which case the top of the device points to the 180° or the 0° (Greenwich) Meridian, respectively.

Date and time limits and accuracy

The data used for presenting the globe are loaded in compressed form (from almost exactly two Kilobytes). The coastline and lake data were compiled from several different sources, with some manual editing to improve the representation in critical areas such as narrow straits and isthmuses. The accuracy of the coastline and other data is not guaranteed in any way, but is believed to be within 40km (25miles) in the worst case (near the equator) and significantly better in the East-West direction in Northern and Southern latitudes.

When distance calculations are carried out, the pen position can only be determined to the nearest pixel (picture element) on the screen. The longitude and latitude is then reported as being at the center of that pixel. However, more accurate positions can be entered by using the **Tap** button in the *Viewpoint* dialog, which simulates a pen tap at the exact point specified.

Distances are then calculated between the two coordinates selected and should be accurate to the nearest unit (km or mile), or 0.2%, whichever is greater. The 0.2% limit is a consequence of the assumption used in the calculation that the earth is spherical (which it is not).

Time and sun position calculations are only important when the *Sunlight* option is selected. In this case, Palm Globe needs to know the current date and time-of-day (taken from your computer's clock – make sure it is set correctly). It also needs to know which time zone that clock is set to: you will have been asked for this when Palm Globe was first started (you may also need to change it if your computer clock changes for daylight saving, summer, or winter time).

From the current time and time zone information, Palm Globe can determine the apparent solar time (which is as much as 16 minutes different from the Civil time used for clocks) and hence the sun's position. This is then used to display the globe as though lit by the sun: the light/dark dividing line thus shows where the sun is rising or setting.

The various calculations done should give an accuracy of sun position that leads to a sunset or sunrise indication that is correct to within twenty seconds of time. Actual sunset or sunrise times will be a little different because of atmospheric effects, which vary with the time of year, the weather, and latitude. However, Palm Globe does give a useful indication of sunrise and sunset, and of course lets you see at a glance which parts of the globe are in night or daylight.

Celestial events such as equinoxes, and solstices especially, are very dependent on the earth's movements; equinoxes should be correct within some tens of minutes, solstices should be correct within about ten hours.

Please note that results will be incorrect if you set your computer's date to be earlier than 1 January 1990. Also, the formulae used to calculate the sun's position may prove to be inaccurate at some distant time in the future, because the earth's movement is not entirely predictable.

Performance considerations

Palm Globe is designed as a "32-bit" application, with heavy use of long (32-bit) integers. All computation is done using long integers, so no floating-point overhead is incurred.

The relatively long draw times are due to the number of calculations needed; for each pixel that is part of the globe, the program must determine the corresponding latitude and longitude, whether that point is land or water, and how brightly it is lit (which depends on the angle of the surface of the globe at that point, relative to the sun's current position). Finally, an enhanced error diffusion algorithm is used to simulate a range of tones on the image.

In general, therefore, the simpler the image presented the faster it is drawn. Selecting *Sunlight*, *Starlight*, or *3-D* all slow down the drawing. Similarly, non-equatorial (tilted) views take significantly longer to draw than equatorial views (hence the *Snap to equator* choice).

As a rough guide, the simplest (flat lighting, equatorial view, no sunlight) image at the smaller size should take about 7 seconds to draw on a PalmPilot (16MHz processor). The time taken is inversely proportional to the speed of the processor and proportional to the square of the image diameter. The most complicated drawing (3-D shading, non-equatorial view, sunlight, and full screen) might take two or three times longer.

When you switch to Palm Globe from another application, the last-shown image is displayed first; this takes much less time.

Acknowledgement: I would especially like to thank John Marshall for his assistance in reducing the cost of divisions during pixel computations, which resulted in a 30% performance improvement.

Formats for specifying degrees

A coordinate in degrees, as used in the *Viewpoint* dialog (see page 5), may be specified in `degree°minutes'seconds"` format, or in `degree.decimal` format.

If the degree value is specifying a latitude or longitude, then it may be followed by one of the characters N, S, E, W (in either case), as appropriate. The default is N (North) for latitude and E (East) for longitude. A leading minus sign is allowed in either format, and negates the direction implied by any N, E, S, or W. A leading plus sign is also allowed; it has no effect.

No blanks are allowed; the seconds, or seconds and minutes, may be omitted, as may insignificant leading zeros (and trailing degrees, minutes, or seconds indicators). The syntax is therefore one of:

```
[+|-][d]d[o[m]m['[s]s["]]][x]
[+|-][d]d[.[[d]d]d][x]
```

where the degree indicator in the first format may be either the letter O (either case) or the true degree character (°, decimal 178 in Unicode and on Palm OS devices).[4]

Examples (all specifying a negative angle of 12 degrees 30 minutes):

```
12°30'S        -12°30         12°30W        -12.5
12°30'0"S      -12°30'00N     -12.500E       12o30s
```

---

[4] The Graffiti strokes for the degree character are Extended Shift (backslash drawn from top left) followed by an O drawn clockwise from the lowest point.

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