Royal Meteorological Society

SIG Aviation Meteorology
Newsletter 2 2013, September 2013

In this newsletter Bob Lunnon reports on the latest at the UK Flight Safety Committee meetings, latest articles attached to our Facebook page, Jacob Kollegger discusses possible turbulence and wind shear issues approaching Switzerland's Sion airport from the west, and Michael de Villiers looks at north-moving thunderstorms south of Heathrow's heavy traffic airspace on June 19, 2013. Rebekah Sherwin reminds us of the Met Office College, of which a general link is attached. Some aviation photos are also attached. Thanks for your interest, and feedback is always welcome

Report on attendance at UK FSC meetings

By Bob Lunnon

[note: This report is a continuation and addition to the one made by Bob in the April Newsletter. It has been edited to list only the new material from the period since April, with the exception of what the editor thinks should be repeated for clarity. For the link to the April newsletter (newsletter 1 - 2013), refer to the RMetS SIG aviation meteorology page http://www.rmets.org/about-us/special-interest-groups/aviation-meteorology-special-interest-group *]*

[Following section added 10/9/2013]
At the July [UK FSC] meeting two separate airlines reported tailstrikes. I spoke to both at the lunch break and both conceded that wind could be a factor. There was an indirect mention of volcanic ash – one major UK low cost airline is investigating the installation of instrumentation on their aircraft to detect volcanic ash.

At the September meeting one member asked whether others thought there was an increasing trend of badly flown windshear escape manoeuvres. He later said that he had no evidence to suggest an increase in windshear events.

A union representative reported that occasionally when a [helicopter] pilot is using a FLIR [Forward Looking Infra-Red detector] the runway can "disappear". This was due to a combination of the runway lighting (LEDs) and a lack of thermal contrast between the runway and the surrounding area. I explained (off-line) that the Met Office had done a lot of work on thermal contrast on behalf of the military.

FACEBOOK

by Jacob Kollegger

For those of you not Facebook-inclined, a few articles which were posted on the SIG page for a general audience:

http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-12-00039.1

http://www.ainonline.com/aviation-news/ainsafety/2013-08-12/eurocontrol-updates-safety-reminder-weather-deviations#.Ugp2RqvDOGQ.facebook

http://www.nbaa.org/ops/airspace/20130822-national-weather-service-upgrades-could-improve-aviation-forecasts-within-the-year.php

http://www.climatecentral.org/news/new-study-questions-arctic-warming-extreme-weather-links-16375

NON-SIG AVIATION METEOROLOGY MEET

Emma Irvine's October 2, 2013 meet in Reading Town Hall, as listed in the last newsletter:

http://www.rmets.org/events/reducing-climate-impact-aviation-potential-climate-optimal-flights

The RmetS History Special Interest Group meet on the use of aircraft in meteorology:

http://www.rmets.org/events/uses-aircraft-meteorology-late-1960s-present-day-and-future

MET OFFICE COLLEGE

Rebekah Sherwin sent an email regarding the Met Office College, with the following information, from the Met Office, on aviation meteorological studies:

Aviation training from the Met Office College

As leaders in aviation meteorology, the Met Office College has developed a wide range of training courses for the aviation community which:

- enable meteorological observers to meet International Civil Aviation Organization (ICAO) requirements;
- teach international best-practice techniques in forecasting and observing and review the latest developments in aeronautical meteorology;
- help you to better understand and interpret meteorological information, and the impacts of weather on your activities;
- can be delivered at a site convenient to you or at our excellent facilities in Exeter.

Our courses and training include:

- **General Aviation** - We help delegates prepare for the meteorological elements of the PPL, PPL(B) , CPL(B) and BGA Bronze 'C' badge and blend theoretical meteorological knowledge with practical exercises.
- **Air Traffic Control** - We are contracted by the Civil Aviation Authority (CAA), the UK Meteorology Authority, to train all airfield observers and deliver comprehensive aviation meteorological training.
- **Offshore Meteorological Observing** – As a CAA approved provider of aviation observer training, our Offshore Meteorological Observing courses enable staff on offshore installations to make accurate aviation weather reports for helicopter operations.
- **Aeronautical Meteorological** - We offer training for both aeronautical observers and forecasters which conforms with the latest WMO training and education guidelines.
- **Commercial Aviation** - Our courses help airline and airport personnel better understand and interpret meteorological information and blend theoretical meteorological knowledge with practical exercises.

Specific to General Aviation, training is aimed at aviators of all levels of competence and courses include:

- **Meteorology for Aviators** – Meteorology for Aviators is aimed at light-aircraft pilots of all levels of competency and covers topics such as basic meteorological theory and the interpretation of meteorological charts.
- **Weather Decision-Making for Pilots** - Weather Decision-Making for Pilots brings together knowledge in aviation meteorology theory and interpretation skills with Meteorological Threat and Error Management (TEM).

For more information about training please email moc.enquiries@metoffice.gov.uk or visit http://www.metoffice.gov.uk/training to download a prospectus.

http://www.metoffice.gov.uk/training/industry/aviation

PHOTOS Jacob Kollegger

Ziller Valley (Zillertal) in Austria, looking northwards, on approach into Innsbruck Airport from the south, under radar vectors. The Schlegeisspeicher Dam is visible in the lower centre of the photo. July 20, 2013.

Kastellorizo Island (Greece) in the lower centre of the photo, looking northwards to the Turkish coast near Kas. Antalya is to the upper right of the photo, close to the horizon. July 27, 2013.

The region of San Sebastian airport in north-central Spain, by the Bay of Biscay. The towns of Hondarribia, Irun, and Hendaye in France are shown in the centre of the photo, taken over part of the Bay of Biscay. August 11, 2013

Approach into Cork Airport, Ireland, Aug. 20, 2013, at around 1720 UTC.

Mount Erciyes, 3916 metres or 12848 ft above sea level, in central Anatolia in Turkey. . The city of Kayseri is in the centre left of the photo. September 2, 2013.

Approach into Istanbul's Sabiha Gokcen airport. The Island of Buyukada is prominent in the sunlight off the Sea of Marmara. September 2, 2013.

Southerly Flow in the Martigny – Fully Region of Southwestern Switzerland and its Possible Effect on Sion Approaches: A Discussion

Jacob Kollegger

Introduction

Easterly flows in the Valais region can happen with both northerly and southerly flows. Because of the "barrier" effect of the Bernese Alps to the north and east of Sion, and the Pennine or Valais Alps to the south and east of Sion, coupled with local mountain passes like the Gemmi, Sanetsch and Rawil passes to the north, and the Simplon and Gt. St. Bernard passes to the south, the winds can be deflected and put under the influence of the venturi effect to instil an easterly flow within the Rhone Valley.

This paper discusses the theoretical aspects of possible aviation hazards of rotors and downdrafts involving a southerly flow with an easterly landing into Sion airport, particularly for VFR traffic approaching from the Martigny region

Southerly Flow

According to the climatological report on LSGS, the warm and dry South Foehn wind in the Rhone Valley slows down westerly-moving fronts, with generally clear skies[1]. The flow crosses the Pennines, predominantly over the Simplon and Gt. St Bernard passes, and flows "downhill" through the Rhone Valley into the Lake of Geneva region. Due to the venturi effect the wind speed increases as the flow crosses the passes, and as the flow descends it is warmed adiabatically to often considerable relative temperatures, especially in winter. As a result you have a mix of strong gusty katabatic winds mixed with higher temperatures, resulting in what could possibly be a decrease in performance together with strong downdrafts. As a result, the climatological report on LSGS states: "Turbulence and lee waves occur and can also reach the wider region of the airport. Attention must be paid to severe turbulence and down draft."[2]

1 Aeronautical Climatological Information Sion LSGS, p.9
2 Aeronautical Climatological Information Sion LSGS, p.9

Geographical and topographical area of Martigny - Sion

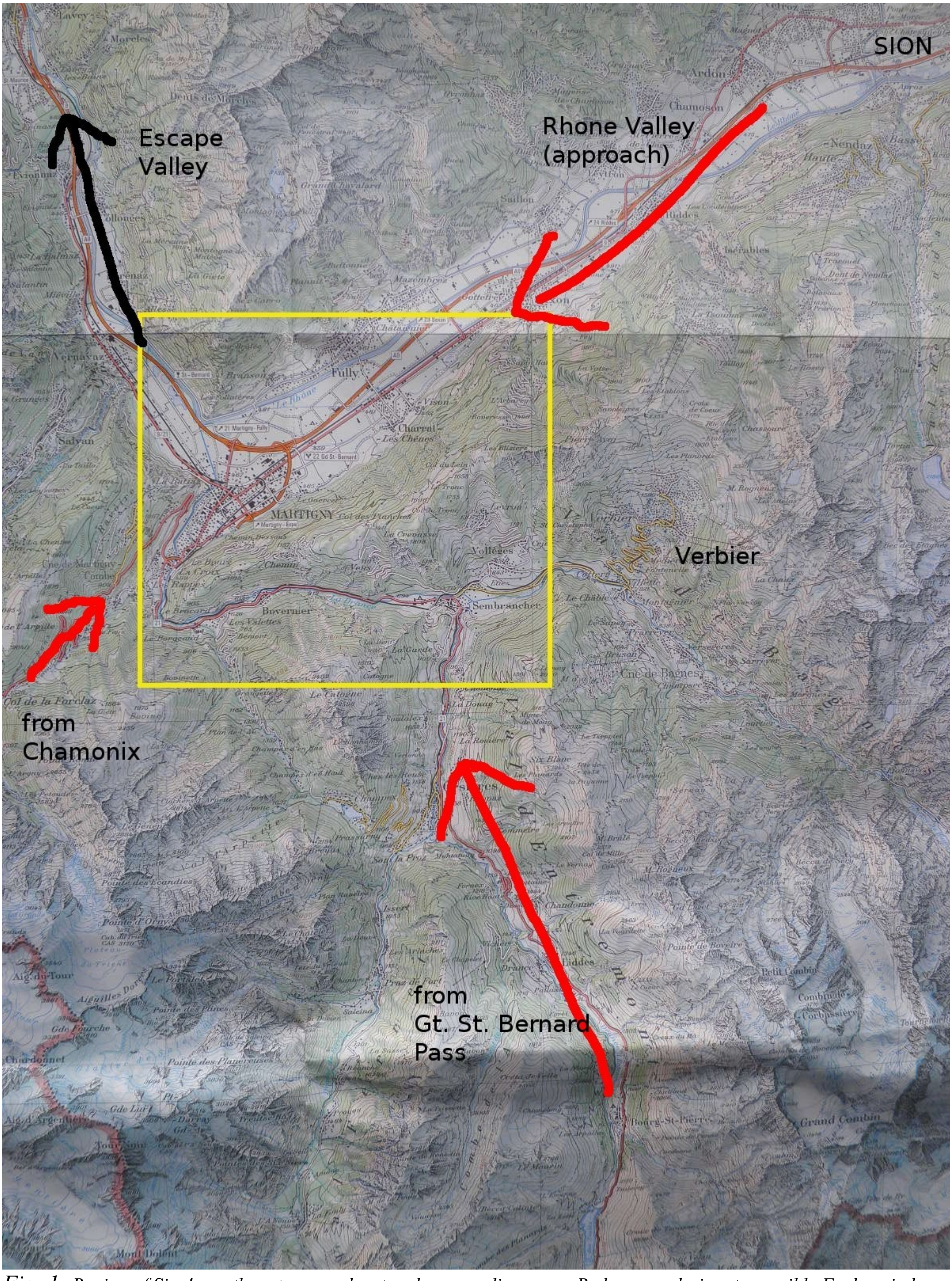

Fig. 1: Region of Sion's southwestern quadrant and surrounding area. Red arrows designate possible Foehn winds with a description from where they "come". The yellow box designates the region to be looked at in more detail in subsequent figures. The black arrow is the continuation of the wind through the Rhone Valley towards the Lake of Geneva region, also considered the "escape valley" in business and airline aviation. (map source: Swisstopo)

Fig. 1 shows the general area of the Martigny region 10 miles to the west of Sion airport. The red arrows designate the major areas from and through which Foehn winds flow. The wind focussed in this paper is the one at the bottom centre of the diagram which comes from the Gt. St. Bernard pass, through the Entremont Valley and via Martigny out to the Lake of Geneva region.

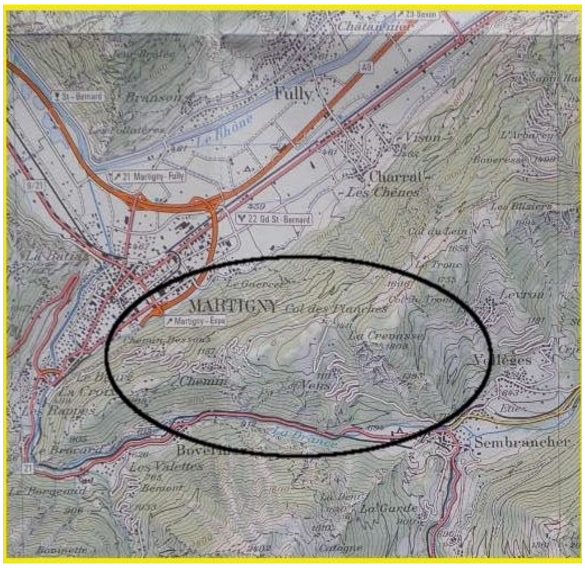

Fig. 2: yellow boxed region from Fig. 1 with black circle denoting the ridge between the main Rhone valley to the north of the ridge and the Entremont valley to the South. (map source: Swisstopo)

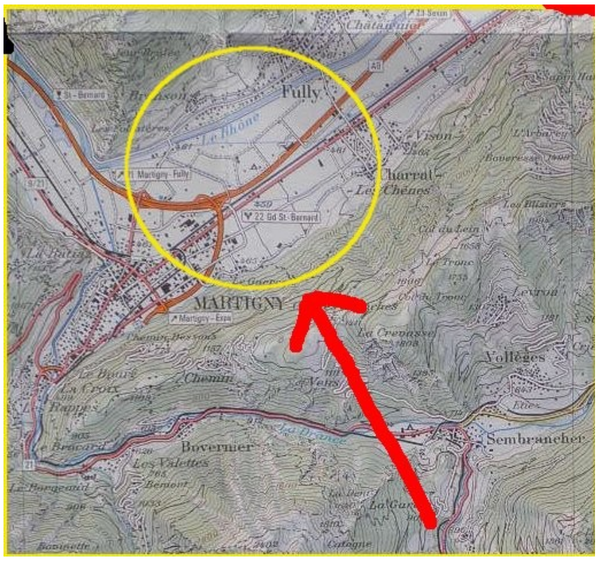

Fig. 3: region of the yellow boxed region from Fig. 1. The yellow circle denotes the region of discussion. The red arrow is part of the Foehn wind "from" the Gt. St. Bernard Pass which may pass over the ridge in Fig. 2 (map source: Swisstopo)

Fig. 2 shows the yellow boxed region from Fig. 1. To the south of the main Rhone valley and from where VFR traffic generally enter the region from the west (yellow circle in Fig. 3), there is a rather prominent ridge (circled in black) which separates the Rhone and Entremont valleys. This ridge is around 4800 feet elevation at the Col des Planches Pass. As it is a Pass the venturi effects there may even enhance the strength of the Foehn wind in the immediate region to the leeward in the Rhone valley region of Martigny - Fully. The red arrow in Fig. 3 shows part of the Foehn wind from the Entremont valley flowing northward to the ridge. Part of the Foehn may follow the valley to the west and hence to the Martigny area. Considering the elevation of the Gt. St Bernard Pass is 8100 feet, the flow may have enough strength to flow over the ridge.

Issue Regarding Turbulence and Rotors in the Martigny-Fully Region:

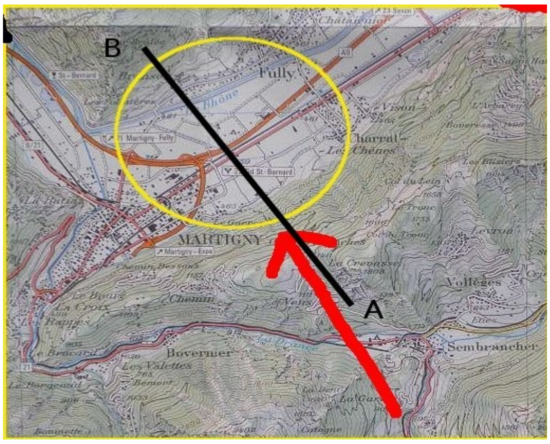

Fig. 4: Fig. 3 but with the cross-section A-B (map source: Swisstopo)

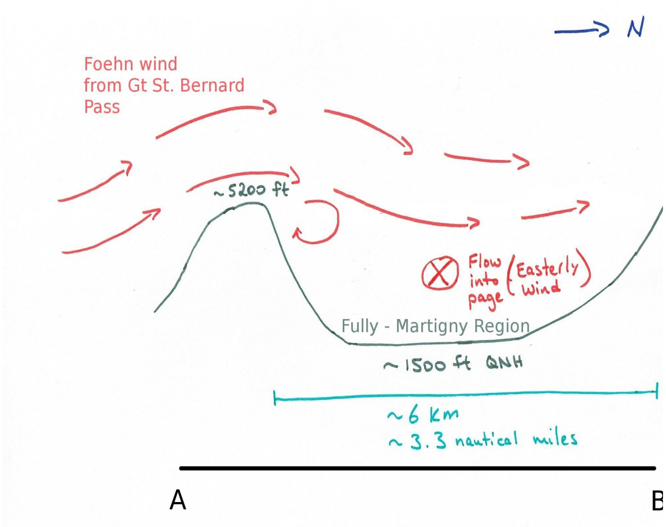

Fig. 5: Author's drawing of cross-section A-B from Fig. 4. The designation "N" is north

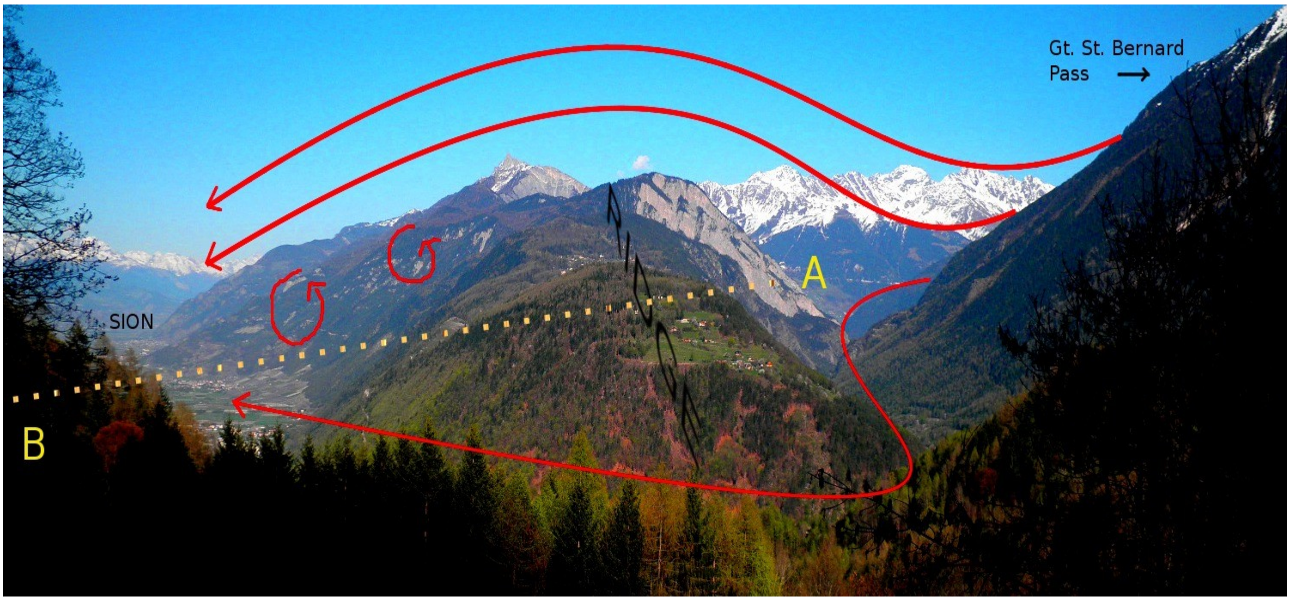

Fig. 6: Photo taken by the author above the Martigny region showing the ridge in question in its entirety. Red arrows indicate theoretical wind flow over the ridge and along the valley leading from the Val d'Entremont to Martigny. Areas of possible rotors are also shown. The yellow dashed line is the cross-section A-B introduced in fig. 4. The point B is indicated here as reference only, as the "actual" point B is further to the left (north) of the photo and behind the trees in the Rhone Valley.

Figs. 4 and 5 show a theoretical hypothesis on what may be occurring through the cross-section A – B (Martigny – Fully region of the lower Valais). Fig. 6 shows the theory superimposed on the actual topography of the ridge region. Part of the Foehn flow may overrun the Col de Planches ridge, and the dynamics resulting from such an overrun may, in principle, be a "mini" mountain effect, with rotors and downdrafts on the leeward side of the ridge, in this case over Martigny – Fully regions, or basically where VFR flights approach Sion from the west. If we consider VFR altitudes of 4500 ft and 5500 ft QNH (average 5000 ft), we can further expand Fig. 5 to give the following result:

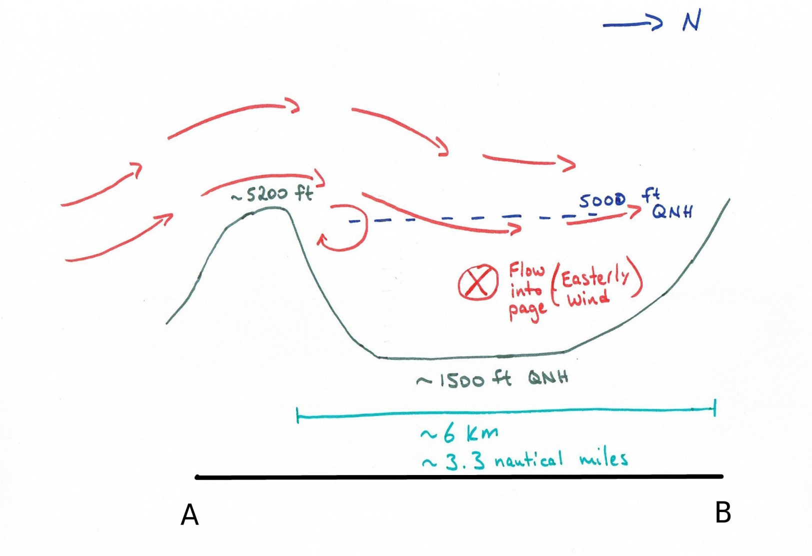

Fig. 7: Fig. 5 with the 5000 ft QNH dashed line added and the "from the Gt. St. Bernard Pass", and "Martigny – Fully region" descriptors removed.

Fig. 7 shows, theoretically, that VFR traffic may well experience turbulence, rotor, and/or down draft areas in this region.

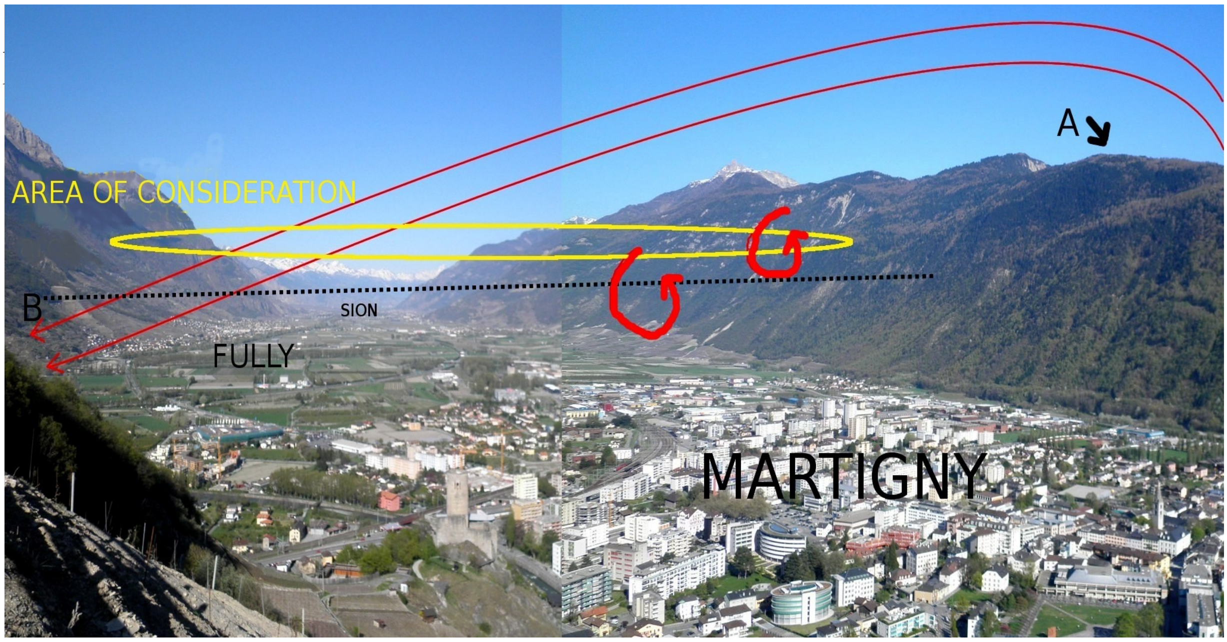

Fig. 8: 2 photos taken in the vineyards above Martigny and merged to show the Rhone Valley area of the Martigny - Fully region. Colour codes and points A. B are as described in Fig. 4.

Fig. 8, like fig. 6, superimposes the theoretical flow on the actual topography of the region. Unlike fig. 6, fig. 8 does not show the wind flow coming from the valley beneath and around the ridge from the right to Martigny. Considering fig. 1, where the winds flow further down the Rhone Valley to the Lake of Geneva area, the "escape valley", the flow is not as simple as the two dimension representation given in fig. 8. For instance, part of the wind flow may flow up the ridge in the area of point B (above and to the left of Fully in fig. 8). Another issue may be that the valley wind flowing from the right to Martigny may shear the vertical rotors shown in fig. 8 and tilt their axes vertically (resulting in horizontal rotors). In winter, the north side of the Rhone Valley, if sunny conditions persist, will enjoy sun for most of the day, whereas the south side of the Rhone Valley will likely be in shade, enhancing katabatic effects on the south side and anabatic effects on the north side. These effects may enhance or deteriorate the rotor development. Because the steep valley walls allow for venturi effects, the south wind may theoretically experience a momentary lull over Martigny before being rushed through the Rhone Valley to Lake Geneva, further altering the wind flow over the Martigny Fully region.

The main issue here is "theoretically". We cannot show that what is represented with respect to the rotors in figs. 5, 6, 7, and 8 is the case because, quite frankly, to the author's understanding there is no data, nor have any test flights been done during periods of southerly flow to specifically find out more about the wind flow. Is the effect enhanced with a south westerly flow? South-easterly flow? Does it occur at all, or are the dynamics involved strong enough to pose risk to traffic?

Conclusion:

The theoretical issue of possible turbulence and downdraft occurrences during southerly flows in the Martigny – Fully region of the Rhone Valley; the main region in which aircraft arrive to Sion from the west . Open questions remain with regards to whether or not the theoretical implications here reflect reality.

Bibliography:

Christoph Schmutz, Daniela Schmuki, Olivier Duding, Simon Rohling: "Aeronautical Climatological Information Sion LSGS", MeteoSchweiz, 2004.

Thunderstorms over the Eastern Approaches, 19th June 2013

Michael de Villiers

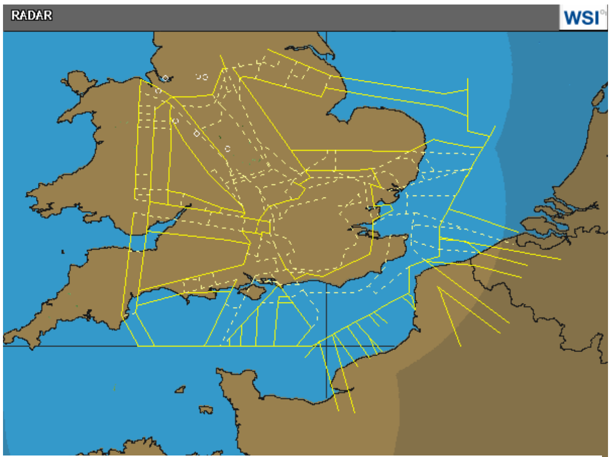

Figure 1. Controlled airspace around Heathrow (EGLL) showing the eastern approaches.

During the morning of the 19th June 2013 thunderstorms moved northward from France across the busy eastern approaches (figure 1) to London Heathrow (EGLL) airport. This caused considerable disruption and re-routing of air traffic during the early morning peak of around 0600Z to 0900Z (figure 2). Out of idle curiosity it was decided to a simple investigation of the event.

The direction in which thunderstorms will be steered can be determined by using the formula $H_{base} + {}^{1}/_{3}\,(H_{top} - H_{base})$. Thunderstorms observed at Brussels and Paris Orly airports gave the base of the storms at 5000 (1524 metres, FL050) to 5500ft and 6000ft (1829 metres, FL060), respectively. Inspection of upper air soundings in the vicinity of the thunderstorms, for example at Trappes in northern France and Beauvechain in Belgium at 0000Z (figures 5a and b), indicated that the tops were at around 12000 metres (39000 ft, FL390). Using this top and the lowest cloud base the steering winds would be at

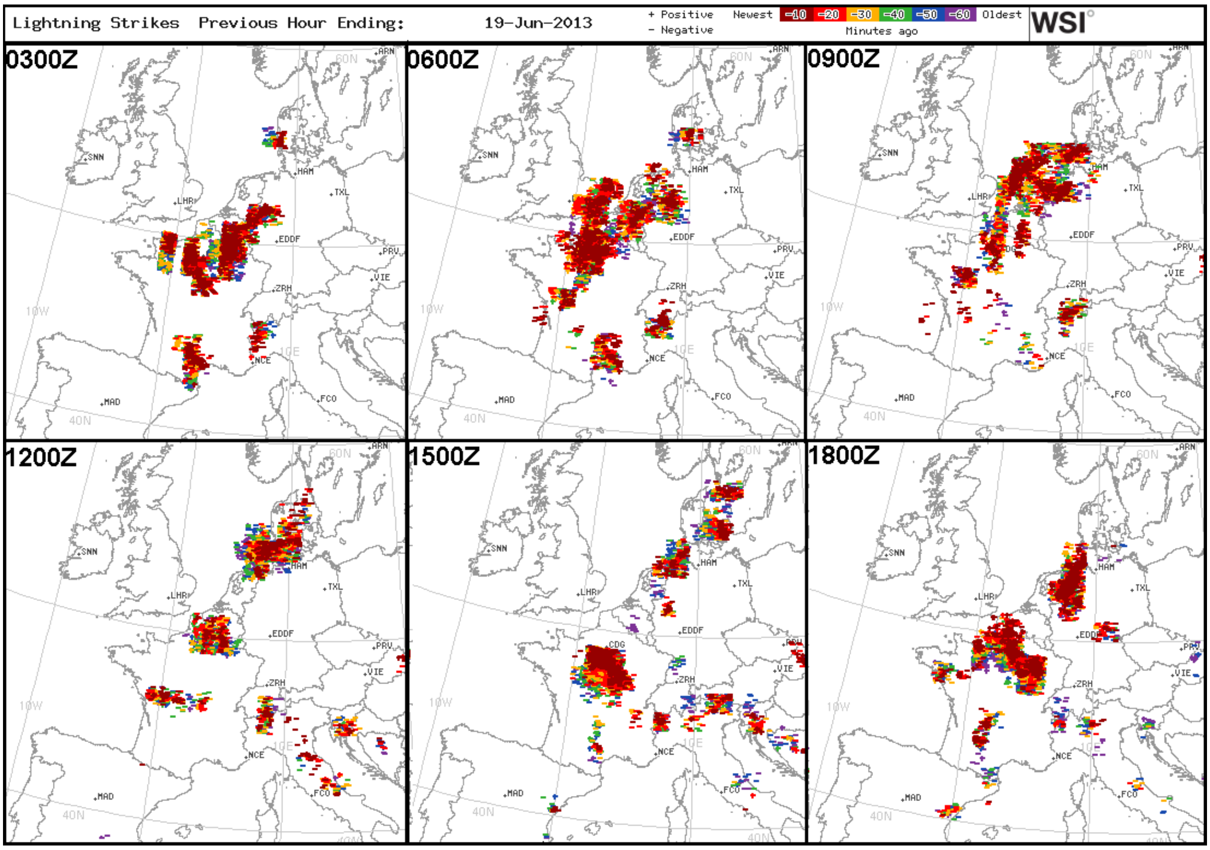

Figure 2. Lightning strikes recorded from 0300Z to 1800Z. Note strikes are an accumulation during the previous hour and not the previous 3 hours. Courtesy Weather Services International (WSI).

5016 metres, which is near to 550 hPa. Inspection of the two shows that the winds at this level and through most of the troposphere were southerly at 40 knots.

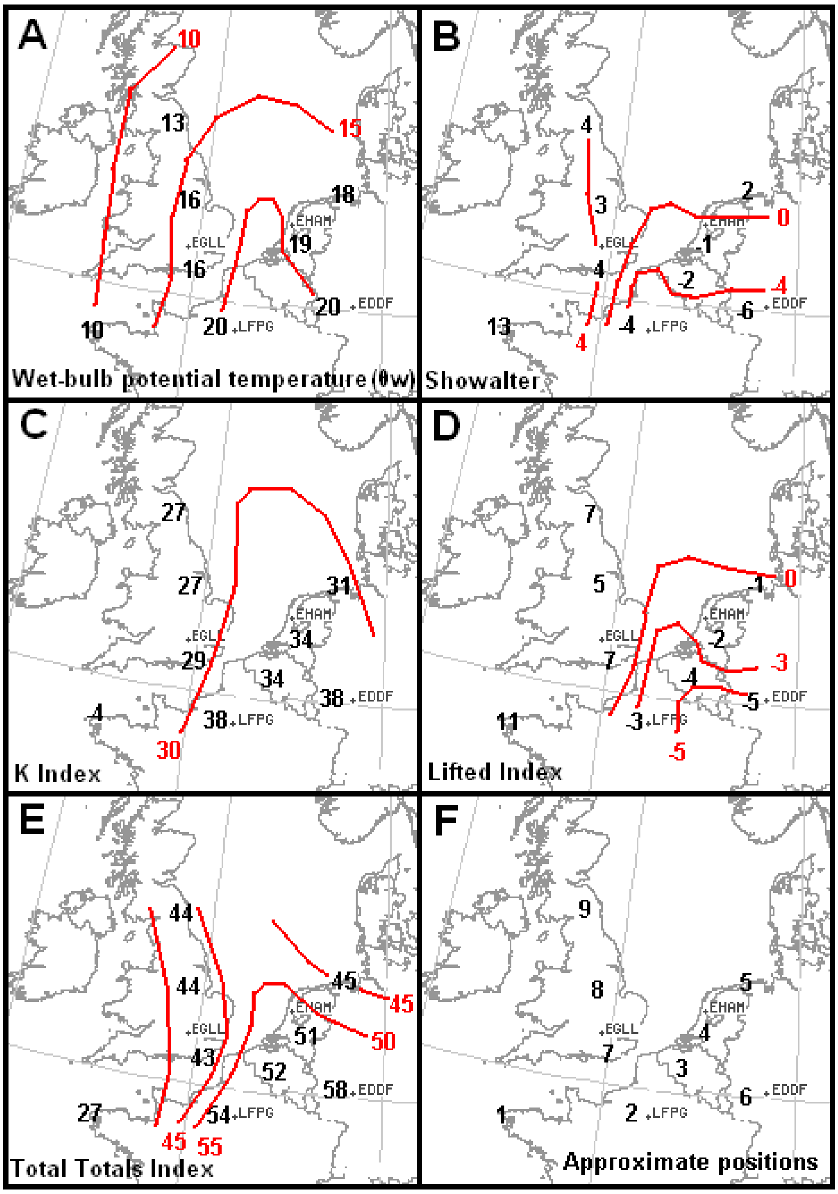

Figure 3. Wet-bulb potential temperatures, instability indices and atmospheric sounding locations mentioned in the text.

Thunderstorms are most likely to occur in and area of highest wet-bulb potential temperature (θ_w) and low level convergence. 850 hPa wet-bulb potential temperatures, in figure 3a, were determined from upper air soundings at 9 sites shown in figure 3f, namely, Brest (1), Trappes (2), Beauvechain (3), De Bilt (4), Nordany (5), Idar-Oberstein (6), Herstmonsaux (7), Nottingham (8) and Albermarle (9). Comparison with the development in figure 2 clearly shows that thunder activity was in a tongue of highest θ_w. The remaining diagrams in figure 3 show empirical indices (derived from the same soundings) that also indicate that this part of France and toward the North Sea was an area of potential thunderstorm activity. Note, the potential values are a useful guide and limits can differ globally. These were negative Showalter values (figure 3b) where -4 to -6 is very unstable; higher K Index values (figure 3c) where 30-40 indicates good potential, poor below 30; negative Lifted index (figure 3d) where -3 to -5 indicates moderate instability, 0 to -2 weak; higher Total Totals values (figure 3e) where 50-55 indicates strong to severe thunderstorm potential and 45 to 50 thunderstorms possible.

The NCEP/NCAR Europe reanalysis for the day, in figure 4, shows that the thunderstorms occurred in an area of surface low pressure over France, which was also a source of low level convergence. Considering the position of the 250 hPa upper level cut-off low and the core of maximum wind speed below the tropopause it can be assumed that the surface low was below an area of upper air divergence with enhanced upward air vertical velocity (Dines compensation), which also favoured thunderstorm development.

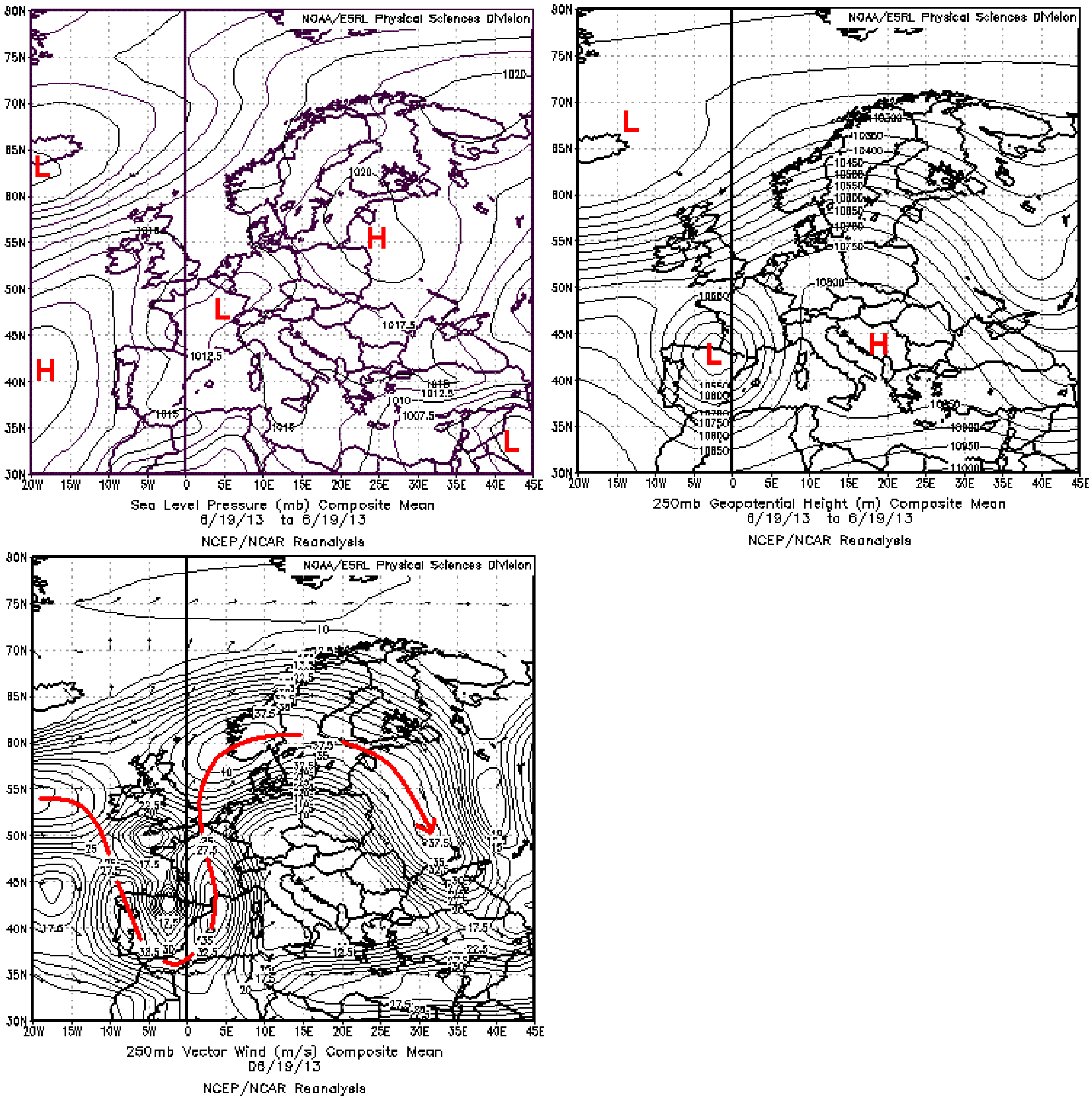

Figure 4. 2013-06-19 NCEP/NCAR Europe reanalysis showing the mean analysis for the day at the surface, 250 hPa and the mean vector wind showing the path of the strongest wind. Courtesy NCEP/NCAR.

Using the Parcel method (figure 5), by drawing a line from the surface temperature along the dry adiabatic lapse rate to intersect the saturation mixing ratio line from the surface dew-point temperature and then following the saturated adiabatic lapse rate to intersect the environmental temperature trace it can be seen that there was a large area of potential instability and, the instability index, convective available potential energy (CAPE) between about 850 hPa to the Tropopause at approximately 200 hPa at Trappes (figure 5a) and Beauvechain (figure 5b). By way of contrast the air was stable at Herstmonseax (figure 5c) and Albermarle (figure 5d). The CAPE at Trappes and Beauvechain was 798 and 1360, respectively. Similarly, but not shown the CAPE at 517 at De Bilt and 542 at Norderney. Further off to the east it was 1392 at Idar-Oberstein. CAPE of <1000 is indicative of marginal instability, 1000-2500 moderate instability, 2500-4000 strong instability and >4000 extreme instability. Notice the deep layer of southerly steering winds that became south-westerly at Albermarle in the upper air as seen in figure 5. Apart from the potential for Cumulonimbus cloud to reach about 200 hPa shown in the sounding at Beauvechain, mixing of the parcel of air with the surrounding environment would have retarded ascent as well as the lapse rate of the parcel falling below that of the environment at about 350 hPa (±8500 m, FL280) where most cells would reach their maximum development. On the other hand, some cell could have overshot the tropopause into the lower stratosphere.

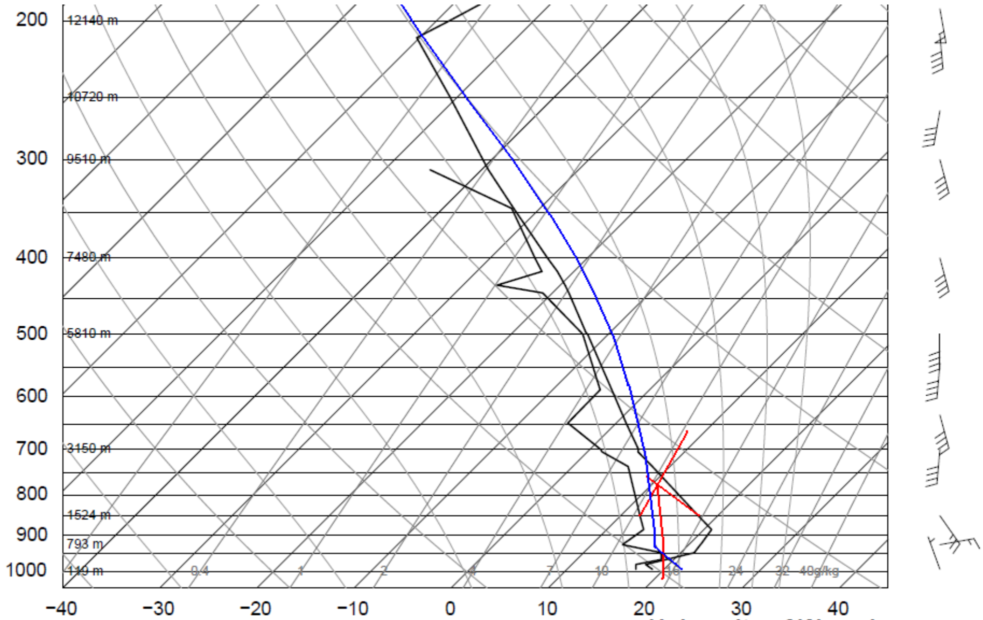

Figure 5a **Trappes** **00Z 19 Jun 2013** **University of Wyoming**

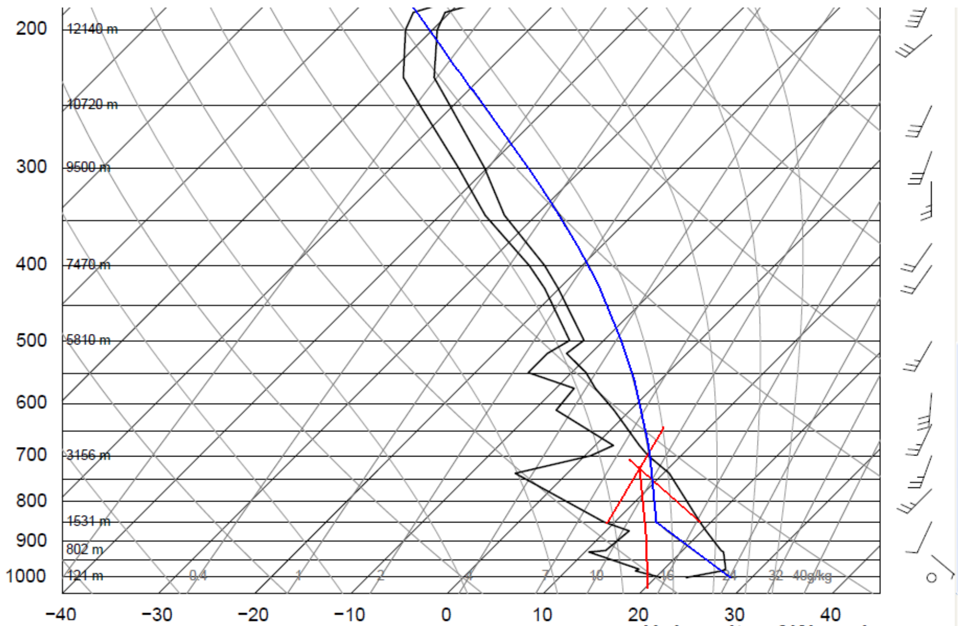

Figure 5b **Beauvechain** **00Z 19 Jun 2013** **University of Wyoming**

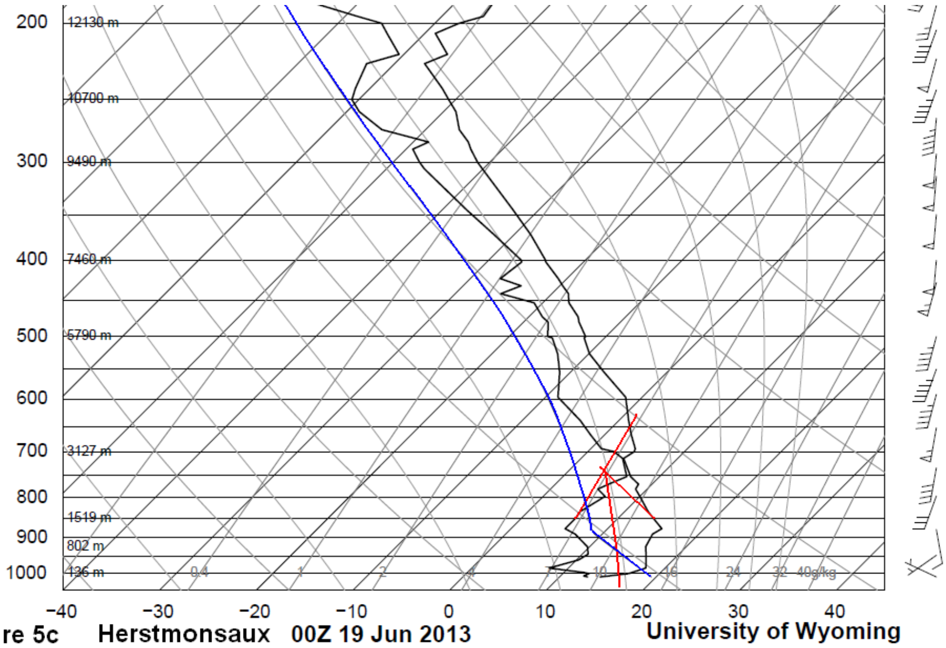

Figure 5c **Herstmonsaux 00Z 19 Jun 2013** **University of Wyoming**

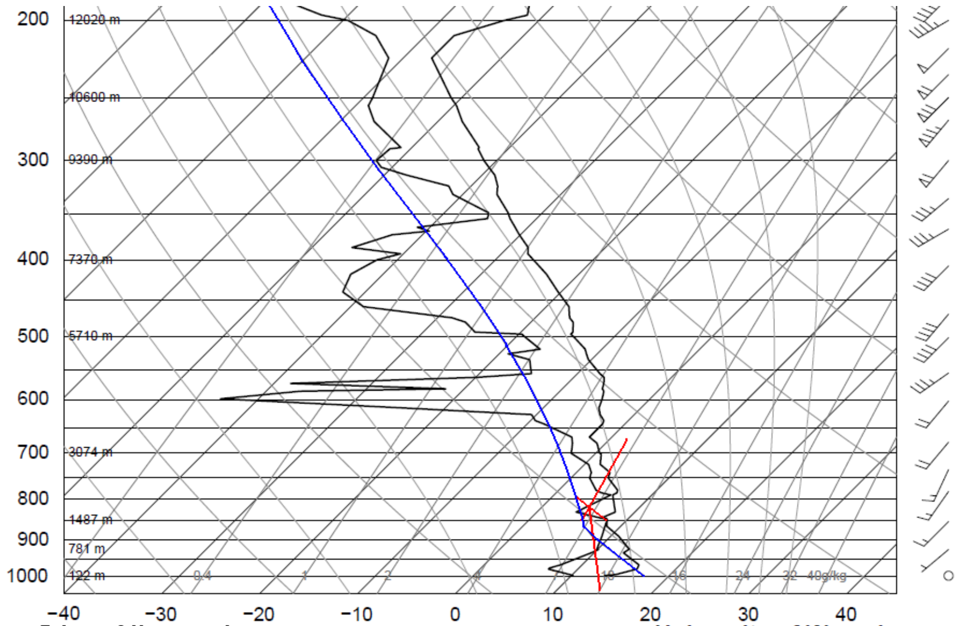

Figure 5d **Albermarle 00Z 19 Jun 2013** **University of Wyoming**

The satellite image at 0600Z (figure 6) depicts bright and circular echoes over northern France and the Channel area that indicate marked Cumulonimbus anvils, which are indicative of developing thunderstorms and potentially heavy rainfall. A weak warm front extended from a triple point of south-west England, across the Midlands to the North Sea with an occluded front from in the other direction to the Bay of Biscay and a weak cold front toward north-west France. In other words, the thunderstorms developed in an area of low level warm moist air advected northward in the wake of a warm front and ahead of a cold front with colder air aloft, as seen in the soundings for Beauvecchain and Trappes, a known recipe for instability.

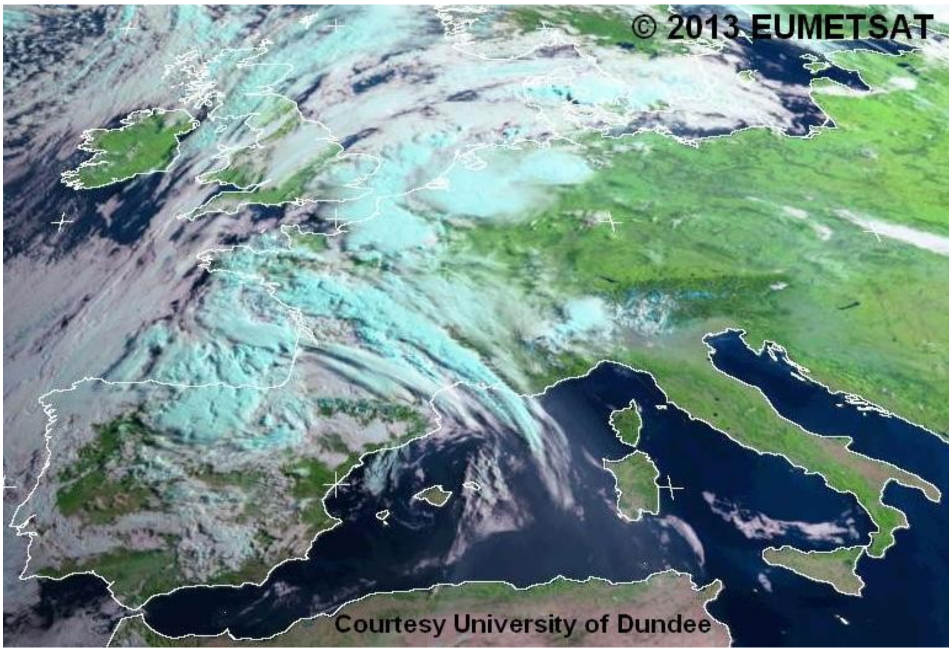

Figure 6. Colour enhanced MSG3 channel 16 image at 0600Z 2013-06-19.

The thunderstorms shifted to the extreme north-eastern part of Germany in the evening, before dissipating, but persisted over central France, before moving to eastern France and central Germany the following day, the movement being in conjunction with movement of the baroclinic low pressure system to the north-east (figure 7).

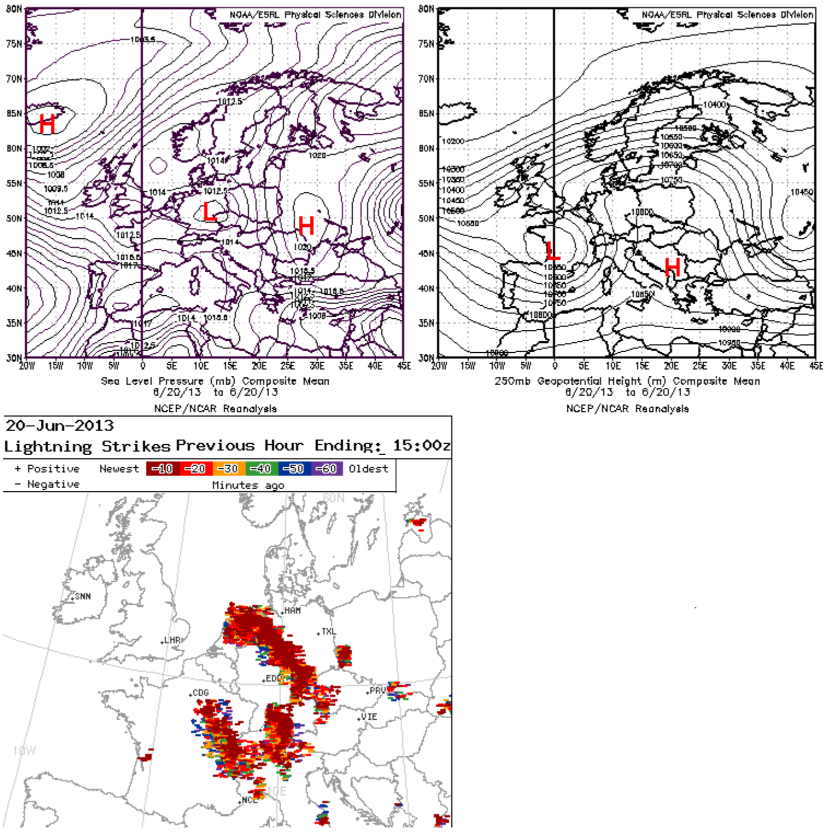

Figure 7. NCEP/NCAR Europe reanalysis 2013-07-20 mean surface and 250 hPa circulations and 1500Z lightning strikes.