Kestrel Pressure Altimeters

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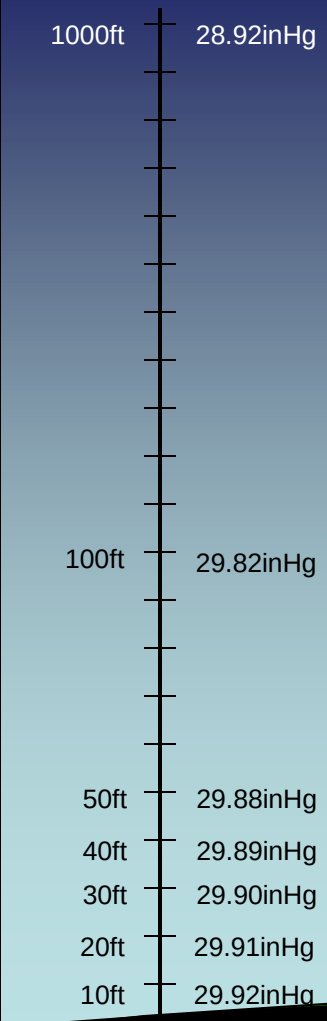
Air Pressure

At high elevations, the air is not very dense at all. The effect of gravity is less than at lower elevations on the surface of the Earth. Because there is very little air above, the *air pressure* is low.

At low elevations, the air is much more dense. The effect of gravity is greater than at higher elevations. Because there is a lot of air above, the *air pressure* is high.

The same phenomenon is more easily understood in terms of water depth. It's obvious to most people that the deeper you go under water, the greater the water pressure. The same concept is true for air.

Air Pressure and Altitude



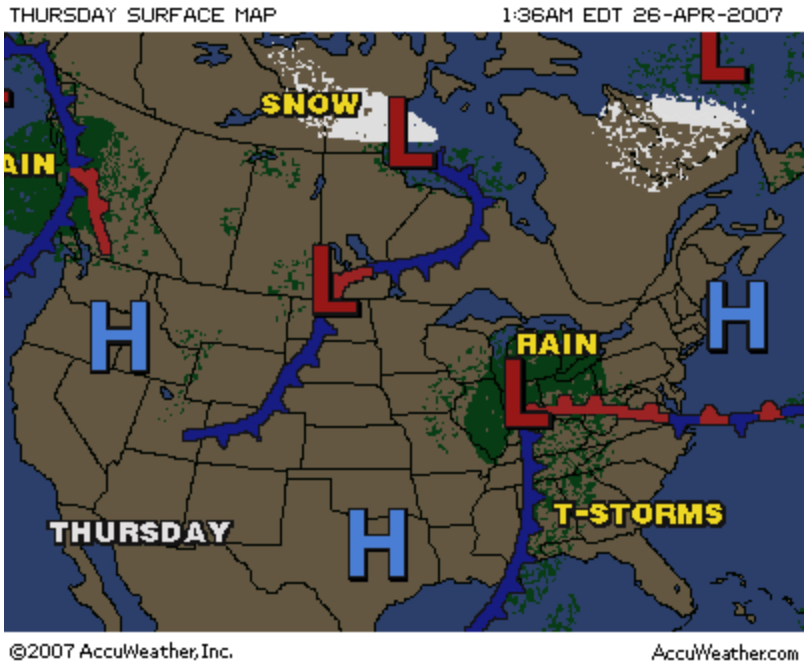
The pressure measurement at any location is called STATION PRESSURE. You can remember this because it's the pressure that you measure at a particular place, or station. Another term is unadjusted pressure.

There is a very good rule of thumb for estimating the difference in station pressure as you change altitude.

- For every 10 feet of altitude, the pressure decreases by 0.01inHg.
- For every 100 feet of altitude, the pressure decreases by 0.10inHg.
- For every 1000 feet of altitude, the pressure decreases by 1.00inHg.

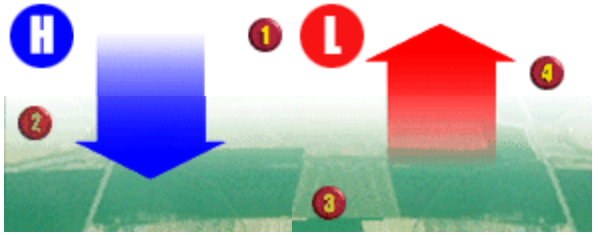
Therefore, if the pressure is measured at sea level to be 29.92inHg, the pressure 1000ft higher would be 28.92inHg.

Weather Fronts



Air pressure at a certain location constantly changes depending on the weather.

An area described as High pressure has air which has a tendency to push downward toward the Earth. Low pressure areas have air push upwards from the Earth.



Pressure trends can be very useful in weather forecasting. A very good rule of thumb is that a quickly decreasing pressure indicates a storm is coming.

Barometric Pressure

Cloudy

54° F

Feels like
54° F

UV Index:	1 Low
Wind:	From East at 11 mph
Humidity:	68%
Pressure:	30.21 inHg ↓
Dew Point:	44° F
Visibility:	10.0 miles

Weather stations, weather websites and airports report a current pressure and pressure trend. The example to the left was taken from weather.com for Denver. But Denver is a big area, and there are very different altitudes throughout the region. How can this information be used?

Weather reports always publish *BAROMETRIC PRESSURE*. This is NOT the same as *STATION PRESSURE* described in the earlier slides. Barometric pressure is the pressure found at sea level rather than at your particular altitude.

Let's assume that the weather information here was taken at the Denver airport, which is located at 5000ft elevation. The would use an instrument at the airport which measures station pressure. The measurement they would get on their instrument is 25.21inHg. This low pressure should make sense because Denver is very high, and we know that pressure decreases as we increase in altitude.

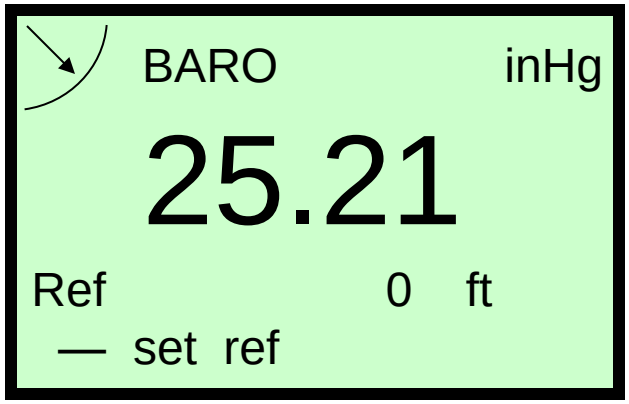
5000ft above sea level = 5.00inHg

25.21inHg + 5.00inHg = 30.21inHg

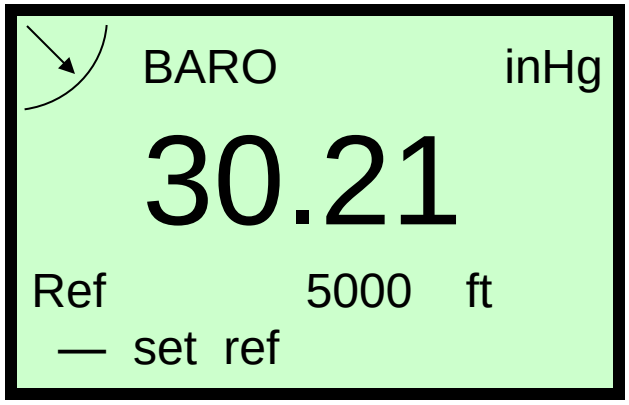
They would adjust their station pressure measurement to account for their altitude above sea level. We already learned that 1000ft = 1.00inHg. So they would add 5.00inHg to their measurement in order to calculate the barometric pressure (adjusted to sea level) of 30.21inHg.

Kestrel: BARO Mode

The Kestrel is capable of displaying station pressure as well as barometric pressure. In order to display barometric pressure, the user will be required to input the current altitude.



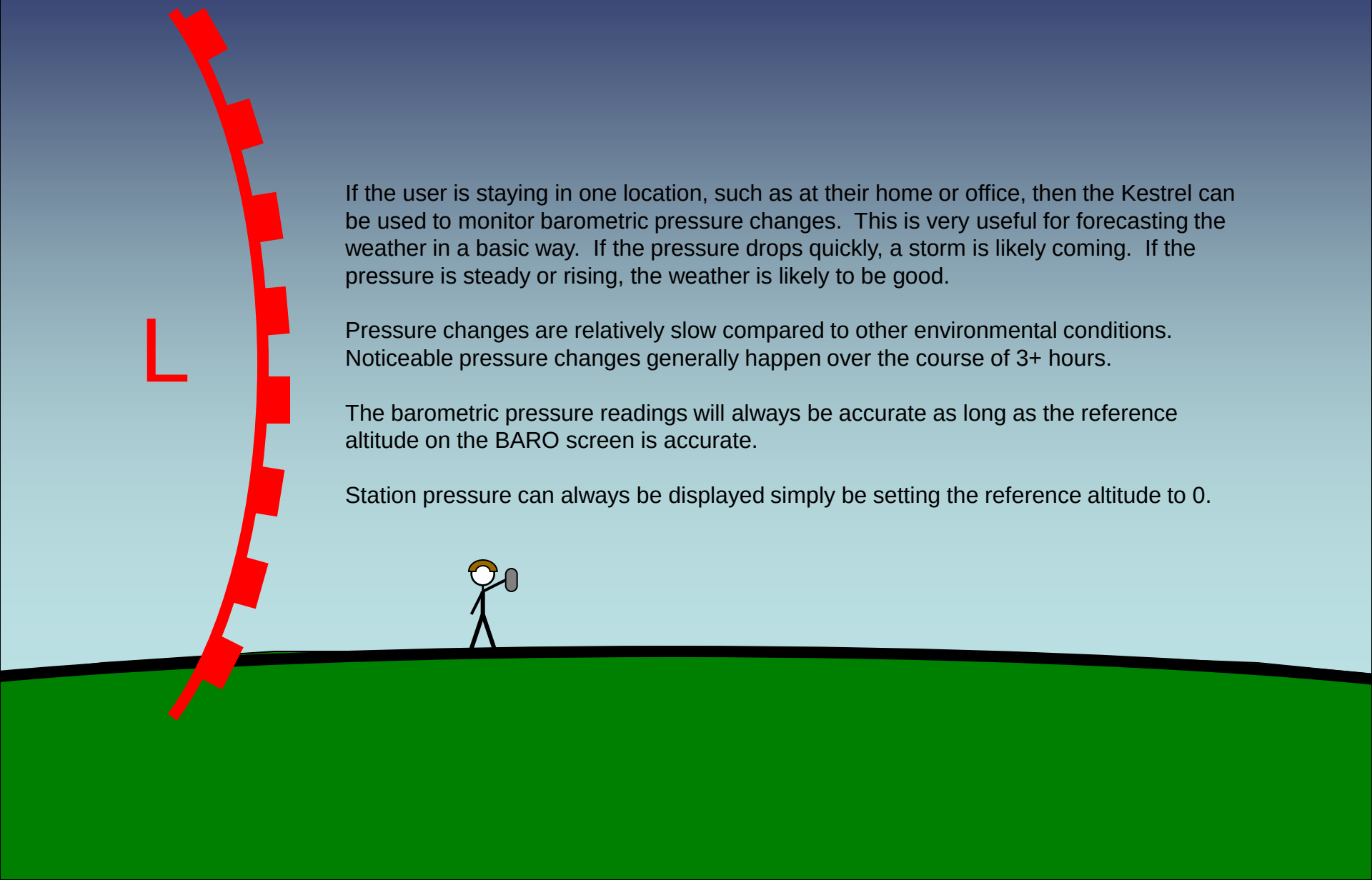
The Kestrel at the Denver airport would look like the display to the left. If the reference altitude is set to 0 ft, the Kestrel will not adjust for an altitude change. This measurement is station pressure.



If the reference altitude is set to 5000 ft, the display would look like this. This measurement is barometric pressure.

The barometric pressure will be correct AS LONG AS THE USER IS IN THIS LOCATION (at the same altitude). If the Kestrel is moved to another location, then the reference altitude will have to be changed accordingly.

Monitoring Barometric Pressure



If the user is staying in one location, such as at their home or office, then the Kestrel can be used to monitor barometric pressure changes. This is very useful for forecasting the weather in a basic way. If the pressure drops quickly, a storm is likely coming. If the pressure is steady or rising, the weather is likely to be good.

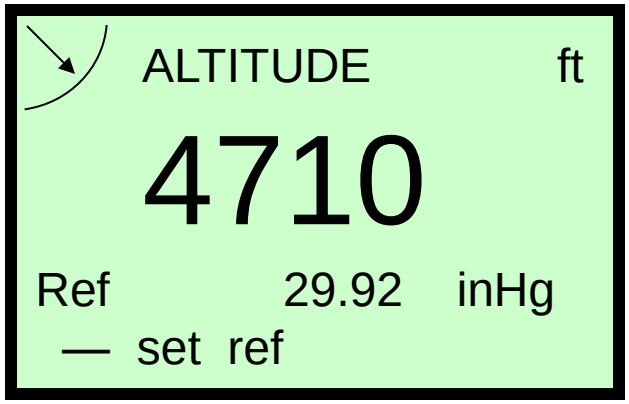
Pressure changes are relatively slow compared to other environmental conditions. Noticeable pressure changes generally happen over the course of 3+ hours.

The barometric pressure readings will always be accurate as long as the reference altitude on the BARO screen is accurate.

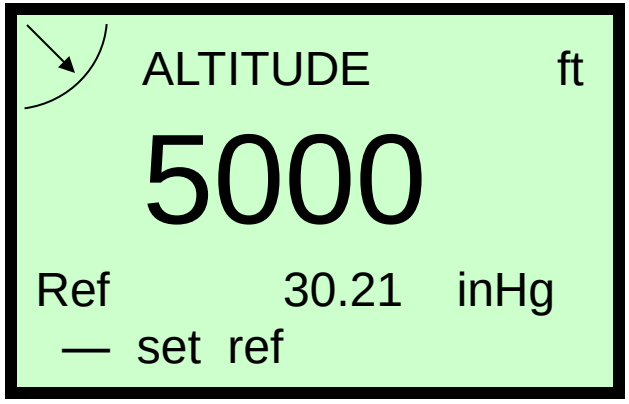
Station pressure can always be displayed simply be setting the reference altitude to 0.

Kestrel: ALTITUDE Mode

The Kestrel will display PRESSURE ALTITUDE, which is an altitude *calculated* based on a station pressure measurement and a barometric pressure reference setting. The ALTITUDE mode is completely independent of the BARO mode. Making changes to the reference value on one screen has no effect on the other screen.



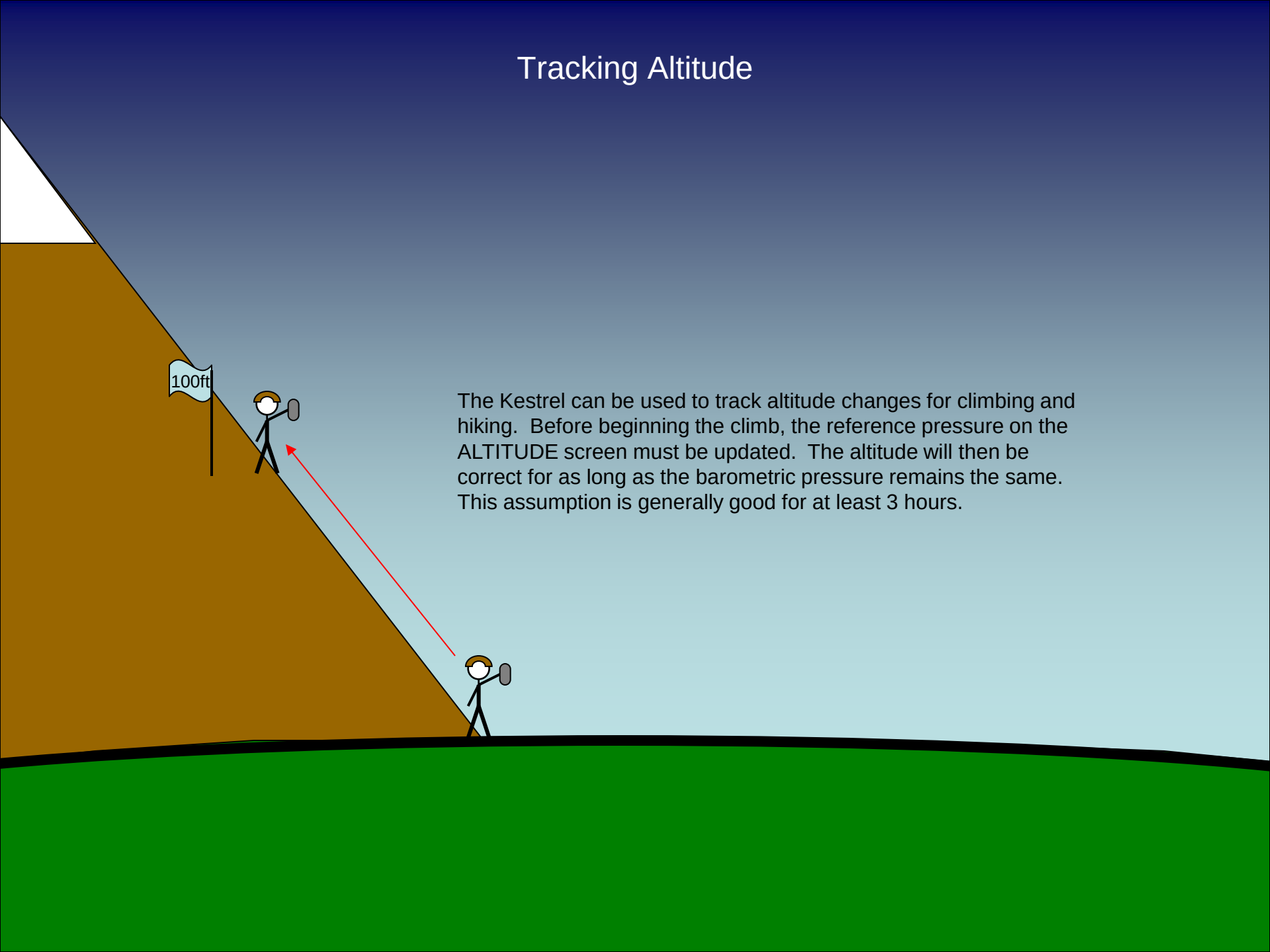
The Kestrel at the Denver airport would look like the display to the left. If the reference barometric pressure is set incorrectly, the calculated altitude will be incorrect.



If the reference pressure is set correctly to 30.21inHg, the display would look like this.

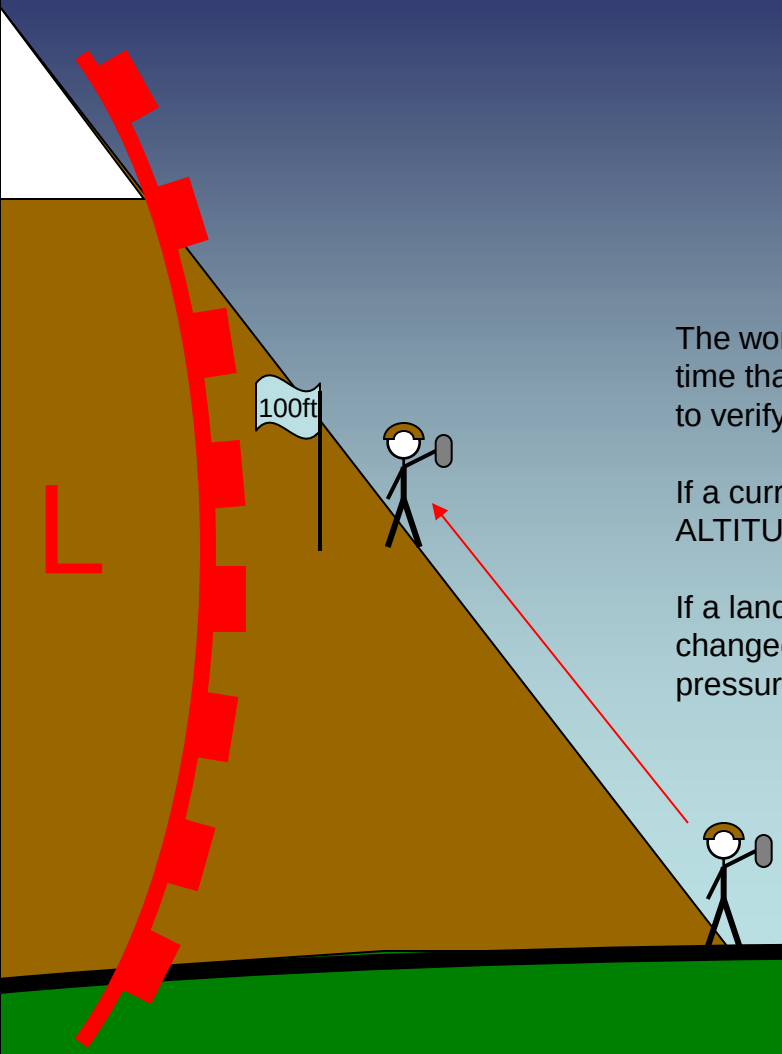
What happens if a weather front changes the pressure? The altitude will be wrong. If the barometric pressure ISN'T 30.21inHg any more, then the altitude calculation will be based on bad information. The user would have to update accordingly.

Tracking Altitude



The Kestrel can be used to track altitude changes for climbing and hiking. Before beginning the climb, the reference pressure on the ALTITUDE screen must be updated. The altitude will then be correct for as long as the barometric pressure remains the same. This assumption is generally good for at least 3 hours.

Altitude and Pressure Changes



The worst case scenario is when the Kestrel is changing altitude at the same time that the weather is changing the pressure. Therefore, it is always advisable to verify the measurements as frequently as possible.

If a current barometric pressure is available, the reference pressure on the ALTITUDE screen should be updated.

If a landmark is available, the reference altitude on the BARO screen should be changed. Use the new barometric pressure measurement as the reference pressure on the ALTITUDE screen.

Test

Baro = 30.00inHg
Alt = 1000ft = 1inHg
Station = 29.00inHg

Baro = 30.00inHg
Station = 29.95inHg
Alt = 50ft

Baro = 30.00inHg
Station = 30.10inHg
Alt = -100ft

Station = 29.50inHg
Alt = 2000ft
Baro = 31.50inHg