Black Cat Sonde
Version 0.4.1 May 9, 2019

Black Cat Sonde is an app to decode radiosondes (weather balloons). It currently can decode LMS6 and Mark IIa style radiosondes. Support for other styles could be added, I would need high quality recordings of them for testing purposes.

Requirements:

Macintosh: macOS 10.9.5 or later.

Windows: Windows 7, 8, 10.

Installation:

Presumably you've gotten this far, and have downloaded and unzipped the .zip file.

If you are running on macOS, move the application anywhere you wish.

If you are running Windows, you can move the entire download directory/folder wherever you wish, but you must keep the Libs and Resources directories with the EXE file, or the app will not run.

First Things First:

Run the program by double clicking on the app's icon. You'll see the main window.
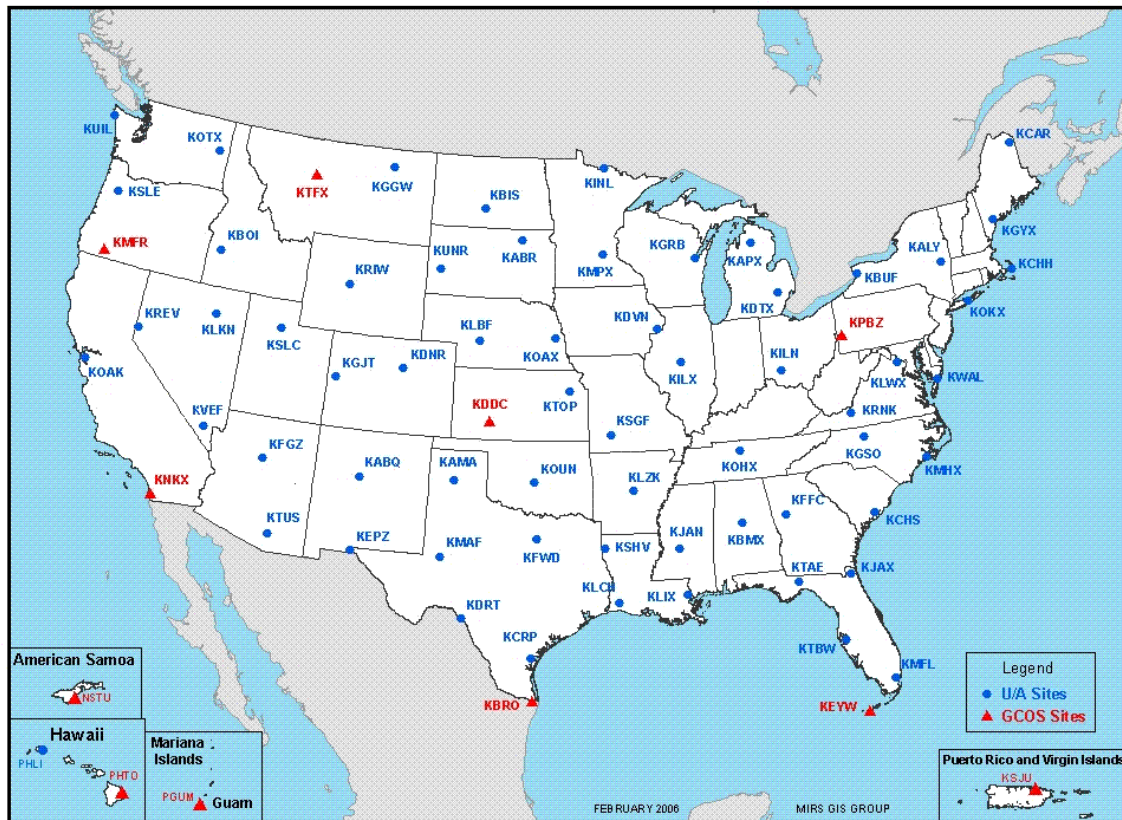
You need to set a few things up.

First, you will want to set your location: latitude, longitude, and altitude, all as decimal numbers. South and West are negative, and altitude is in meters. Also set the maximum distance decodes should be considered valid when plotting on the map. This helps filter out obviously bad decodes. Bad decodes will still be included in the list.
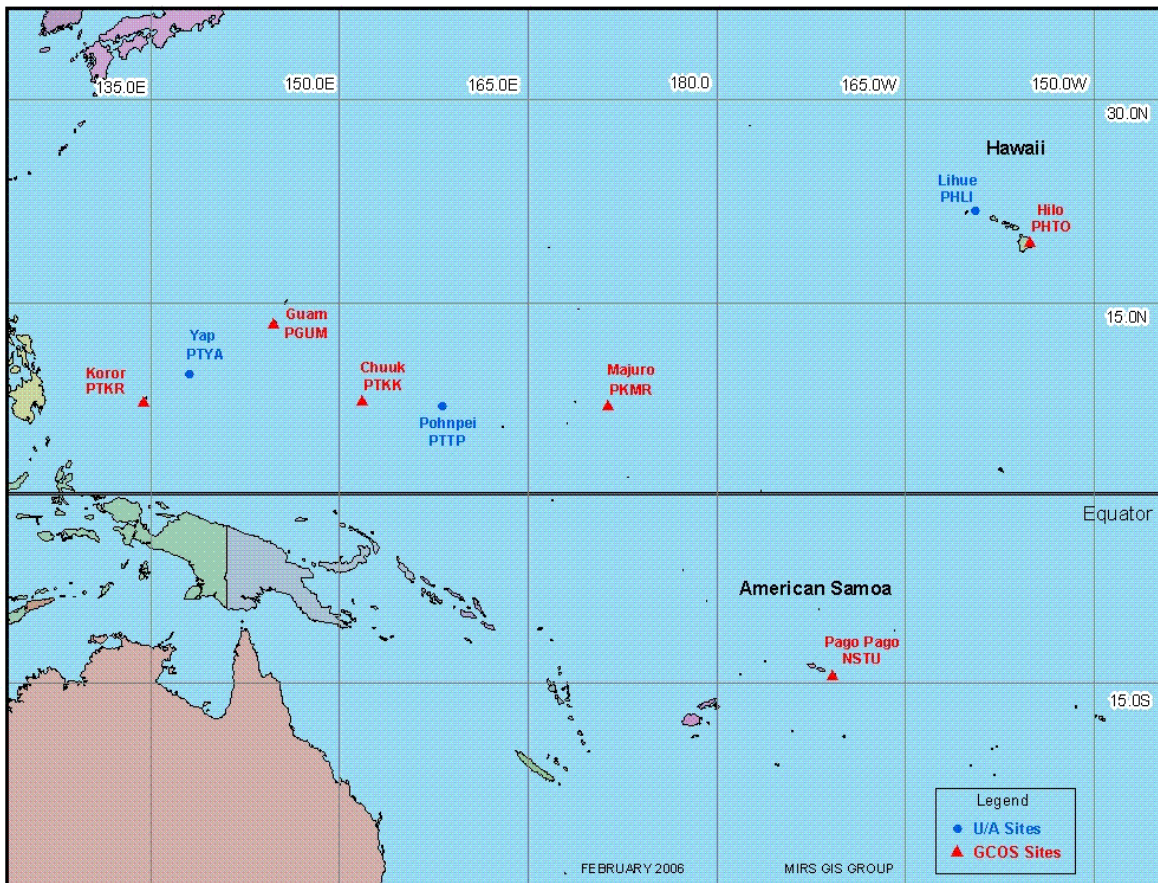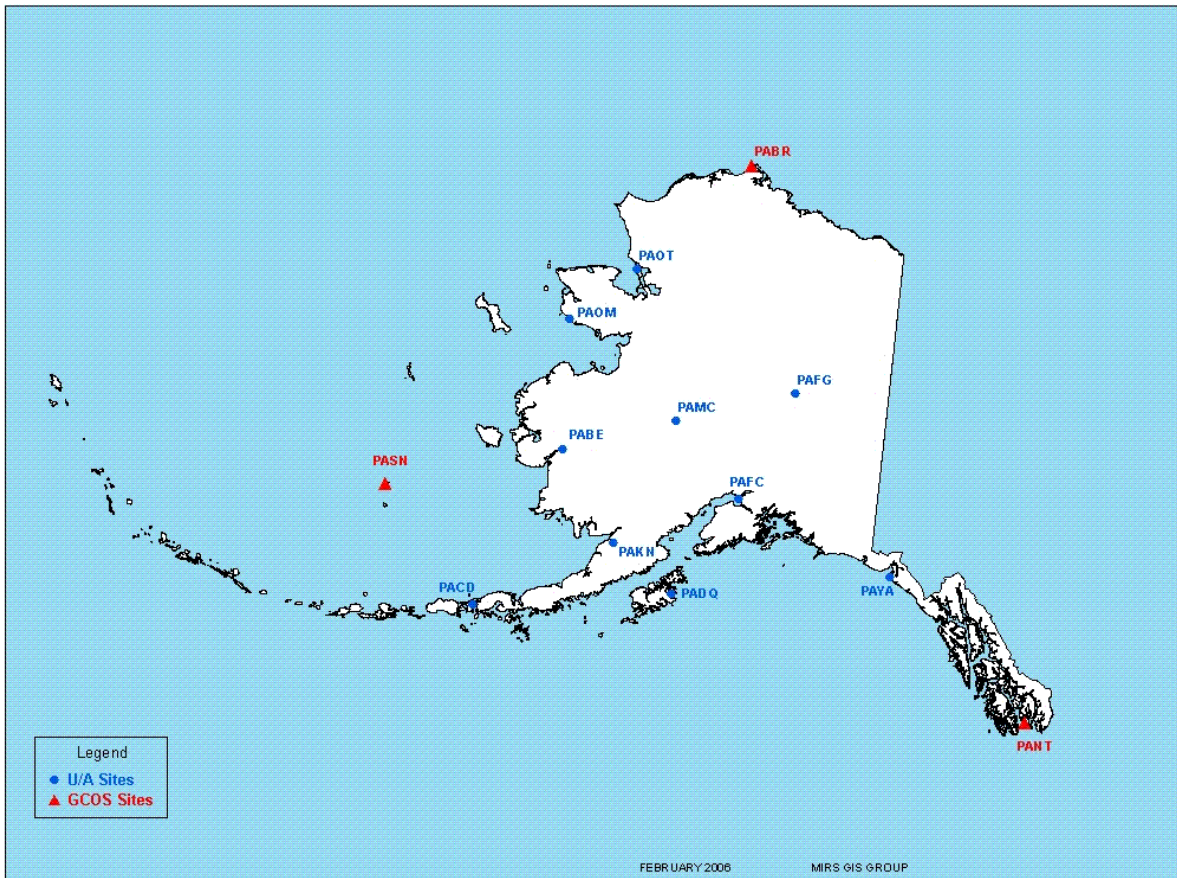
Second, select the correct radiosonde type. If the Mark IIa, you will have several other settings, see details further down.

Third, if decoding from live audio from a radio, select the correct sound input device. This is done via the Audio device popup menu. Also set the input gain appropriately (note that not all sound input devices let you change the gain).

Radiosonde Launch locations:

Radiosondes are launched from many locations in the USA, as well as various locations in the rest of the world. These maps show the US launch locations:

PABR

PAOT

PAOM

PAFG

PAMC

PABE

PASN

PAFC

PAKN

PACD

PADQ

PAYA

PANT

Legend
● U/A Sites
▲ GCOS Sites

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135.0E   150.0E   165.0E   180.0   165.0W   150.0W

30.0N

Hawaii

Lihue
PHLI

Hilo
PHTO

15.0N

Guam
PGUM

Yap
PTYA

Chuuk
PTKK

Majuro
PKMR

Koror
PTKR

Pohnpei
PTTP

Equator

American Samoa

Pago Pago
NSTU

15.0S

Legend
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▲ GCOS Sites

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When selecting a nearby launch site, keep in mind the prevailing wind directions, which dictate how they will generally travel through the air. In the USA, prevailing winds are typically from the west, so select a launch site to your west.

Launches generally occur twice a day, around 1100 and 2300 UTC. Sometimes there are special launches six hours later, when there are extreme weather events and more data is needed for weather models. There is a very useful site that will generate prediction maps for the path of a radiosonde launch: http://predict.habhub.org

You will need to set it up with the location of the launch site of interest (latitude and longitude). I find it is very accurate, in general.


Tuning In Radiosondes on your radio:

Radiosondes transmit on several frequencies. Here in the USA, approximately 401 MHz is often used, as well as either 1676, 1678, 1680, or 1682 MHz. You'll need to determine what frequency is active in your area.

You may be able to contact your local NWS office that launches radiosondes, and ask them what style and frequency they use, I have found them to be very open about this.

Your radio needs to be in FM mode, and the appropriate bandwidth selected, which varies based on radiosonde type. An SDR is ideal for locating radiosonde signals, and determining the bandwidth.

If using an SDR, you will want to route the audio via a virtual audio cable type program, so it appears as a sound input device to Sonde. Select the appropriate audio device in Sonde, and click Start. Adjust the gain as necessary (not all devices support gain). You should see a waveform in the demodulation view, ideally with relatively sharp rise and fall times, with a square wave look. Make sure to disable any filters, noise blankers, etc. in the SDR software which could distort the waveform.
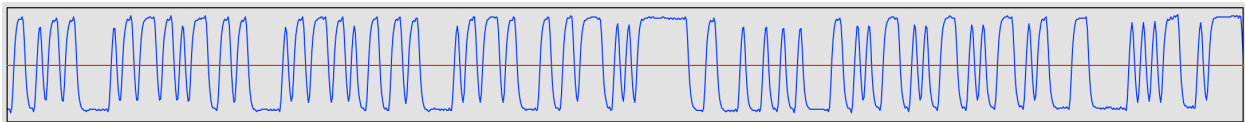
If using a traditional radio, you will want to use the "discriminator tap" as the output, as is commonly used for decoding pager and other digital signals. Web searches can often locate information about how to do this for various model radios.

It is also possible to decode from WAVE format audio files, they must be 16 bit monophonic (not stereo) files, ideally sampled at 48000 Hz, although Sonde will resample from other rates.

Make sure the correct radiosonde type is selected in Sonde. The LMS6 style radiosonde has no additional settings. The Mark IIa has several other settings, such as the demodulation type, threshold, etc. A brief overview:

Demodulator: Edge, Level, or Pattern. Pattern is a special type, and requires careful adjustment of the number of pattern samples (audio samples). Usually this is around 5.000, but can vary roughly from 4.900 to 5.100, depending on the error in your sound card sample rate. It needs to be *exactly* set, for example 4.992 may work but 4.994 won't. But it is also the most sensitive demodulator for weak signals.

For all of the Mark II modes, you may also need to toggle Invert on and off, as well as set the threshold manually or use auto threshold (which usually works well). Trial and error may be required initially, to get things working. Also make sure you have a very good strong and clean radiosonde signal. It may be best to make a high quality recording, and then try to decode off of that, to get things correctly configured, as the window of reception can be short, an hour or two, and perhaps not again for a few days depending on the wind direction.

Once you have found the proper settings for your configuration and radio, they rarely need to be adjusted again.

When correctly configured and a good signal is being received, the data fields will update about once per second, with the location of the radiosonde, distance and bearing, etc. No sensor data (temperature, pressure, etc. is decoded). The history tab will show a list of all of the received data packets. These can be saved and then reloaded at a later date.

Other tabs in Sonde:

The History tab shows a list of all received radiosonde messages.

The Map tab shows a plot with all received positions.

The Altitudes tab shows a plot of the received altitude vs message number.

The Ascent tab shows a plot of the received vertical velocity vs message number.

Sonde is presently under development and in beta, so please send any bug reports, as well as suggestions for additional features: support@blackcatsystems.com

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