SkySonde User Manual

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SkySonde is a software package created at NOAA for collecting, calculating, and plotting data from ozonesonde and/or hygrometer weather balloon flights using iMet-1-RSB radiosondes. The program is split into two pieces: a client and a server. The server collects iMet data from a serial port or audio cable and makes it available to one or more clients, which can be either locally run (on the same computer) or remotely connected through the network.

Note that SkySonde is only available for Microsoft Windows computers (XP and above), and requires the .NET Framework 4.0 or higher, available from Microsoft's website at:

https://www.microsoft.com/net/download

Modem

iMet radiosonde data is collected on the ground using an antenna and radio receiver hooked up to a computer through a modem to decode packets. The receiver should be set in WFM mode at the iMet's transmit frequency (plus about 0.04 MHz, they are always a little higher) with squelch turned off and AFC disabled. The latest version of SkySonde Server includes an audio/software modem which allows data collection directly from the receiver through the computer's microphone port. Attach a 3.5mm male-male audio cable, either mono or stereo, from the receiver's audio output (often labeled "REC OUT") to the computer's microphone input as shown here:

Figure 1: Audio cable from the receiver to the computer

If a window pops up asking if the input is "line in" or "microphone", choose "line in". Make sure the audio cable is attached to the computer before starting SkySonde Server, as the microphone is

sometimes disabled by Windows until a cable is detected. You may also have to enable the recording device using the Control Panel in Windows, and increase the recording volume if necessary. In SkySonde Server you may need to use "Options->Select Audio Input Device" to choose the appropriate recording device if the default doesn't work. All configuration settings are remembered in SkySonde Server, so this setup should only be needed once. If your receiver has volume control for the audio output, set it to a middle value… too high or low might stop packet decoding in the audio modem.

We recommend using the audio modem if possible, as it performs great even on older machines and collects more data packets in noisy situations than the hardware modem. But if there is a persistent problem with sound drivers or some other issue with the audio modem, a 1200 baud Bell 202 USB hardware modem may be used instead (available from EN-SCI / Droplet Measurement Technologies). Since it has a USB interface, a driver is required to install the device when it is first used. The driver needed is the ft232r USB Virtual COM Port Driver, which can be downloaded from the following URL:

http://www.ftdichip.com/Drivers/VCP.htm

Plug the modem into a free USB port and install the driver[1]. The COM port assigned to the modem varies from computer to computer, though it is typically COM3 - COM5 (you can check this in the Device Manager).

There are a few known problems with the hardware modems that sometimes occur. If audio data is being fed through the modem while it is plugged into a computer's USB port, Windows sometimes confuses the device for a serial mouse (causing the on-screen mouse to rapidly move around and behave oddly). If this happens, disconnect the modem from the computer and remove the modem's audio input before plugging back into the USB port and restart SkySonde Server/Client. The hardware modems can also stop transmitting packets if the cables are bumped or jiggled. Again the solution is to reconnect the modem and restart SkySonde (occasionally they need to have a new com port number assigned to them in the device manager before operation will continue). For these reasons, the audio modem is recommended over the hardware modem for most users.

SkySonde Server Setup

If you have yet to install SkySonde, go ahead and run the "SkySonde Server Setup" and "SkySonde Client Setup" executables on your data acquisition computer.

With either the audio cable from the receiver or the hardware modem plugged in, open SkySonde Server (either from the start menu or the desktop icon). It will try to use the audio modem by default... if you're using a hardware modem instead, select the correct port from the "Data Source" menu (any new selection will be remembered and used the next time this program is opened). If you have the data connection setup and an iMet radiosonde is transmitting on the right frequency, SkySonde Server will blink colored "lights" (circles) for each packet type received (see Figure 2). The iMet by itself will send either a PTU or PTUX packet, and a GPS or GPSX packet (depending on configuration). Either packet type is fine, as long as one of each is coming through (the PTUX packet has some extra internal temperature information and the GPSX packet has extra velocity data).

The SkySonde Server window also contains a list of connected clients (displayed as ip address : port

[1]Installation guides available from http://www.ftdichip.com/Documents/InstallGuides.htm

number), a status message viewer, and the server's IP address and port (in the lower right corner). With the server running and packet lights blinking, it's time to set up the client.

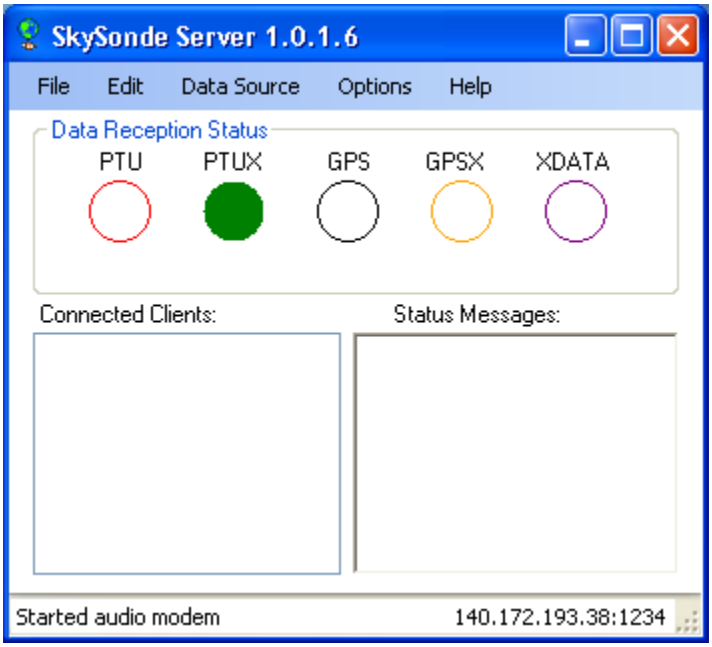

Figure 2: SkySonde Server with packet light for PTUX

SkySonde Client Setup

With the server running, open SkySonde Client. This program contains detailed flight setup information, parses and calculates instrument data from packets, and stores several output file types.

Configuration

When starting SkySonde Client, the configuration dialog will open up first. This window allows entry of various flight, station, instrument calibration, and server connection information. There are seven different tabbed configuration panes: Acquisition, Station, Ozone, Hygrometer, Other, Multiple Instruments, and GRUAN. The Acquisition tab contains fields for data source selection, server connection, output file information, and other flight options. The Station tab allows for site/station/ground data to be entered, such as latitude/longitude and surface conditions. The Ozone tab contains EN-SCI ECC Ozonesonde calibration fields and loading of coefficient files. The Hygrometer tab allows selection of the mirror thermistor number / calibration coefficients. The Other tab allows the use of other XDATA instruments with the iMet (contact Allen Jordan to add more). The Multiple Instruments tab allows for launches with multiple/duplicate ozonesondes or hygrometers (only used if there's more than one ozonesonde or more than one hygrometer on the same radiosonde). Finally, the GRUAN tab (only required for NOAA ozonesonde flights) collects extra metadata about the ozonesonde setup and checkout as needed by the GCOS Reference Upper-Air Network.

Acquisition Fields:

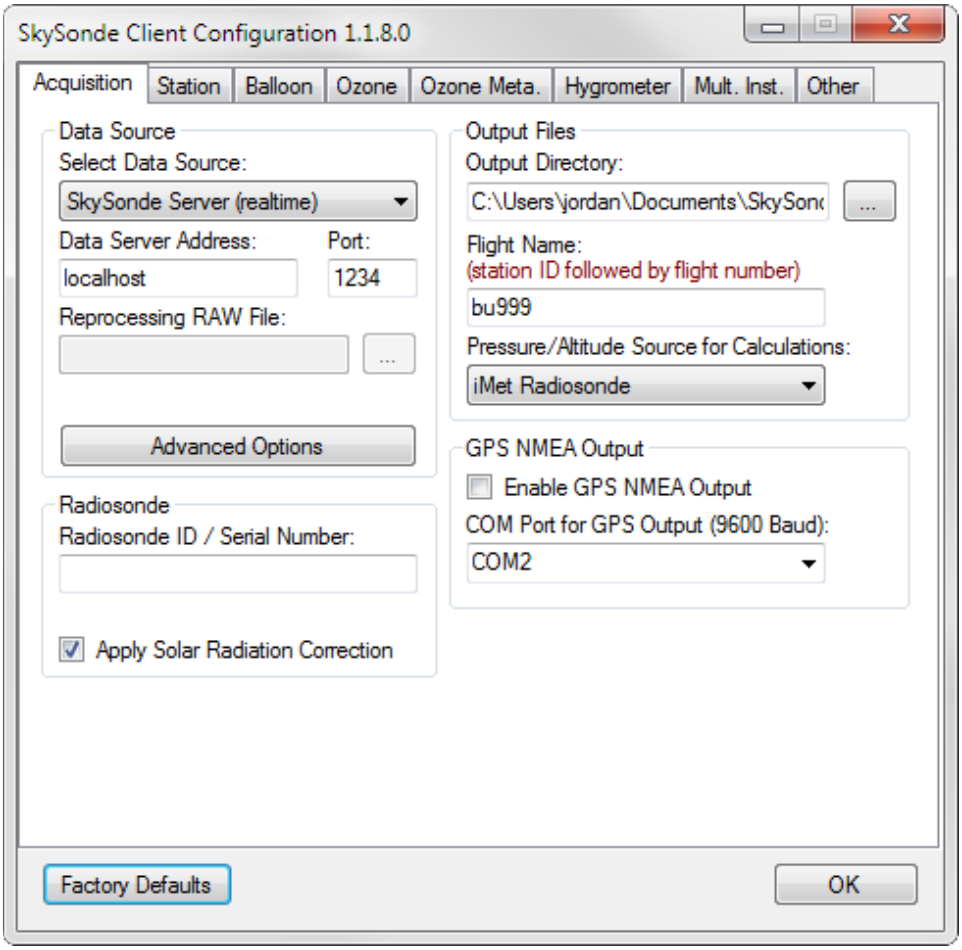

Figure 3: The Acquisition tab in SkySonde Client's configuration dialog

Select Data Source	Select to receive data from either a running SkySonde Server or a RAW file gathered from a previous flight. Choosing the RAW file option puts the SkySonde Client into "reprocessing" mode (enabling other reprocessing fields).
Data Server Address / Port	The IP address and port number of a running SkySonde Server.
Reprocessing RAW File	File name and browser for selecting the RAW file for reprocessing (when this option is selected as the data source).
Radiosonde ID / Serial Number	The ID / Serial Number of the iMet-1-RSB radiosonde, which can be found on the foam packaging (optional).
Output Directory	The directory for output file storage. These files include a .csv with every output field, .dat and .de1 for balloon.pro plotting, .raw and .rawconfig for reprocessing, and more.
Flight Name	The name for the flight, often represented by the station ID followed by a sequential flight number. (Example: BU012 for the 12th flight in Boulder, CO)
Pressure/Altitude Source for Calculations	This selects the source of pressure and altitude used for plots and various internal calculations (partial pressure, mixing ratio, etc). It is selectable in case one of the sensors is bad, so another can be chosen while reprocessing.
Enable GPS NMEA Output	Check this box to enable outputting of Garmin NMEA formatted GPS strings for plotting in an external application after redirecting (using a serial port redirector program like VSPE or a null modem cable).

COM Port for GPS Output	The serial COM port for GPS NMEA string output, if enabled.

Station Fields:

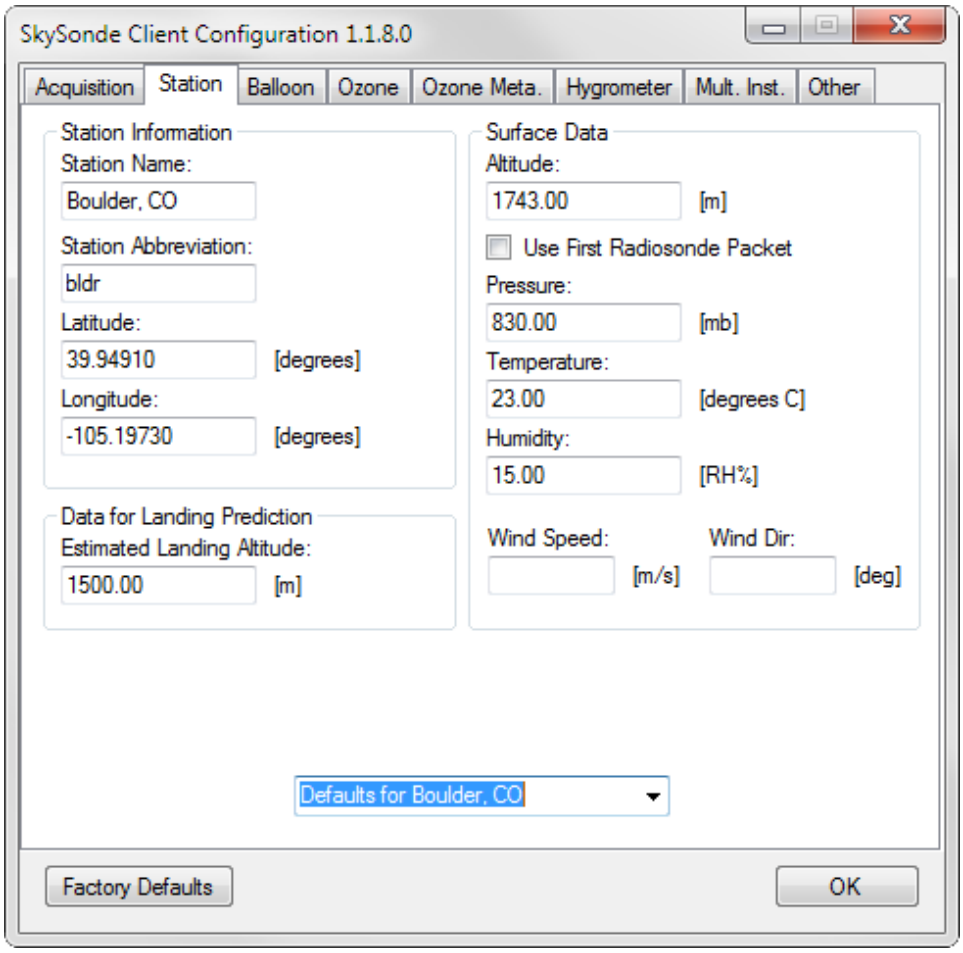

Figure 4: The Station tab in the SkySonde Client's configuration dialog

Station Name	The name of the launch site/station. This can be any string... the format is not important.
Station Abbreviation	A short abbreviation of the site/station name (optional).
Latitude / Longitude	The latitude and longitude location of the site/station, in decimal degrees (west longitude is negative).
Altitude	The site/station's altitude in meters.
Use First Radiosonde Packet	Choose this option to get the surface pressure/temperature/humidity from the first iMet packet when data collection starts. This is useful when the launch station doesn't have standard weather sensors, though the iMet must be outside and near the launch site when first powered on to get accurate station information.
Pressure	The current surface pressure in millibars.
Temperature	The current surface temperature in degrees Celsius.
Humidity	The current surface relative humidity percent.
Estimated Landing Altitude	An estimation of the landing altitude, used in landing location/time prediction.
Defaults	This combo box selects default station values for several pre-defined sites.
Wind Speed / Dir	The current wind speed and direction.

Balloon Fields:

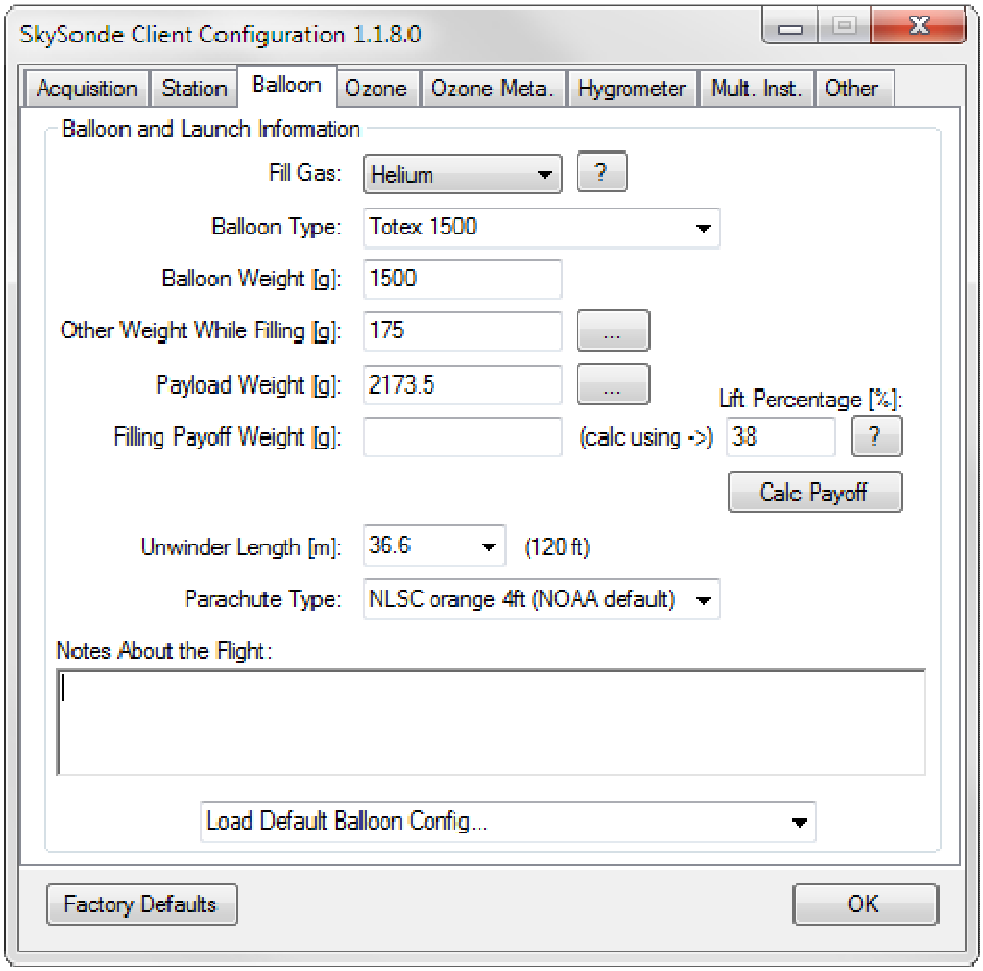

Figure 5: The Balloon tab, containing balloon-related metadata and notes.

Fill Gas	The type of lift gas filling the balloon (helium or hydrogen).
Balloon Type	The type and size of balloon used
Balloon Weight	The weight of the balloon
Other Weight While Filling	Any other weights attached to the balloon while filling (inlets, valves, etc)
Payload Weight	The weight of any items attached to the balloon after filling (typically the instrument itself and any clips, parachutes, etc)
Filling Payoff Weight	The weight the balloon can barely lift when the gas is shut off.
Lift Percentage	This is the ratio of net force to weight force, used to determine the payoff weight. Typically 30-40%. This percentage can be used to calculate the ideal payoff weight using the "Calc Payoff" button.
Unwinder Length	The length of the unwinder / pay-out reel attached to the balloon, or if not used enter the length of the string between the payload and balloon.
Parachute Type	The type and size of the attached parachute.
Notes About the Flight	Enter in any notes about the flight. They will be saved with the raw metadata and can be viewed later.
Load Default Balloon Config…	Use this to load default balloon configurations in this tab for standard NOAA flights.

Ozone Fields:

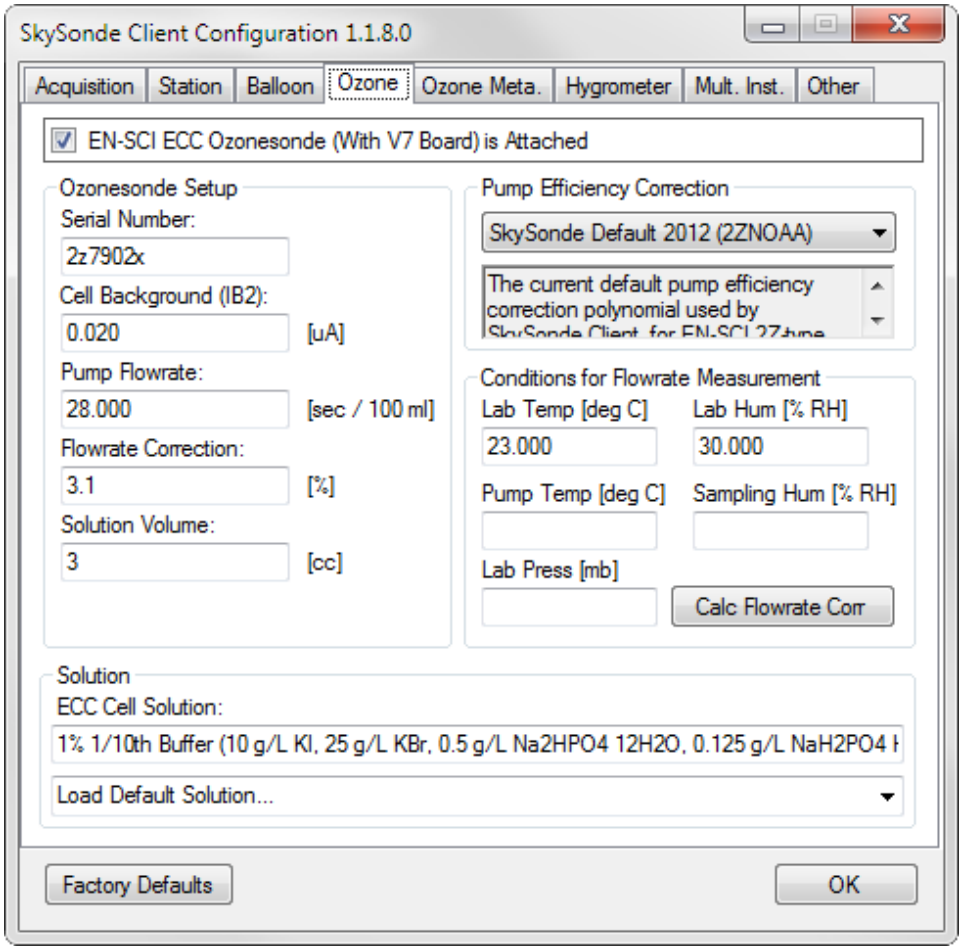

Figure 6: The Ozone tab in SkySonde Client's configuration dialog

Ozonesonde is Attached	Check this box if there is an EN-SCI ECC ozonesonde attached to the balloon package.
Serial Number	The ozonesonde's serial number.
Cell Background	The ozonesonde's cell background current in uA.
Pump Flowrate	The ozonesonde's pump flowrate in seconds per 100 ml.
Flowrate Correction	The ozonesonde's flowrate correction percentage (for the wet bubble flow meter).
Solution Volume	The volume of cathode solution in the cell in cc.
Pump Efficiency Correction	The pump efficiency correction to use, since the pump gets less efficient at low pressures.
Lab Temp for Flowrate	The lab temperature when the flowrate measurement was taken.
Lab Hum for Flowrate	The lab humidity when the flowrate measurement was taken.
Pump Temp for Flowrate	The temperature of the pump during flowrate measurement (optional).
Sampling Hum for Flowrate	The humidity of the test unit’s airstream being sampled by the ozonesonde during flowrate measurement (optional).
Lab Press for Flowrate	The pressure of the lab during flowrate measurement (optional).
ECC Cell Solution	The solutions used in the ozonesonde cells (just for record keeping).

Extra Ozone Metadata Fields:

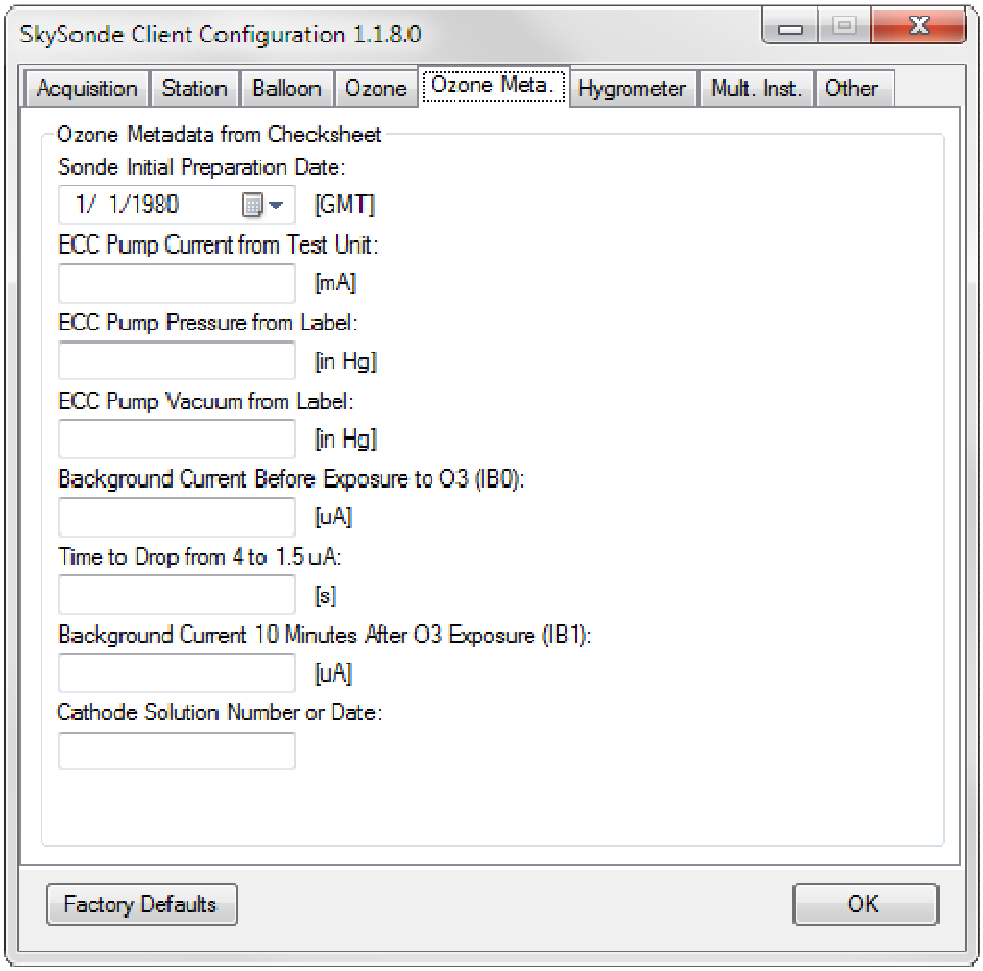

Figure 7: Extra ozone metadata fields.

Fill out the fields on this tab by directly copying them from the ozonesonde checksheet. They are all optional, though mandatory for GRUAN sites.

Hygrometer Fields:

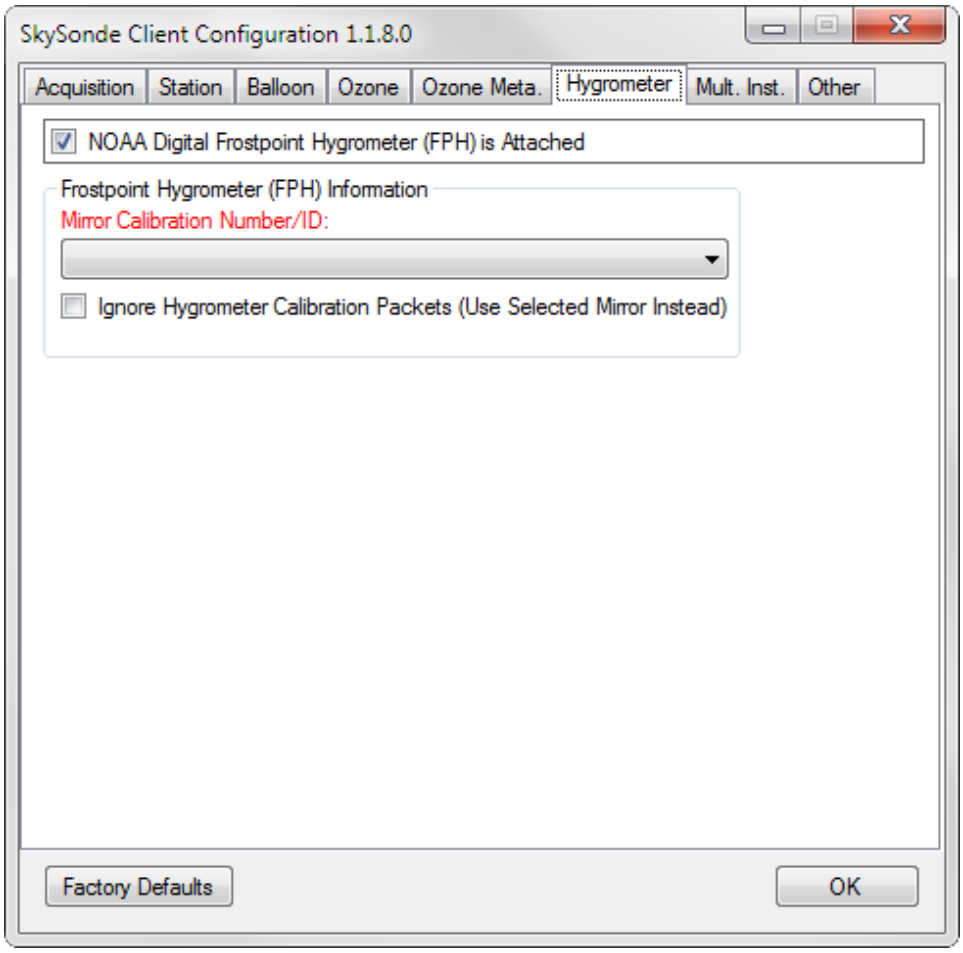

Figure 8: The hygrometer tab in SkySonde Client's configuration dialog

Hygrometer is Attached	Check this box if there is a NOAA Frostpoint Hygrometer attached to the balloon package.
Mirror Calibration Number / ID	Select the hygrometer mirror calibration number. This is redundant information for backup purposes, as the calibration should be stored on the hygrometer as well.
Ignore Hygrometer Cal. Packets	Check this to use the selected mirror calibration instead of the on-board hygrometer calibration (only use if the hygrometer cal was not properly set).

Other Fields:

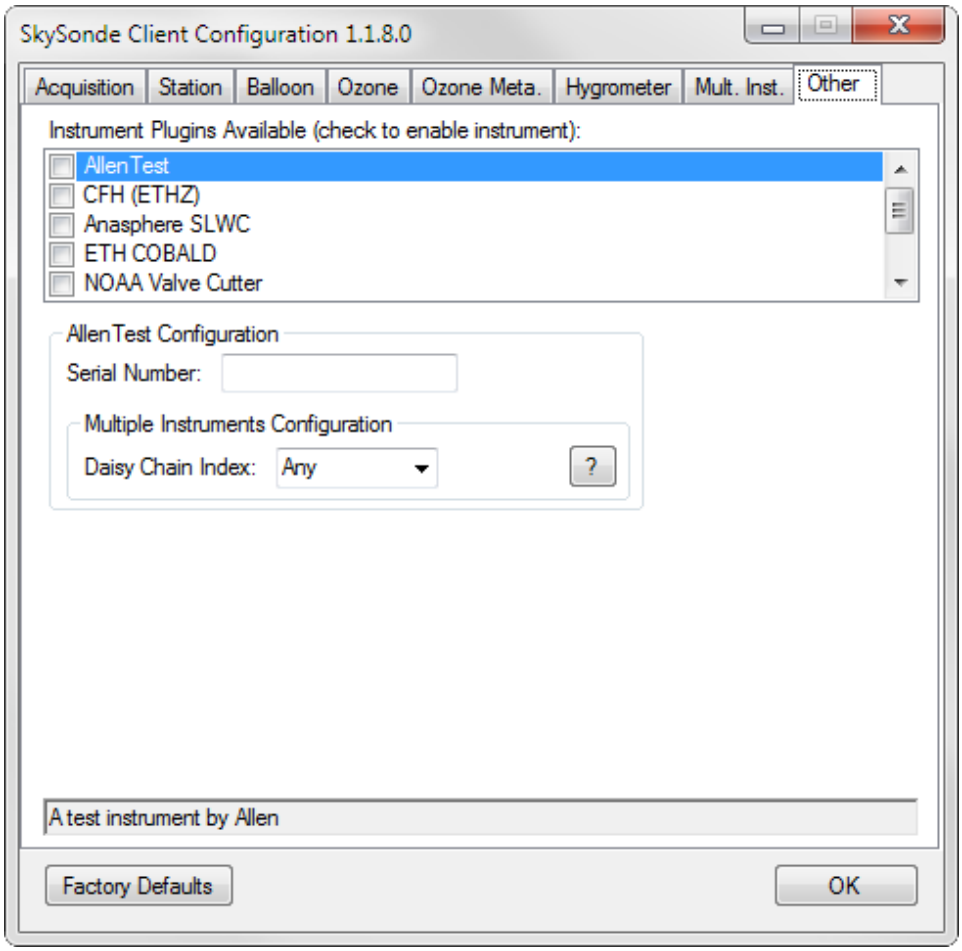

Figure 9: The other tab in SkySonde Client's configuration dialog

Instrument Plugins Available	Put a check mark next to any extra instruments daisy chained to the iMet radiosonde
Configuration Area	Any plugin-instrument-specific configuration options are available here
Multiple Instruments Configuration	If launching more than one of the same plugin instrument type, use one instance of SkySonde Client for each, and specify the daisy chain index here.

Multiple Instruments Fields:

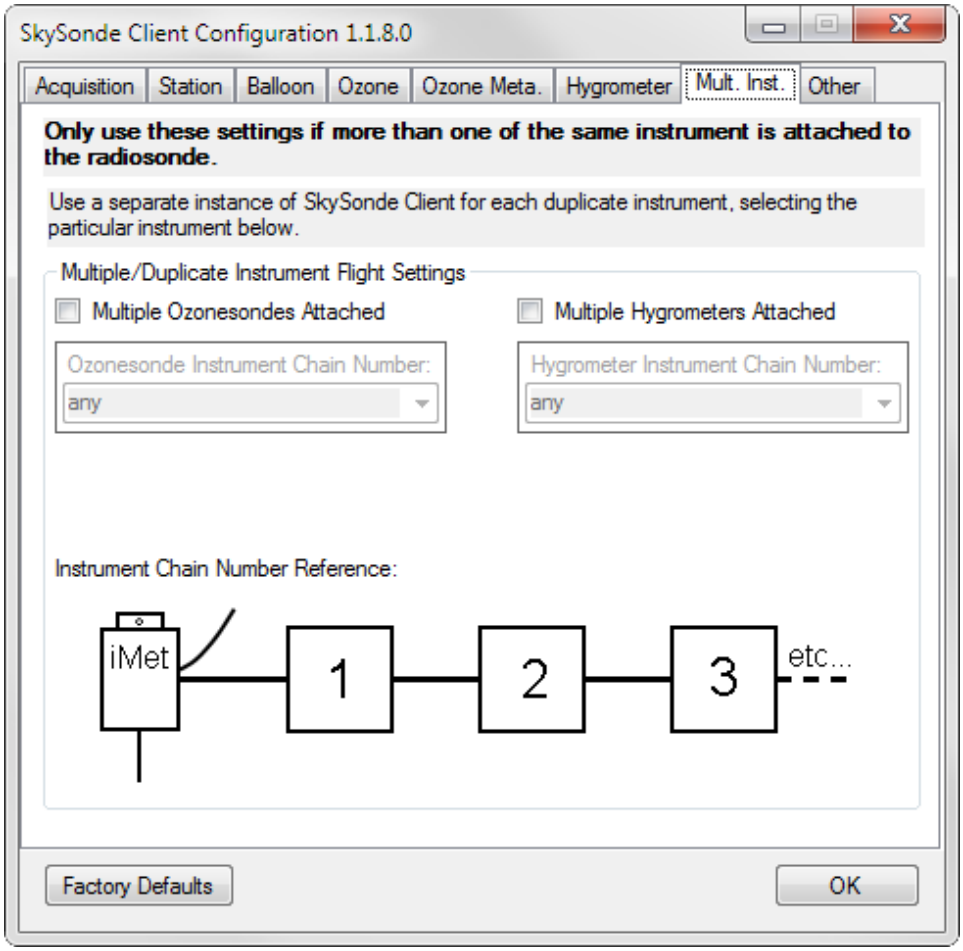

Figure 10: The Multiple Instruments tab for duplicate instrument launches

Multiple Ozonesondes Attached	Check this if more than one ozonesonde is attached to the radiosonde.
Multiple Hygrometers Attached	Check this if more than one hygrometer is attached to the radiosonde.
Ozonesonde Instrument Chain Number	The position at which the ozonesonde is attached in the chain of instruments (use the instrument chain graphic for reference).
Hygrometer Instrument Chain Number	The position at which the hygrometer is attached in the chain of instruments (use the instrument chain graphic for reference).

After filling out the configuration dialog, press “OK” to open the main SkySonde Client window. If successful, your configuration will be saved for the next program launch.

Main Window

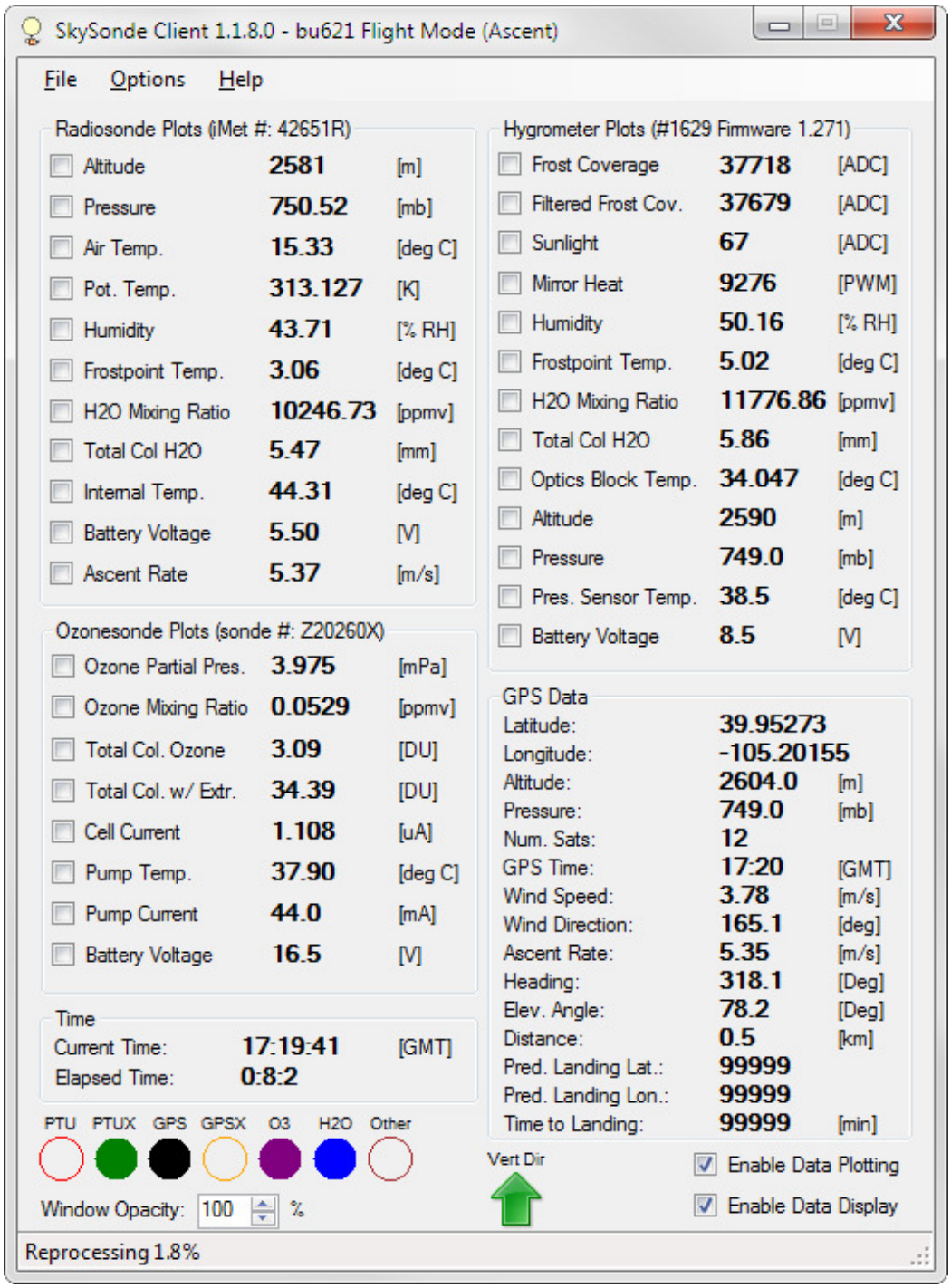

Figure 11: The main SkySonde Client window

The main SkySonde Client window shows the current data fields, incoming packets, and options for plotting/mapping. The data field displays are divided into three sections, one for each type of instrument (radiosonde, ozonesonde, and hygrometer).

Incoming data packets are displayed with blinking “lights” (colored circles) in the corner of the

window. This display is similar to the SkySonde Server, and provides an easy way to check for data reception quality.

If the computer running SkySonde Client becomes slow and unresponsive during a flight, use the Options->Reduce Plot Points menu option. This will remove every other point from each data plot to reduce memory consumption. If this is not enough, uncheck the "Enable Data Plotting" box to completely disable the plots.

At the beginning of a flight, this program will try and detect the launch time automatically. When this happens, the title will change to include the text "Flight Mode" and the window's status bar will display the launch time and detection method. If this automatic detection does not work within the first few minutes of flight, use the Options->Force Flight Mode menu option. The main purpose of flight mode detection is for changing from a pre.dat file to a flt.dat file, separating the preflight and main flight into two separate files for the balloon.pro plotting package.

Checking the box next to a data field opens up a plot for easy visualization (see Figure 12). The default plots are vs. elapsed time (or vs. altitude in flight), but this can be changed using the "Independent Variable" menu. Changing to pressure or altitude plotting flips the axes so that a vertical profile is displayed. The time plot will scale the dependent variable axis to match the data, while the pressure and altitude plots are fixed to maintain the profile views.

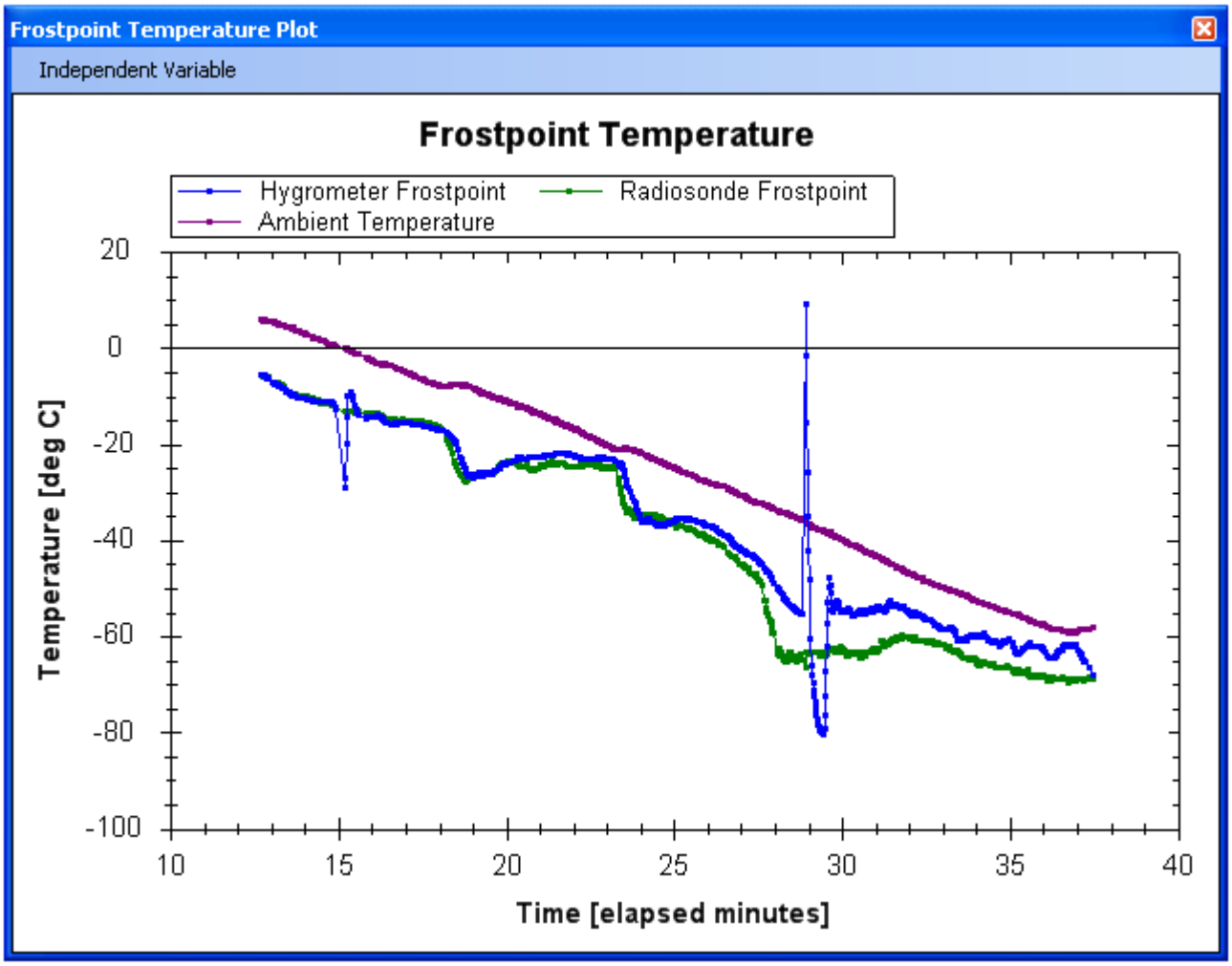

Figure 12: A time plot of the hygrometer's frostpoint temperature

Use the "Options->Track Balloon on Map" menu option to open up a map showing the balloon's path. Maps are available everywhere using online map servers like Google Maps when an internet connection is available. Figure 13 shows the map with small displays for wind direction, heading from launch, and elevation angle from launch. Un-checking the "Auto Scale Map" box will allow you to drag and scroll with the mouse for pan/zoom. When the balloon is descending and close to the ground, an estimated landing point will be shown as well.

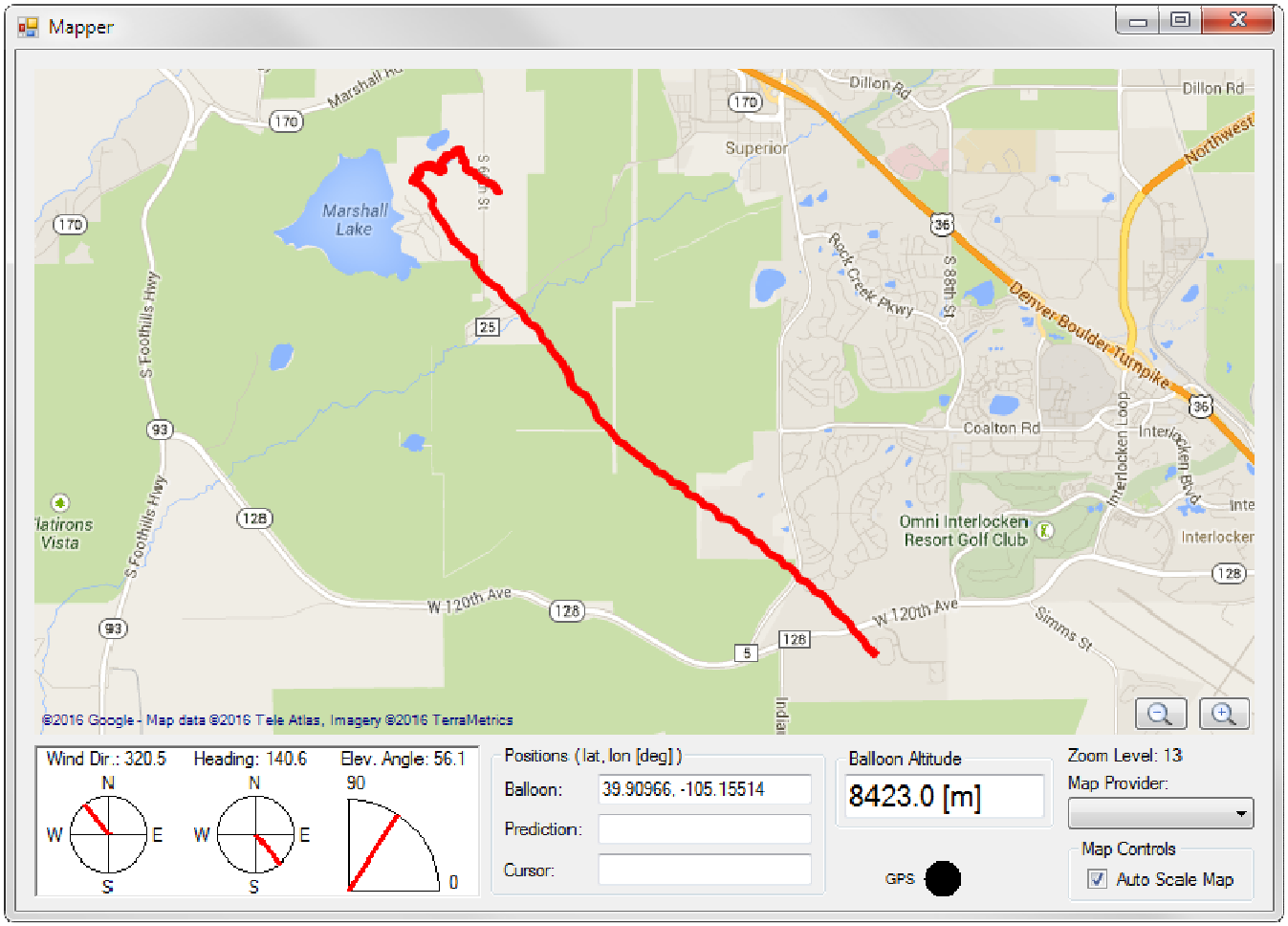

Figure 13: A map of the balloon trajectory.

Files

Several types of data files are produced by SkySonde Client:

CSV	The main flight data file, containing every output field in a comma separated value format (Excel friendly).
KML	A Google Earth file containing the 3d balloon trajectory.
RAW	A file containing raw packet bytes (with timestamps) that is used for reprocessing data.
RAWCONFIG	The set of configuration options entered for the flight, used in conjunction with the RAW file for reprocessing.

DE1	The flight description file created for balloon.pro compatibility.
FLT.DAT	The in-flight data file created for balloon.pro compatibility.
PRE.DAT	The pre-flight data file created for balloon.pro compatibility.

Reprocessing

RAW files from a flight can be “reprocessed” with different configuration options. This is useful for entering different instrument calibration values and selecting different sensors for the pressure/altitude source. To start reprocessing, open SkySonde Client and set the “Select Data Source” to use a RAW file, then select the specific file in the “Reprocessing RAW File” field. The flight's previous configuration options will be loaded and displayed in the GUI (using the RAWCONFIG file), and can be changed before continuing. When ready, press “OK” to enter the main program window and reprocessing will commence. Plots are disabled by default for speed (you can re-enable them using the “Enable Data Plotting” check box), and the progress is shown in the lower status bar. When complete, the process will have overwritten the flight output files with new ones, leaving the RAW file intact for future reprocessing.