

AMountains

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Chapter 1

AMountains

1.1 AMountains Documentation

AMountains is a fractal landscape generator. It is based on xmountains 2.4 (UNIX, X) by Stephen Booth and was ported to the Amiga by [Michael Böhnisch](#). This is version 1.1, see the [revision history](#) for an overview of changes

Please read the original [Copyright notice](#).

AMountains differs from xmountains in several ways. First of all, the UNIX-stylish option handling (-foo 3 -q -z 42 and the like) was replaced by Amiga typical keywords. See the [option overview](#) for details.

Options specific to the X Window system are removed or are modified to make sense for the Amiga computers.

AMountains runs fine on systems with graphics boards and CyberGfx driver. Other driver software may run as well, but this is untested yet. A fast CPU and a math coprocessor is recommended but for completeness' sake a 68000/FFP compiled version is included. However, Kickstart 3.0 is the minimum supported OS version.

See [Algorithm](#) for a description of the technical details of AMountains.

When you click on the window's close gadget, AMountains will terminate the next time the rendering routine is called (you may encounter a short delay).

1.2 Author Information

Copyright 1994 by Stephen Booth, the University of Edinburgh
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1.3 Copyright Notice

Original copyright notice for xmountains:

```
*****

Copyright 1994 by Stephen Booth, the University of Edinburgh

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the above copyright notice appear in all copies and that both that
copyright notice and this permission notice appear in supporting
documentation, and that the name of the author not be used in advertising
or publicity pertaining to distribution of the software without specific,
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without express or implied warranty.

*****
```

1.4 Revision history

- 1.1 · Completely revisited option handling, see `amountains.c` to get a picture. The `DoArgs()` function is provided as link-time libraries `"billy.lib"` and `"billy68000.lib"`. To rebuild the executables, copy `DoArgs.h` to your `INCLUDE:` directory and both libraries to `LIB:`

`billy.lib` is compiled for 68020/68881 and above, `billy68000.lib` for 68000 or 68010 and FFP math. Use the `SCOptions` program to set up options for linkage of the library appropriate to your machine.

`billy.lib` may become a separate product by itself, it is already a extremely useful tool when porting UNIX® sources to the Amiga. It most probably will become shareware, so no source or documentation for this part - sorry, guys...

- 1.0 · Amiga style option handling
 - Arbitrary screenmodes
 - Arbitrary window sizes
- 0.0 · Pre-release version
 - Unix-style option handling
 - Many limitations.

1.5 Description of Algorithm

AMountain's Algorithm

This program uses a modified form the mid-point displacement

algorithm

The mid-point displacement algorithm is a recursive algorithm, each iteration doubles the resolution of the grid. This is done in 2 stages.



The new points are generated by taking an average of the surrounding points and adding a random offset.

The modifications to the standard algorithm are as follows:

There are three optional regeneration steps to reduce "creasing". A regeneration step recalculates the height of existing points using an average and offset from a newer generation of points. The three regeneration steps are:

step 1: recalculate corner points (A,B,C,D) from the midpoints (E) after the stage1 update.

step 2: recalculate midpoints (E) from the edge points (F,G,H,I) after the stage2 update

step 3: recalculate corner points (A,B,C,D) from the edge points (F,G,H,I) after the stage2 update

The regeneration stages are turned on by the SMOOTH tooltype.

When performing the regeneration steps the random offset is added to a weighted average of the previous value of the point and a the average of the new points. The weighting factors are controlled by the MIX and MIDMIX tooltypes.

The CROSS tooltype (cross update) controls whether the midpoints (E) are included in the average when performing the stage2 update or if only the corner points are used.

1.6 Option Overview

AMountains Options:

- Display and size control
- 3D Mapping options
- Colour settings
- Fractal generation options
- Lighting
- Multitasking features

Default values for all options

Options may be entered on the Shell command line or by icon tooltypes (which is the preferred way). Use entries like OPTION=value for options with parameters or simply OPTION for switches.

Tooltype parameters are overridden by Shell parameters. So if the icon tooltype array contains

```
HLIGHTANGLE=22\textdegree{}33'20"  
ALTITUDE=2.0
```

And your Shell command line is

```
AMountains ALTITUDE 1.5
```

Then the value for HLIGHTANGLE comes from the tooltype array, but the ALTITUDE parameter is 1.5 now.

1.7 Display and size control

This page lists the available options to modify the Amiga specifics of the graphics display and window sizings.

DISPLAYMODE	Select a Monitor ID to use
WIDTH	Width of the display
HEIGHT	Height " " "
DEPTH	Colour depth to use
BACKDROP	Use a special window mode
PUBSCREEN	Open window on a public screen

1.8 3D Mapping options

This page lists the options that affect the geometry of the landscape and the position of the viewer.

REFLECTIONS	Implement reflections in the water
MAP	Generate a map view
VSTRETCH	Vertical scaling factor
VSHIFT	Vertical offset
ALTITUDE	Vertical position of the viewer
DISTANCE	Viewing distance

1.9 Colour settings

This page lists the available options that affect the colors used by AMountains.

BANDSIZE	Number of shades to use for each terrain type
COLOURS	Number of colours to use in whole

1.10 Fractal generation options

This page lists the options that affect the algorithm used for the fractal landscape generation ↩

SEALEVEL	Height of water line
SLOPE	Reduce variation in the foreground
FORCEHEIGHT	Average foreground height
CONTOUR	Contour parameter
FDIM	Fractal dimension
SEED	Seed for random generator
LEVELS	Number of levels of recursion
STOP	Number of non fractal iterations
CROSS	Cross update
SMOOTH	Smoothing
MIX	Fraction of old value for rg2 & rg3
MIDMIX	Fraction of old value for rg1

1.11 Lighting

This page lists the options affecting the lighting of the view.

VLIGHTANGLE	Vertical angle of light
HLIGHTANGLE	Horizontal angle of light
CONTRAST	Contrast
AMBIENT	Ambient light level
VFRACT	Vertical light level

1.12 Multitasking features

This page describes the options affecting the multitasking behaviour of AMountains.

SCROLLCOLUMNS	Number of colums before scrolling
SLEEP	Time to sleep before scrolling
ACTIVEPRI	Task priority when AMountains window is active
INACTIVEPRI	Task priority when AMountains window is not active

1.13 Default values for all options

BACKDROP	Not set
WIDTH	320
HEIGHT	240
PUBSCREEN	Workbench
DISPLAYMODE	No default
DEPTH	No default
MAP	Not set
REFLECTIONS	Not set

SCROLLCOLUMNS	20
BANDSIZE	80
COLOURS	245
SLEEP	0
VLIGHTANGLE	40.0\textdegree{}
HLIGHTANGLE	0.0\textdegree{}
VSTRETCH	0.6
VSHIFT	0.5
SEALEVEL	0.0
SLOPE	2
FORCEHEIGHT	-1.0
CONTOUR	0.3
ALTITUDE	2.5
DISTANCE	4.0
CONTRAST	1.0
AMBIENT	0.3
VFRAC	0.6
FDIM	0.65
SEED	0
LEVELS	10
CROSS	Not set
SMOOTH	1
MIX	0.0
MIDMIX	0.0
STOP	2
ACTIVEPRI	0
INACTIVEPRI	-25

1.14 BACKDROP

BACKDROP

When this tooltype is present, AMountains uses a Backdrop window for its graphic rendition. This maximizes the viewable portion of the landscape since Intuition does no window border rendering to this window type.

Use BACKDROP with care, there is no close gadget attached to the window and you will not be able to terminate AMountains without rebooting.

The default behaviour of AMountains is not to use a Backdrop window.

1.15 WIDTH

WIDTH=«width»

This option sets the viewable width of the AMountains window in pixels. Window borders are not included in this value, so the actual window is slightly bigger. Note that screen size limits the size of windows and your width setting may be adopted to fit the window on the screen.

The default value for «width» is 320 pixels.

See also: HEIGHT

1.16 HEIGHT

HEIGHT=«height»

This option sets the viewable height of the AMountains window in pixels. Window borders are not included in this value, so the actual window is slightly bigger. Note that screen size limits the size of windows and your height setting may be adopted to fit the window on the screen.

The default value for «height» is 240 pixels.

See also: WIDTH

1.17 PUBSCREEN

PUBSCREEN=«public screen name»

Open the AMountain window on the named public screen. This option is ignored if DISPLAYMODE is also set.

The named screen already must exist, it is not created by AMountains.

The default value for «public screen name» is "Workbench".

1.18 DISPLAYMODE

DISPLAYMODE=«display mode identifier»

Open the AMountain window on a private screen, specified by «display mode identifier». Use the representation shown by the ScreenMode preferences program, e.g. NTSC:HighRes Interlace.

Spaces must be included exactly as listed by ScreenMode whereas capital/lower case letters can be used as preferred by you. Thus, NTSC:HIGHRES INTERLACE and ntsc:hIgHrEs InTeRLaCE are also valid and specify the same screen mode.

In order to make this option work you also must set the DEPTH tooltype.

If the specified screen cannot be opened for any reason, AMountains will fall back to the default public screen.

This option overrides the PUBSCREEN option.

There is no default for «display mode identifier».

See also: Graphics board support

1.19 DEPTH

DEPTH=«colour depth»

In combination with DISPLAYMODE this option specifies the colour depth of the screen to open. «colour depth» must be set to a valid value or else the specified screen cannot be opened. In this case AMountains will fall back to the default public screen.

There is no default for «colour depth». Typical values are 8 for 256 colour screens or 24 for CyberGfx True Colour modes.

See also: Graphics board support

1.20 MAP

MAP

If this tooltip is present, AMountains generates a map view of the landscape instead of the panorama display.

By default MAP is not set.

1.21 REFLECTIONS

REFLECTIONS

If this tooltip is present, AMountains generates reflections of the mountains on the water surface. Greatly adds realism to the scene.

By default REFLECTIONS is not set.

1.22 SCROLLCOLUMNS

SCROLLCOLUMNS=«columns»

This tooltip defines the number of columns the display scrolls to the left when calculation reaches the right window border. Due to the algorithm used, «columns» should be an even number. In case you disregard this, 1 is added internally to «columns».

The default for «columns» is 20 pixels. For smooth scrolling I recommend a setting of 2.

See also: SLEEP

1.23 VLIGHTANGLE

VLIGHTANGLE=«angle»

This tooltype affects the vertical angle of the imaginary light source. A value of 0\textdegree{} means sunrise, 90\textdegree{} noon and 180\textdegree{} sunset.

Values outside the interval from 0\textdegree{} to 180\textdegree{} are rounded to the nearest legal bound.

«angle» may be specified in a number of different formats. See Angle specifier for details.

The light source itself is invisible, you will only note the shadows it casts.

The default value for «angle» is 40.0 degrees.

See also: HLIGHTANGLE , AMBIENT , Angle specifier

1.24 HLIGHTANGLE

HLIGHTANGLE=«angle»

This tooltype affects the horizontal angle of the imaginary light source. A value of 0\textdegree{} means left side, 90\textdegree{} you look directly in direction of the light source and 180\textdegree{} right side.

Values outside the interval from 0\textdegree{} to 180\textdegree{} are rounded to the nearest legal bound.

«angle» may be specified in a number of different formats. See Angle specifier for details.

The light source itself is invisible, you will only note the shadows it casts.

The default value for «angle» is 0.0 degrees.

See also: VLIGHTANGLE , AMBIENT , Angle specifier

1.25 Angle specifier

Angle specifiers

Angles may be specified in various formats:

Without units degrees are assumed.

Example: 45.7

You may append the unit specifiers "deg" or "grad" to make clear you want degrees.

Examples: 45deg -22.55grad

As an alternative, a "degrees-minutes-seconds" format is supported.

Examples: 18\textdegree{}12'45.2" 45.44\textdegree{} 22' 5\textdegree{}2"

On my (german) keyboard I get \textdegree{} by Alt-w or Alt-4 and ' by Alt-ä. Refer to your Amiga manual for the proper key press combination on your national keyboard. Also note, there are further characters that look similar to the apostrophe sign ' but are different and may not be used instead. These are the accent characters ` and ´.

If you append the unit specifier "rad" or shorter "r" the angle is interpreted in radians.

Examples: 3.14rad 0.6r

In land-surveying applications occasionally a decimal division of the angle is used. Append "gon" or "g" to the numerus for this unit.

Examples: 100gon 18.22g

For your reference: $360\text{degrees} = 2 \times \pi \text{ rad} = 400 \text{ gon}$

NOTE: Do not embed spaces in any angle specification!

1.26 VSTRETCH

VSTRETCH=«factor»

VSTRETCH defines a multiplicative factor that is taken into account when calculating the height of a landscape point. Higher values mean, the mountains get higher and pointier, lower values lead to soft, flat hills.

«factor» is an arbitrary floating point number, reasonable values range from 0.2 to 3.0.

The default value for «factor» is 0.6.

1.27 VSHIFT

VSHIFT=«shift»

VSHIFT defines an additive constant offset to the landscape's height. Higher values result in a wintry scene with large snowcaps on the mountains. Lower (even negative) values result in a tropical isle landscape.

«shift» is an arbitrary floating point number. Use your imagination and experiment to find a value that best suites your esthetic

feelings.

The default value for «shift» is 0.5.

1.28 SEALEVEL

SEALEVEL=«height»

This option defines the level of the sea surface. Any landscape point below this level is considered underwater and consequently is not shown.

«height» is an arbitrary floating point number. However, if you choose a too high value, you will drown the landscape and you'll see water only. If your setting is too low, black dropouts at the bottom of the land will appear.

The default value for «height» is 0.0.

1.29 SLOPE

SLOPE=«iterations»

Reduce the variation in the foreground height to ensure a good view of the surface. This tooltype sets the number of iterations for which the foreground height is constrained to a constant value.

The default value for «iterations» is 2.

1.30 FORCEHEIGHT

FORCEHEIGHT=«altitude»

Mean altitude for the foreground.

The default value for «altitude» is -1.0.

1.31 CONTOUR

CONTOUR=«contour»

Set the contour parameter. The base colour of a point depends on its height and how flat the surface is. CONTOUR controls the relative importance of these factors.

The default value for «contour» is 0.3.

1.32 ALTITUDE

ALTITUDE=«height»

Set the Altitude of the viewpoint.

The default value for «height» is 2.5.

1.33 DISTANCE

DISTANCE=«dist»

Set the distance of the viewpoint from the front of the surface.

The default value for «dist» is 4.0.

1.34 BANDSIZE

BANDSIZE=«bandsize»

Amountains supports two ways to set the number of colours it uses. With BANDSIZE you control the number of colours in every terrain type (snowcaps, high-area vegetation, tropic vegetation).

However, remember that a total of 245 colours should not be exceeded. Intuition does not allow more than 256 pens per screen and moreover uses some of them itself for window rendering. Also, Amountains needs some additional pens for the sky etc.

The intent of this option is to create reasonable pictures on screens with less than 256 colours.

The default value for «bandsize» is 80.

See also: COLOURS

1.35 COLOURS

COLOURS=«colours»

Amountains supports two ways to set the number of colours it uses. With COLOURS you control the total number of colours of all terrain types (snowcaps, high-area vegetation, tropic vegetation).

However, remember that a total of 245 colours should not be exceeded. Intuition does not allow more than 256 pens per screen and moreover uses some of them itself for window rendering. Also, Amountains needs some additional pens for the sky etc.

The intent of this option is to create reasonable pictures on screens with less than 256 colours.

The default value for «colours» is 245.

See also: BANDSIZE

1.36 CONTRAST

CONTRAST=«contrast»

Set the contrast parameter. Values too far from 1.0 will give strange results

The default value for «contrast» is 1.0.

1.37 AMBIENT

AMBIENT=«level»

Set the ambient light level. This is a fractional value that sets how bright shaded areas will be compared to fully illuminated ground.

The default value for «level» is 0.6.

1.38 VFRACT

VFRACT=«level»

Set the vertical light level. The program also implements a secondary light source shining from directly above the surface. This tooltype sets how bright this light source is relative to the main light source.

The default value for «height» is 0.6.

1.39 FDIM

FDIM=«dim»

Set the fractal dimension of the surface. This should be in the range 0.5 - 1.0.

The default value for «dim» is 0.65.

1.40 SEED

SEED=«seed»

Set the seed for the random number generator. A value of 0 causes the seed to be set from the clock.

The default value for «seed» is 0.

1.41 LEVELS

LEVELS=«levels»

Set the width of the surface. Increasing this value by one doubles the width of the surface.

The default value for «levels» is 10.

1.42 STOP

STOP=«iterations»

Set the number of non-fractal iterations. Increasing this value by one doubles the average number of mountains across the width of the surface.

The default value for «iterations» is 2.

1.43 CROSS

CROSS

Use cross updates, see Algorithm

By default CROSS is not set.

1.44 SMOOTH

SMOOTH=«flags»

SMOOTH controls which optional regeneration steps are performed by AMountains, see Algorithm for details.

«flags» can take values from 0 to 7 which mean:

«flags»	Step 3	Step 2	Step 1
0	off	off	off

1		on		off		off
2		off		on		off
3		on		on		off
4		off		off		on
5		on		off		on
6		off		on		on
7		on		on		on

By default «flags» is 1, so only regeneration step 3 is performed.

1.45 MIX

MIX=«weight»

When performing the regeneration steps (see Algorithm) the random offset is added to a weighted average of the previous value of the point and a the average of the new points. The weighting factors are controlled by the MIX and MIDMIX tooltypes.

MIX gives the weight of the corner points (A,B,C,D)

By default «weight» has a value of 0.0.

1.46 MIDMIX

MIDMIX=«weight»

When performing the regeneration steps (see Algorithm) the random offset is added to a weighted average of the previous value of the point and a the average of the new points. The weighting factors are controlled by the MIX and MIDMIX tooltypes.

MIDMIX gives the weight of the midpoint (E).

By default «weight» has a value of 0.0.

1.47 ACTIVEPRI

ACTIVEPRI=«task priority»

AmigaOS is a pre-emptive multitasking operating system which allows to run processes concurrently. CPU time is shared between applications based on a value called "task priority". Processes with a high task priority are considered more urgent than others and may block lower prioritized processes when busy.

Of course, this should happen only when there really is something to do and not when the process is waiting for user input or idle otherwise.

Unfortunately AMountains is a very CPU time intensive program and it makes sense to assign it a low task priority so other applications have a chance to get their job done.

AMountains supports two different priorities, one if it's window is active and another when it is not active.

ACTIVEPRI controls the priority of the first case, INACTIVEPRI the latter case.

By default «task pri» has a value of 0, which is default for most other applications, too. Do not set this value higher than 5 or you stir up problems when processes vital for your Amiga's operation get blocked.

You may make AMountains more multitasking friendly by the use of the SLEEP tooltype.

1.48 INACTIVEPRI

INACTIVEPRI=«task priority»

AmigaOS is a pre-emptive multitasking operating system which allows to run processes concurrently. CPU time is shared between applications based on a value called "task priority". Processes with a high task priority are considered more urgent than others and may block lower prioritized processes when busy.

Of course, this should happen only when there really is something to do and not when the process is waiting for user input or idle otherwise.

Unfortunately AMountains is a very CPU time intensive program and it makes sense to assign it a low task priority so other applications have a chance to get their job done.

AMountains supports two different priorities, one if it's window is active and another when it is not active.

ACTIVEPRI controls the priority of the first case, INACTIVEPRI the latter case.

By default «task pri» has a value of -25, which is sufficiently low not to block other applications. Do not set this value higher than 5 or you stir up problems when processes vital for your Amiga's operation get blocked.

You may make AMountains more multitasking friendly by the use of the SLEEP tooltype.

1.49 SLEEP

SLEEP=«delay»

When AMountains filled the window, scrolling starts. Between each scroll step AMountains waits for «delay» seconds giving lower prioritized processes a chance to get their job done.

By default «delay» is 0, and AMountains will not have any idle time at all.

See also: ACTIVEPRI , INACTIVEPRI

1.50 Graphics board support

Graphics board support

Right at the moment AMountains contains no code specific to any graphics board, everything is done by the use of intuition or graphics library functions.

AMountains was written and tested on an A2000 with a Picasso II and CyberGfx driver software, so there may be a thing or two to mention.

You can use AMountains on a 24 Bit true colour screen but you won't get more than 256 colours. AMountains uses a mechanism called "Pen Allocation" for it's colour scheming and neither intuition nor CyberGfx allows more than 256 pens allocated per screen.

However, with 24 Bit screens you will get a better colour resolution compared to 8 Bit screens. True colour screens may display $256 \times 256 \times 256 = 16,777,216$ different colours while 8 Bit screens with colour look-up table are restricted to $64 \times 64 \times 64 = 262,144$ different colours - at least with the Picasso II.

The colours will be more exact on true colour screens and the view should look slightly better.
