Altitude error estimation

If an airspace restriction is set as GPS altitude, then the 5030/IQ-Compeo cannot display directly the altitude. This can cause problems under warm weather conditions, where the air mass layering gives additional differences in altitude readings.

As a rule of thumb, the altitude correction over temperature can be estimated with the following formula:

The altitude changes with 4m per °C temperature difference to standard atmosphere and 1000m altitude difference. The standard atmosphere is 15° on sea level and decreases by 6.5°C per 1000m.

Example: The standard temperature on your actual place on 1500m altitude is 15°C - 1.5 * 6.5°C = 15°C - 9.75°C = 5°C. If you have actual 15°C, the temperature difference is 10°C. If the ceiling is on 4000m, the altitude difference is 2500m/1000 * 10°C * 4m= 100m. You should not go over 4000-100= **3900m**.

Standard atmosphere:

Standard

	Standard				
	atmosphere according to ICAO				
Altitude					
0	15				
500	11.75				
1000	8.5				
1500	5.25				
2000	2				
2500	-1.25				
3000	-4.5				
3500	-7.75				
4000	-11				
4500	-14.25				
5000	-17.5				

A bit more accurate:

Flytec recommends the following procedure if you want it a bit more accurate, or if you like formulas:

- **1. Estimate the maximum A1 altitude on this day** with the following formula: You need the predicted day temperature from the weather forecast for your landing place and an estimated or known altitude of the landing place. Estimate the day typical temperature difference with the following formula: $\Delta T_{day} = T_{pred} \left(15^{\circ}C Alti(m) \cdot 0.0065\right).$ It is the same as explained above. See also table below
- **2. Set the altitude A1 at the start place to the actual QNH.** This can be done by entering a known altitude (e.g. from the map or a triangulation point), or simply set A1 to the GPS altitude by pressing F2 in the "Mod Alt1 menu". Please let the GPS module first settle the altitude. This can last up to 5 minutes. So please switch the instrument on a few minutes before setting the altitude to GPS altitude.

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Temperature difference as table:

	Predicted day temperature at landing place								
Altitude landing place	15	17	19	21 (23 23	25	27	29	31
0	0	2	4	6	8	10	12	14	16
100	0.65	2.65	4.65	6.65	8.65	10.65	12.65	14.65	16.65
200	1.3	3.3	5.3	7.3	9.3	11.3	13.3	15.3	17.3
300	1.95	3.95	5.95	7.95	9.95	11.95	13.95	15.95	17.95
<mark>400</mark>	2.6	4.6	6.6	8.6	10.6	12.6	14.6	16.6	18.6
500	3.25	5.25	7.25	9.25	11.25	13.25	15.25	17.25	19.25
600	3.9	5.9	7.9	9.9	11.9	13.9	15.9	17.9	19.9
700	4.55	6.55	8.55	10.55	12.55	14.55	16.55	18.55	20.55
800	5.2	7.2	9.2	11.2	13.2	15.2	17.2	19.2	21.2
900	5.85	7.85	9.85	11.85	13.85	15.85	17.85	19.85	21.85
1000	6.5	8.5	10.5	12.5	14.5	16.5	18.5	20.5	22.5

To estimate the altitude difference you can use the following formula:

$$\Delta Alti = \left(Alti_{Ceiling} - Alti_{startplace}\right) \cdot \Delta T_{day} \cdot 0.0035$$

The factor 0.0035 means 3.5m per 1000m and degree temperature difference. This is a bit more accurate than the 4 m of the empirical formula above. But with the empirical formula you are on the save side.

Example:

During briefing in the morning you see, that

- the ceiling is set to 3048m (=10'000ft)
- from the weather forecast the predicted temperature at the landing place (altitude 400m) is 23°C.
- the start place is at 1524m (=5000ft)

The temperature difference to standard atmosphere is therefore 10.6°C from the table above. The altitude difference caused by the layering is then

$$\Delta A lti = (3048 - 1524) \cdot 10.6 \cdot 0.0035 = \underline{56.5m}$$

You set your instrument at the start place with altitude 1524m (=5000ft) to the actual QNH e.g. 1524m. This gives a certain reduced pressure of lets say 1030 hPa, but this is nearly independent of the following calculations.

The ceiling is set on 3048m (=10'000ft),

This means you should not fly higher than $Alti_{Ceiling} - \Delta Alti = 3048 - 57 = 2991m$

Please keep in mind, that you should have a margin of 20 to 40 m. because the formula above is an estimation of the atmosphere and the accuracy of the GPS system is in the same range.