Forecasts for Soaring Pilots — a Byproduct on the Common Tasks at National and Regional Forecast Centres

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Soaring is extremely dependent on weather. Therefore sailplane pilots are highly interested in weather information. The number of meteorologists who deal with forecasts for soaring is still relatively small in spite of the considerable growth of soaring. In the Federal Republic Germany for instance there are 28 000 sailplane pilots now and 2 million km of cross-country filghts have been carried out in 1973. On days with favourable weather the number of sailplanes on cross-country flights over the country has been sureley much higher than that of all other aircraft together.

In order to provide sailplane pilots with weather information it becomes necessary that the national meteorological services enlarge their programme for General Aviation. Besides the usual information about the general situation and development, winds, clouds etc. the sailplane pilot needs addition al data to give him an idea of the vertical movements he will find.

But forecasts of the strength and structure or even of the likelihood of vertical movements seem to be impossible at first sight. This atmospheric property is not observed or measured by the network of the meteorological services, and forecasters do not experience it unless they are sailplane pilots themselves. Every element of weather which cannot be calculated directly by the modern highly developed numerical methods must be forecast by estimation based on many years experience. In the case of surface weather the forecaster can always compare his forecast weather to the actual weather experienced and he will see forthwith whether his forecast has been verified or not. This way of gaining experience does not exist with forecasts for soaring. But in spite of this discouraging statement there remains a basis, which entitles us to help sailplane pilots and which promises progress on this field, if the level of demands is not too high at first. The well known results of research by soaring during the last 50 years and the huge body of material, which is available at the airport met, offices are a good basis.

Concerning lee waves we can use the upper wind forecast maps issued by the national forecast centres. Mountain waves are often dangerous to aviation and if they are calculated directly by advanced numerical methods in order to issue warnings – the so-called sigmets – we have a very useful by-product for the planning of lee wave soaring.

Thermal activity can be estimated indirectly by using the terminal aerodrome forecasts – the so-called TAF, which are issued every three hours for the next nine hours. At the larger airports, also, every six hours forecasts for the next 24 hours are issued. They are detailed forecasts of surface winds, visibility, weather and clouds, coded like observations. A 24-hours forecast issued in the evening can give an idea of the conditions for thermal soaring for the next day.

For instance the forecast says: early morning cloudless, then formation of a few eighths of cumulus with base rising quickly up to 5000 ft, no great change until sunset, especially no showers or thunderstorms will occur and surface winds will be less than 15 kts. By knowledge of the mechanism of cumulus development and experience of sailplane pilots the day must be classified to be a good one for thermal soaring. The vertical velocity of the air in thermals is seldom less than 2.5 m/sec and the minimum sink rate of modern sailplanes is less than 1 m/sec.

Of course things are not always simple as in the above mentioned example. But in any case the aerodrome forecasts give a good idea of the general weather conditions which can be expected. The forecasts are the results of profound working on all available material at the office. This material can be divided into two groups: First the large scale forecast maps, for the surface and for several higher levels, produced at the national forecast centre using progressive numerical methods of forecast by means of very efficient computers. Thus having a frame work; i. e. the forecast positions of anticyclones, depressions, fronts and airmasses the forecaster has to study the second group of material: actual weather maps and reports, soundings, observations by radar, aircraft and satellites in order to fill up the skeleton of the forecast map with muscles and blood.

Having got in view a complete three-dimensional picture of the atmospheric state and changes, he is then able to give any usual weather information and forecasts without undue pondering. Inquiries about problems which normally require an extensive quantitative treatment can only be answered rapidly by making use of special devices such as particular types of diagram.

In order to judge for instance the development of thermal activity on days with good insolation a transparent diagram of the hourly heating is useful (Fig. 1). See Ref. 1.

We put the surface pressure line on the foot of a plotted sounding and moving it sideways we can get answers to questions

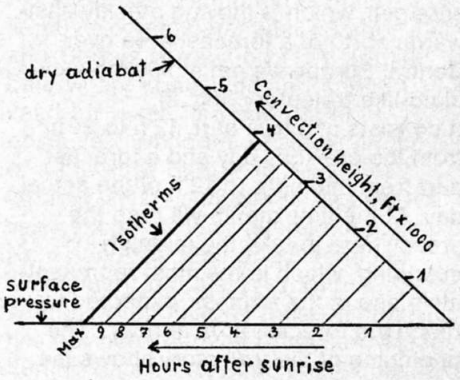

Fig. 1. Diagram of hourly growing areas of heating energy after sunrise on radiation days in summer at 50° N for application on the tephigram ,range 1000–900 mb.

for any height of convection and the time it has grown up since sunrise or vice versa. The height of convection is marked by the lowest intersection of the dry adiabat and the sounding. The associated time is indicated by that isotherm which results from the comparison of the energy areas. Pilots are more interested to know at what time thermals are likely to reach a certain height or at what time the cumulus development will start, rather than to know the so-called «trigger off temperature». There is no thermometer at many sites but everybody has a clock. Pilots want to know at what time in the morning convection will reach the minimum height for it to be worth leaving the site for a cross country flight. The associated temperatures are of secondary interest. In Central Europe the minimum height has been proposed to be 800 m (2500 ft).

Of course calculations of the development of thermal activity are possible only if a sounding is available, which is representative for the locality and time of forecast. Looking at the prevailing advection of the convection layer we must choose that which is the most suitable one in the aerological network. The isobars of the latest surface map show the advection approximately. But if the latest soundings are relatively old and the pressure pattern changes quickly the task becomes rather diffi-

cult. The construction of trajectories would be helpful but uses up too much time at a regional centre. It would be very useful, and not only for the purpose of soaring forecasts, if a few trajectories of the convection layer could be computed at the national forecast centres. In estimating local changes of weather within the planetary boundary layer, advection is a dominating factor. Taking advection into account, we commonly look at pressure maps, which sometimes indicate a state far from stationary, and therefore give a rather inaccurate conception of the true advection.

For instance in the case of a high pressure cell, which is moving quickly eastwards north of a forecast area over Central Europe we get at 900 mb a cycloid-like trajectory (Fig. 2).

It consists of a true part, 12 h to 24 h from the previous day and a forecast part from midnight to 12 h of the actual day. At the time marks we read the area, where to take the midnigh sounding, which is the most representative one of the airmass, expected to reach the forecast area at noon. The beginning of the trajectory shows the area where the behaviour of the airmass can be studied at the surface

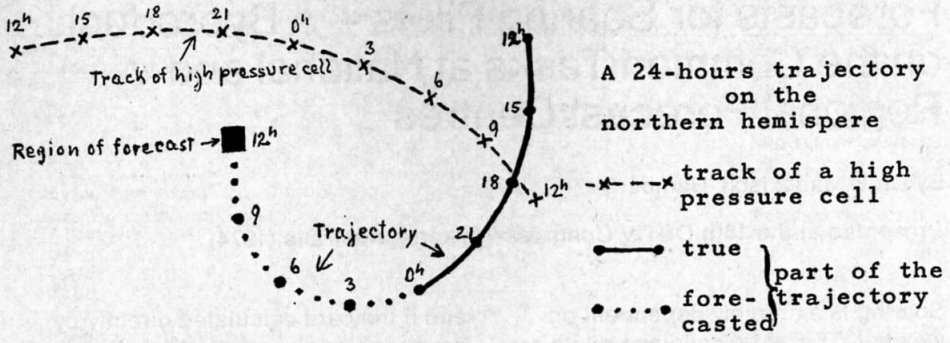

Fig. 2

map of the previous day. The transmission of pressure centre tracks should preferably be left out in favour of more trajectories and in order to avoid confusion.

Summarizing we can say: Due to the steady growth of soaring, which is part of general aviation with a claim to be provided with weather information, distribution of forecasts for soaring becomes a more and more necessary task of the national meteorological services. A great number of meteorologists and forecasters will have to deal with this task. Knowledge of the main peculiarities of soaring and a little additional effort is all that is necessary to provide the information about vertical movements and structure of convection. The elements of atmospheric processes are dependent each on the other and convection is a very important link. The effort of forecasting it will lead to more profound understanding of the total mechanism. By this means both meteorology and soaring will benefit. Concerning the valuable contributions during more than 50 years, soaring has a legitimate claim for the results of research in this field to be applied to its own field.

Reference

1. C. E. Wallington: Meteorology for Glider Pilots. John Murray, London (1972).