

APPI PPG LECTURE 3: BASIC METEOROLOGY



Introduction:

Meteorology is a massive subject and in this lecture we aim to inform you of the basics of this subject so you can learn to judge when and when not to fly! We begin by looking at cloud formations and what they indicate:

Basic Cloud Formations (Use the White Board or a Hand Out to explain)

There are four basic types of cloud formations:

1. Cumuliform – Heaped
2. Stratiform – Layered
3. Cirriform – Fibrous
4. Nimbus – Rain Bearing

These cloud formations can be further divided in to height:

1. Low Level Cloud; from the ground to 6,000ft
2. Mid Level Cloud; from 6,000ft to 18,000ft – known as Alto
3. High Level Cloud; from 18,000ft and above – known as Cirro

The 10 basic cloud formations are as follows:

Low Level Cloud: From the Surface to 8,000ft

1. Cumulus

- Literally translated it means heaped.
- Detached cloud; generally dense and similar to Simpson clouds.
- Look like domes or towers with a cotton wool/fluffy appearance.
- Often have a dark, flat base.
- Caused when warm, moist air rises to the dew point and condenses.
- When the cloud is growing there will still be lift and therefore turbulence.
- DANGEROUS CLOUD TO FLY IN UNLESS EXPERIENCED!

2. Stratus

- Literally translated it means layered.
- Generally gray, overcast, uniform, dull cloud.
- It may give precipitation in the form of drizzle.
- Potentially safe to fly in as it blocks out the sun.

3. Stratocumulus

- Layers of heaped gray/whitish cloud with a cotton wool/fluffy appearance.
- Effectively a layer of attached heaped cloud.
- Can bring precipitation in the form of drizzle.
- May not be safe to fly in so be cautious.

4. Nimbostratus

- Layers of rain bearing dark gray cloud generally covering the whole sky.
- Effectively a continuous layer of gray cloud that brings with it rain.
- Not flyable!

5. Cumulonimbus

- Heaped, dense rain bearing cloud with a considerable vertical extent.
- Can appear in the shape of an anvil head.
- Has a dark, angry looking base.
- Can produce rain, lightening, thunder, wind and death to the pilot!
- Low level cloud which can extend up to 30,000ft and sometimes more!
- NEVER FLY NEAR OR UNDER A CUMULONIMBUS!

Mid Level Cloud: Between 8,000ft–18,000ft known as Alto meaning High

1. Altocumulus

- The same description as cumulus cloud but with a base between 6,000ft and 18,000ft. Normally a sign of an approaching cold front so may produce gust fronts. May not be safe to fly in so be cautious.

2. Altostratus

- The same description as stratus cloud but with a base between 6,000ft and 18,000ft. Normally a sign of an approaching warm front but tends to be a stable air mass. Blocks out the sun so potentially stable and therefore flyable if the wind is low.

High Level Cloud: Above 18,000ft known as the Dry or Ice Level

1. Cirrus

- Fibrous, high altitude cloud with a fibrous/silky appearance.
- Literally translated from Latin it means 'lock of hair'.
- Often denotes high pressure and good flying conditions.

2. Cirrocumulus

- High, heaped and fibrous cloud more or less regularly arranged.
- Often denotes good flying conditions but also an approaching frontal system.

3. Cirrostratus

- A high, layered and fibrous cloud later that usually covers most of the sky.
- Can produce sun dogs which are halos around the sun.
- Can be safe to fly in but is a sign of an approaching warm front so be aware.

Thermals, Airflow, Turbulence and Rotor

Use the White Board or a Hand Out to explain

- Thermals form when the sun heats the ground through radiation, the ground then heats the air above it through conduction and then the warm air rises know as convection.
- As the thermal rises it takes with it warm, moist air which cools as it does so. When it reaches it's dew point temperature it condenses and forms cumulus cloud.
- The air around the thermal sinks in order to replace the air that has risen. This creates an area of turbulence around the edges of the thermal, hence why it is dangerous to fly in thermic conditions.
- Air behaves in a similar manner to water; if you imagine a fast flowing river you see how the water interacts with obstacles in its path, such as a rock. Up stream of the rock the water is smooth and laminar however in the lee of the rock the water is turbulent.
- As air meets an obstacle it acts in a similar way however the size and shape of the obstacle will affect the severity of the turbulence down wind.
- For example, airflow meeting a smooth ridge will be smoothly deflected upwards and compressed over the top of the hill causing the air to accelerate but in a laminar flow.

- However, airflow meeting a jagged cliff is also deflected upwards and compressed over the top however in a turbulent manner due to the uneven and jagged surface that the air has encountered.
- Lone obstacles such as trees, houses, vehicles etc again deflect the air over and around them but create turbulence in the form of rotor which is unstable and very dangerous to fly in.
- The severity of the rotor downwind depends upon the wind speed, the size and the shape of the obstacle that the air has encountered
- The general rule is to expect turbulence 10 times the height of the obstacle downwind of it and twice the height of it.

Conclusion

When to Fly?

- Low winds at the beginning and end of the day unless it is winter when there are no thermals.
- When the wind variation is low; for example between 4 and 6mph.
- Stratified cloud tends to denote safe and stable conditions provided it is not raining.

When NOT to Fly!

- High, gusty winds; rain, thunder or lightening.
- Cumulus clouds tend to denote dangerous and unstable conditions.
- Thermals start to become dangerous as early as mid morning and continue until late afternoon. Do not fly when it is thermic!
- When in doubt do not fly, as it is better to be on the ground wishing you were in the air, rather than in the air wishing you were on the ground!

ANY QUESTIONS?

END OF LECTURE 3