SIG Aviation Meteorology
Newsletter, December 2012

The SIG has been dealing mostly with the change of representation in both the UK Flight Safety Committee (UK FSC) and the General Aviation Safety Council (GASCo). The representatives (Reps) involved are either in the process of contacting each other or have contacted each other regarding when the change will take place.

The American Meteorological Society's Annual Meet in Austin TX in January 2013 will have representation from the SIG. More on this below.

AIR FRANCE DOCUMENTARY:

Since the last newsletter the documentary was shown on Channel 4 in Britain. The program is no longer viewable online from channel 4 or the production company Minnow Films. However, it is still available on youtube, the link is provided for viewing by interest only and not for commercial purposes:

http://www.youtube.com/watch?v=03VJ8xKBl7U

SIG member Michael de Villiers can be seen from about the 15:43 mark in the video....

UK FSC and GASCo Activity Reports:

With the change in representation, there may also be a change in how activity reports of the meets by the Reps will be stored and displayed for SIG members and the Society as a whole. Since membership in these groups costs Society money, it would be ideal to have an activity report of the group meets. These reports may even be published on the SIG page of the Society website, but this has yet to be confirmed. We will be contacting Chris Holcroft for further info on how to proceed there.

American Meteorological Society Austin Texas Meet (Jan. 6 – 10, 2013):

Our SIG Secretary, Bob Lunnon, will most likely attend part of the Austin meet. He sent the following abstract to AMS, which has been accepted:

How useful is it to represent CAT by sequences of vortices?

The severity of an aircraft encounter with turbulence is most commonly quantified by reference to the aircraft normal acceleration. For an encounter between an idealised aircraft and an idealised vortex, the acceleration vector is equal to the cross product of half the vorticity vector with air velocity vector. More realistic expressions for the aircraft acceleration have been derived in the context of aircraft encounters with wake vortices, and, although the scale of wake vortices is smaller than that of naturally occurring vortices, the broad methodology is broadly applicable. For the normal (near vertical) component of aircraft acceleration, vortices with a horizontal axis of rotation are relevant, but vertical vortices will cause horizontal accelerations, and this will be discussed.

Questions that arise are:

1. To what extent is a sequence of vortices an accurate representation of turbulence in the atmosphere?
2. How well can we predict the significant properties of vortices?
3. How well can we predict aircraft behaviour given the characteristics of the vortices?

I will attempt to answer these questions through reference to the published literature on the subject.

A question which is linked to the feasibility of representing turbulence by sequences of vortices is: is the turbulence which causes highest amplitude aircraft accelerations quasi two-dimensional?

A contrasting approach to the quantification of turbulence is the use of turbulent kinetic energy and eddy dissipation rate. Converting from one to the other required the use of a length scale and if the turbulence is quasi 2-D then it is by no means clear what length scale is appropriate. However it is noted that reasonable correlation has been obtained between aircraft acceleration and eddy dissipation rate.

The applicability of sequences of vortices to the representation of turbulence may well depend on the meteorological mechanism causing the turbulence. For both Kelvin Helmholtz instability and flow normal to a quasi 2-D mountain ridge, the representation by vortices seems relatively attractive. For more general flow over orography, and for convection, representation by vortices seems less attractive. All mechanisms causing turbulence need to be considered.

An issue is the dependency of aircraft response to different scales of turbulence. An aircraft will be relatively unaffected by vortices having a characteristic scale much smaller than the aircraft dimensions, because, assuming the aircraft is essentially rigid, it will integrate out the effect of these wind variations. Intentional movement of aircraft control surfaces will enable the aircraft to mitigate the effects of relatively large scale wind fluctuations. Therefore between these two scales there exists a scale where the effect of, say, a single isolated vortex on the aircraft motion will be maximum. It is potentially very useful to say something about the scale of vortices.

Note that it is accepted that, for the foreseeable future, it will not be possible to explicitly forecast individual vortices that pose a threat to aircraft, at least not on the global scale. However there is some evidence that it is already possible to forecast forcing mechanisms, and this is one of the grounds for optimism. It is anticipated that it will be possible to forecast discrete volumes of the atmosphere in which there can be expected to be a finite number of vortices with certain characteristics, e.g. orientation, separation.

Subgroup News:

News involving the newly organized 6 subgroups in the SIGAM.

General issues Sub-group:

The CAT meet organized by Bob Lunnon should take place sometime in the last three months of 2013. If you are interested in knowing more about this meet, or even contributing to it, please contact Jake, who will forward the emails to Bob.

Jake is currently looking into getting together a group consisting of pilots, ATC personnel, meteorologists, to come up with possibly getting literature together regarding mountain meteorology. The focus is on the Alps and Scottish Highlands and the various regions involving major regional and international airports, like Nice, Cannes, Avignon, Grenoble, Chambery, Torino, Geneva, Sion, Milano Malpensa, Lugano, Bern, Buochs, Zurich, Samedan, St. Gallen, Bolzano, Innsbruck, Salzburg, Graz, Klagenfurt, Vienna, and Inverness.

Many people who work in and around meteorology in these geographical areas have many inputs from experience and theoretical knowledge, farmer's tales, etc, which are not documented, and the intention is to have this info recorded, possibly in book form for future reference. Mind you, this is a lofty goal. If you have interest and/or know people from those areas who may be willing to impart knowledge or gather info of specific and/or general geographical areas, please let Jake know.

Flight Ops theoretical training:

There is discussion going on as to creating a new or revised training course for private pilots regarding meteorology. This is an on-going issue for the General Aviation Safety Committee (GASCo), and continues to be one.

At the AMS meet in Austin, there will be a short course on aviation weather: http://annual.ametsoc.org/2013/index.cfm/programs-and-events/short-courses/ams-short-course-on-aviation-weathera-user-and-provider-perspective/

The SIG will get into touch with Barry Choy, who's organizing the course, about the possibility of getting more info about the course, particularly for RmetS and SIG members who cannot make it to the course.

If you have additional issues you feel your subgroup should look into or show interest in, please let us know.

Photos:

If you would like to post a photo in the newsletter, or if you (ie. George) think some of these photos would be suitable for the "Weather" magazine, let us know!

fig. 1: De-icing needed!!! Innsbruck Dec. 4, 2012

fig. 2: Snow removal convoy reaching runway 01L in Stockholm Arlanda, Dec. 5, 2012

fig. 3: Sunrise over central Sweden at 41000 feet, Dec. 6, 2012..

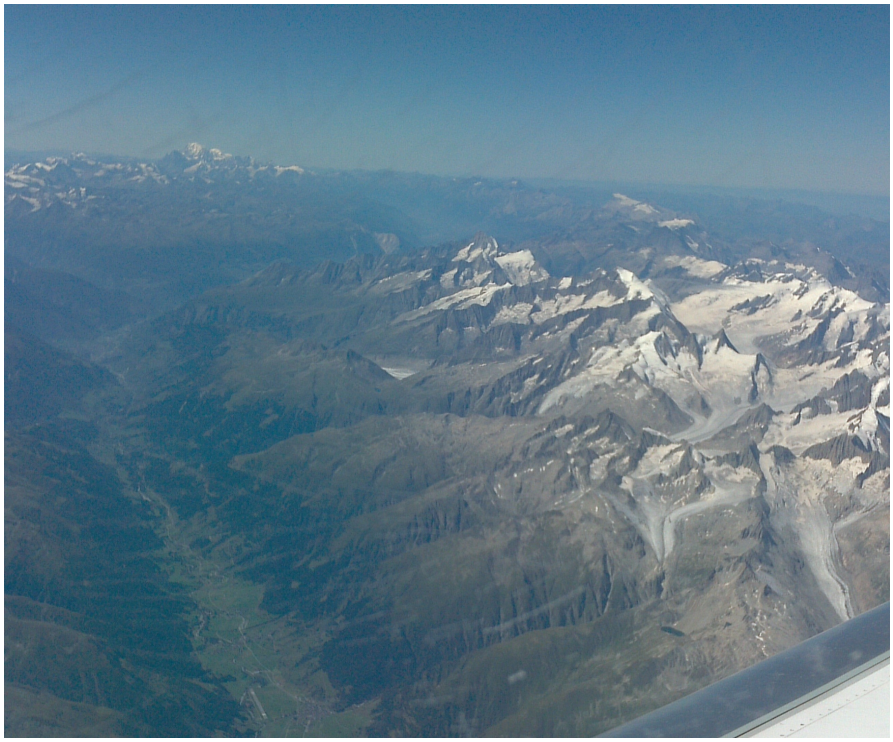
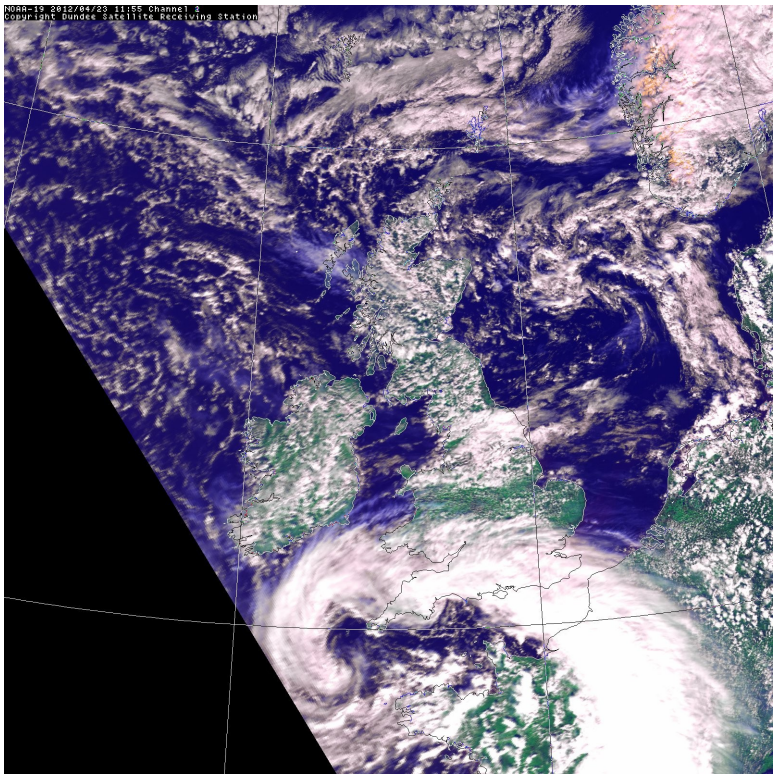


fig. 4: Upper Rhone Valley (Goms) in Valais Switzerland, looking westwards. Bernese Alps to the right, the Mont Blanc by the horizon, to the centre-left of the photo, Aug. 27, 2012.

Weather related aviation incidents in Europe December 2011 to November 2012

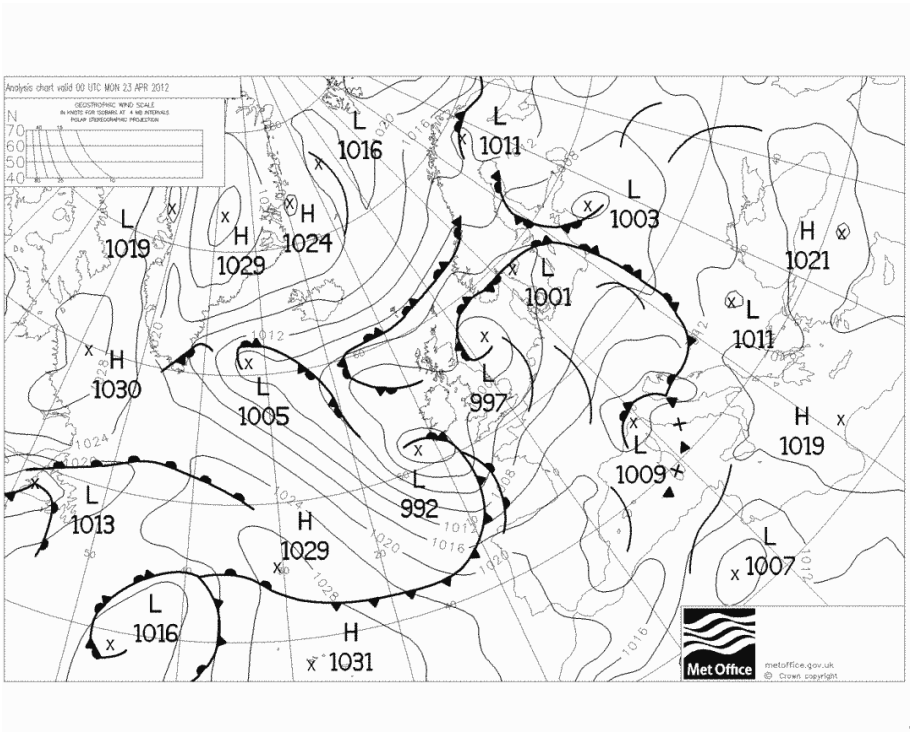
Michael de Villiers

1 Lightning strike near Amsterdam 23rd April 2012



A Corendon Dutch Airlines Boeing 737-800 on a flight from Amsterdam (Netherlands) to Faro (Portugal) was climbing from Amsterdam and about 50nm to the south-south-west when the crew levelled off at FL240 following a lightning strike. Although there were no abnormal indications the crew decided to return to the airport for an external inspection and landed approximately 30 minutes after departure. An external inspection revealed damage such as peeling paint, which required repairs before the aircraft was again serviceable. (Aviation Herald, 2012-04-23, 1117Z).

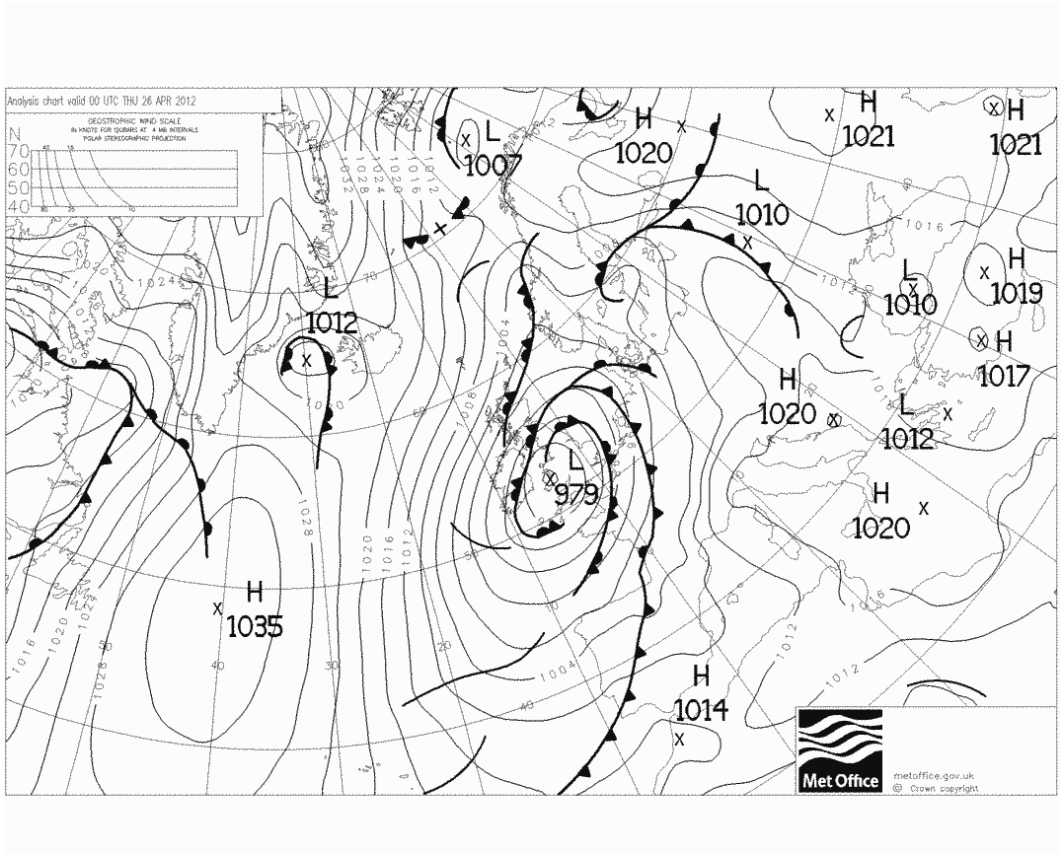
The satellite image at 1155Z (2012-04-23) shows convection cloud over the Netherlands, associated with a trough, while a frontal system was over southern England. These features are shown in the surface analysis below valid at 0000Z (2012-04-23)



2 Lightning strike at Moscow 26th April 2012

A Dniproavia Boeing 737-500, on a flight from Odessa (Ukraine) to Moscow Vnukovo (UUWW, Russia), was descending through FL090 on approach to Moscow when the right side of the aircraft was struck by lightning. The aircraft continued the approach and landed. A post flight inspection revealed that there were rivets were missing from the front right fuselage and the tail plane. The top beacon and tail strobe position lights were inoperative and the strobe lights wiring was damaged (Aviation Herald 2012-05-26, 1558Z).

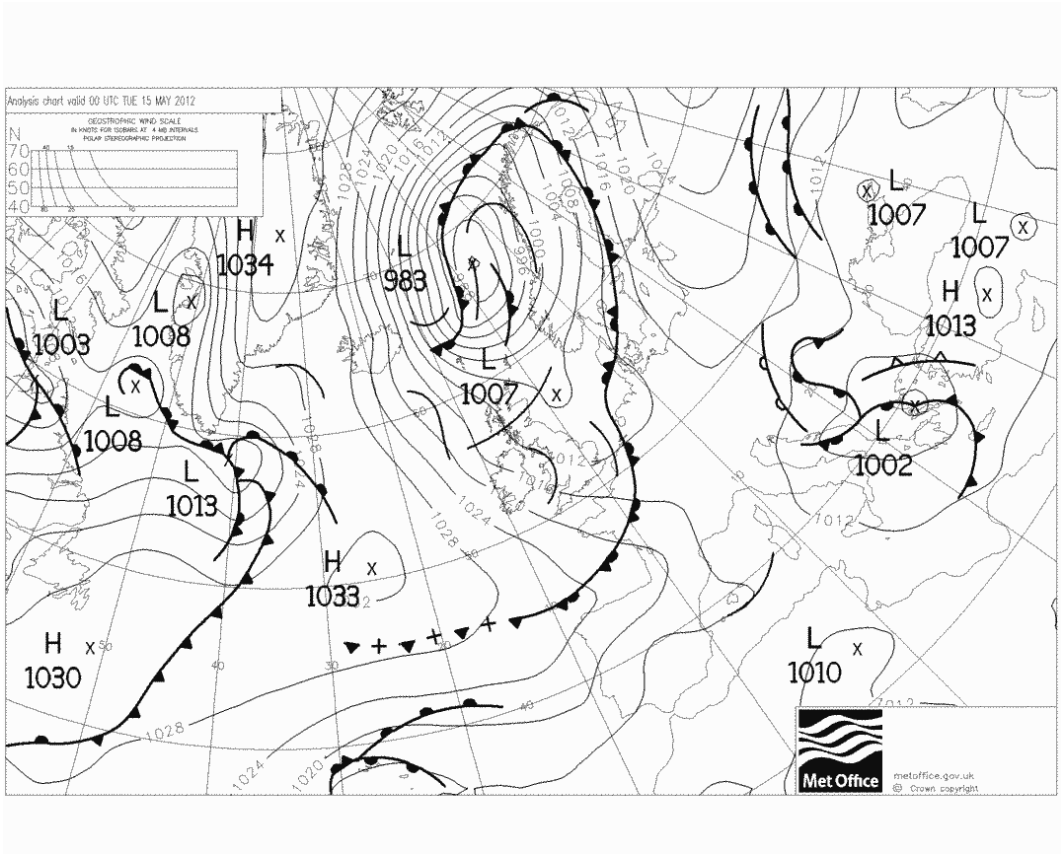
The synoptic situation is shown in the analysis below valid at 0000Z 2012-04-26. CB observed 1400Z to 1900Z and light rain showers 1500Z and 1700Z.

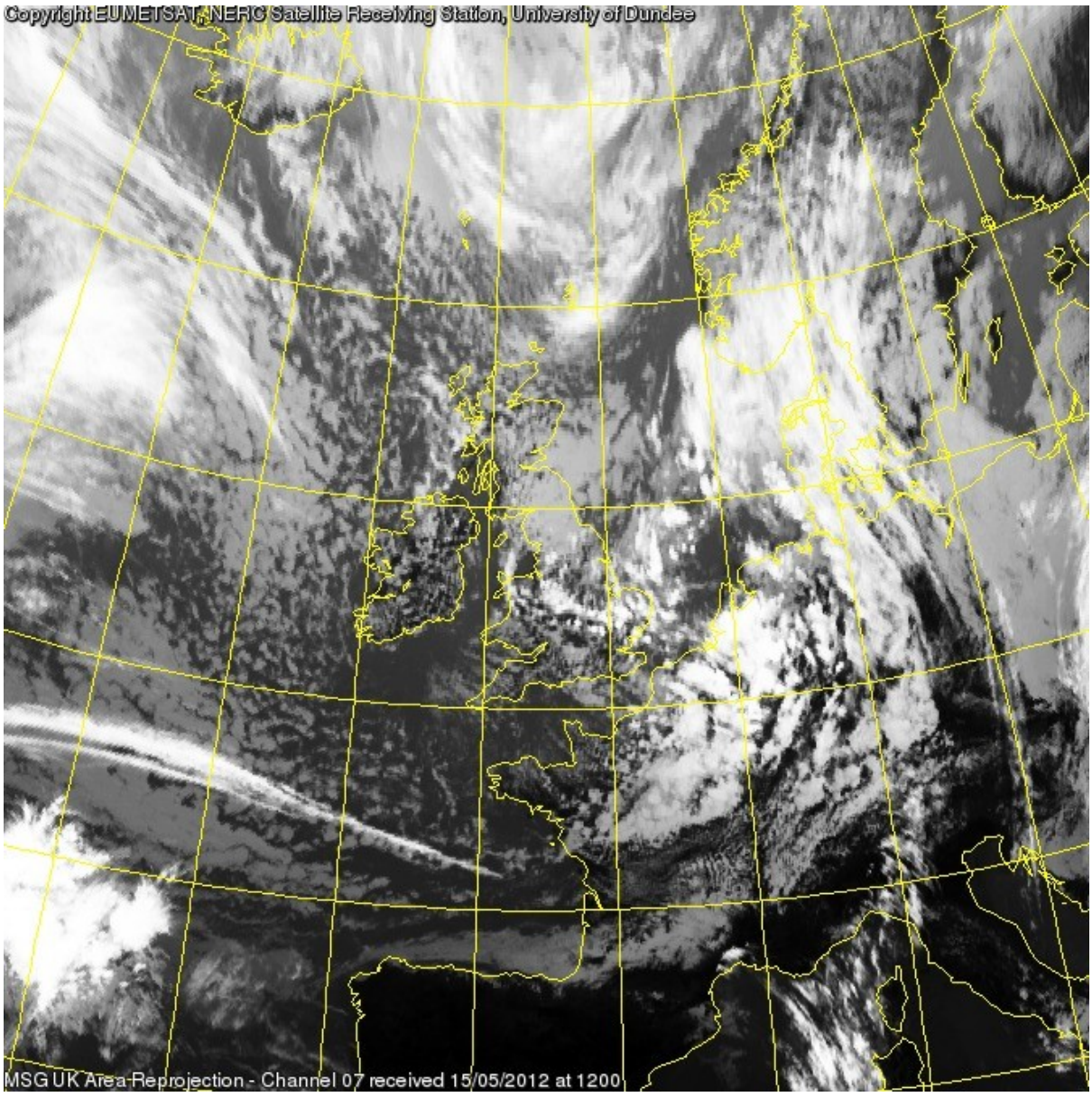


3 Lightning strike near Nuremberg 15th May 2012

A Lufthansa Airbus A319-100 flight from Frankfurt/Main (Germany) to Erbil (Iraq), was climbing about 35nm north of Nuremberg when the aircraft was struck by lightning. The climb was stopped at FL360 and returned to Frankfurt (Aviation Herald 2012-05-16 1052Z).

At the time of the incident an occluded front, which was to the west at 0000Z (chart below), had possibly reached the area. CB cloud was observed at Nuremberg (EDDN) from 1300Z to 2000Z with a thunderstorm reported at 1300Z. A EUMETSAT Meteosat image at 1200Z, showing convection cloud, is on the next page.



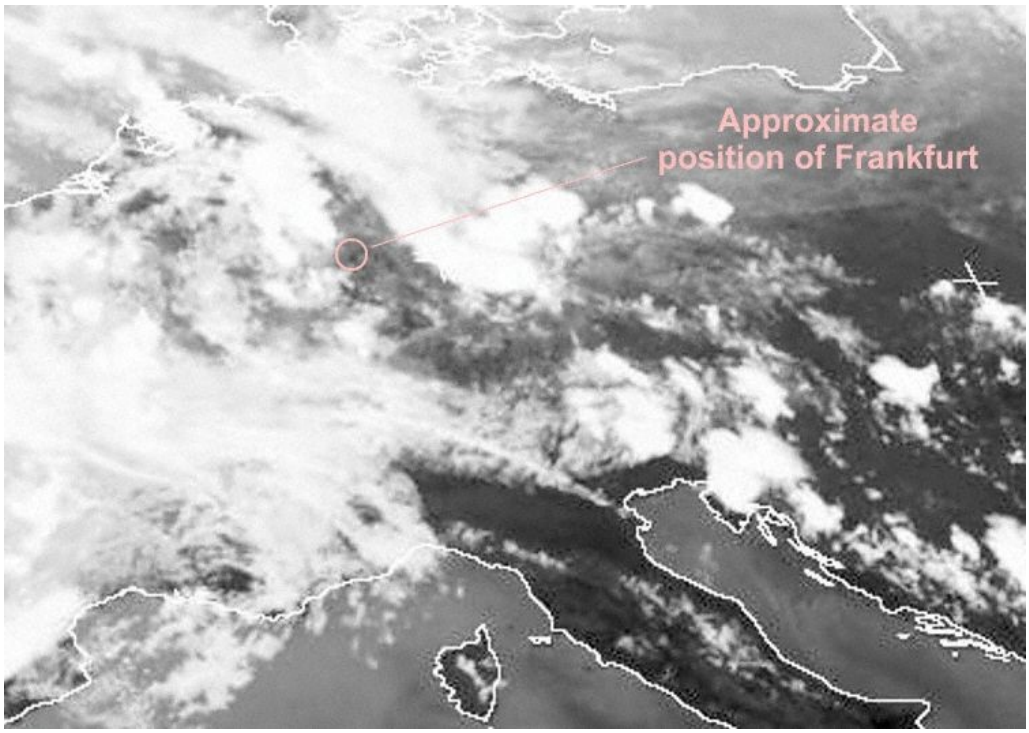

Copyright EUMETSAT, NERC Satellite Receiving Station, University of Dundee
MSG UK Area Reprojection - Channel 07 received 15/05/2012 at 1200

4 Turbulence near Frankfurt 5th July 2012. Flight attendant injured.

A Sun Express Deutschland Boeing 737-800 flight from Gaziantep (Turkey) to Frankfurt/Main (Germany) was descending through FL200 to Frankfurt when the aircraft experienced turbulence causing injuries to a flight attendant. The aircraft landed at Frankfurt'. The flight crew expected turbulence and had turned on the fasten seat belt signs. The flight attendants were checking whether the passengers had fastened their seat belts and were moving towards their seats. The aircraft experienced two jolts; the second caused a -0.15G vertical acceleration (downward). The injured flight attendant had just sat down on the seat at the right hand rear aft door, but had not yet secured her seat belt. She was lifted off the seat, the seat retracted and she fell fracturing her right thigh. There were isolated thunderstorm cells in the vicinity of Nuremberg with strong vertical up and downdrafts between FL050 to FL380 and covered by a SIGMET, valid 0930Z to 1200Z, warning of isolated thunderstorms, 30 knots wind gusts and hail (Aviation Herald 2012-10-12 1539Z)

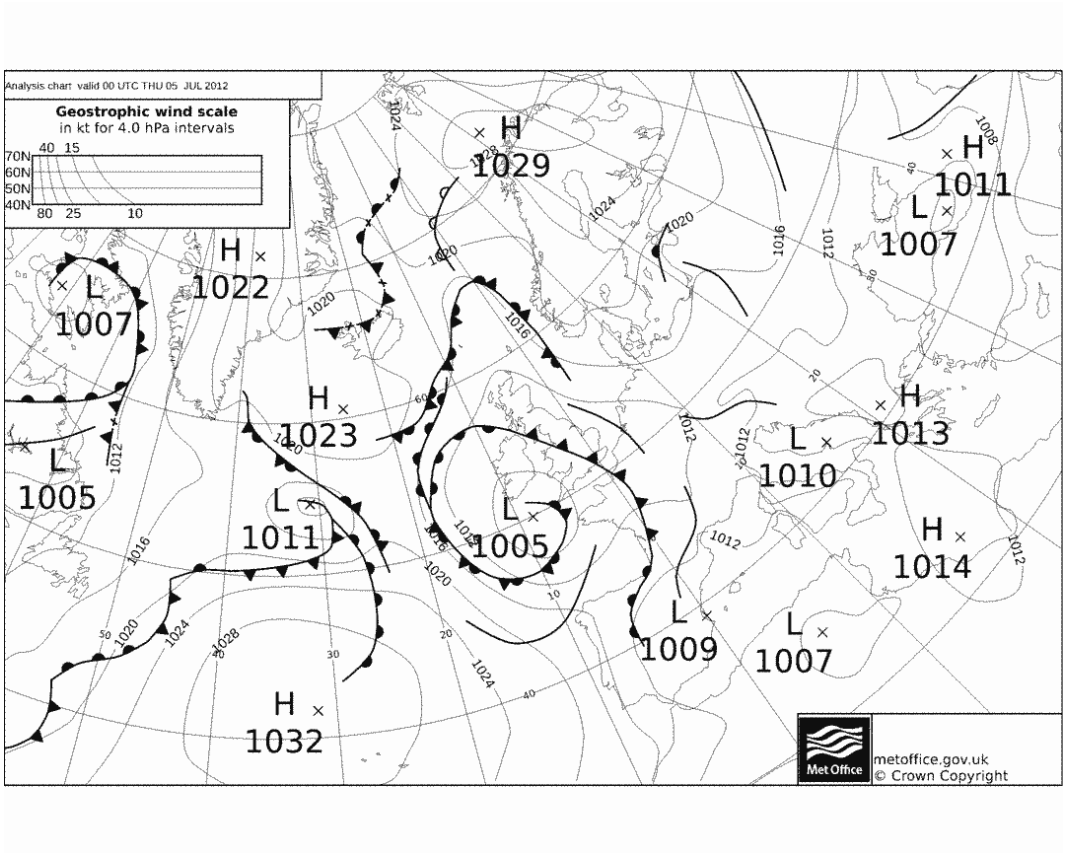
METARs around the time of the event and Frankfurt and Nuremberg:
EDDF 051120Z 09006KT 9999 SCT032 FEW036CB SCT300 26/18 Q1010 NOSIG=
EDDF 051050Z 06008KT 9999 SCT030 FEW035CB SCT280 26/19 Q1011 NOSIG=

EDDN 051120Z 25008KT 210V270 9999 TS VCSH SCT020CB BKN250 25/18 Q1011 TEMPO 20020G30KT 2000 +TSRA=
EDDN 051050Z VRB03KT 9999 VCTS FEW020CB FEW030TCU SCT250 25/18 Q1011 TEMPO 20020G30KT 2000 TSRA=



Infrared satellite image SEVIRI Jul 5th 2012 12:00Z (copyright EUMETSAT 2012).

2012-07-05 0000Z surface analysis below.



5 Thunderstorms at Madrid 26th July 2012. Numerous diversions

Thunderstorms associated with low pressure over Spain moved with a trough to Madrid during the evening (surface analysis chart, METARS and satellite image below). Between 19:52Z to 20:48Z a number of aircraft on approach to Madrid aborted their approaches and went around including all non-Spanish operators, except eight flights of Spanish operators which continued landed on Madrid's runways 18. A number of flights, of various operators, that diverted to various alternates in Spain, needed to declare emergencies as result of their diversions and in order to prevent further delays, that could have put the flights at risk by cutting into the required final fuel reserve. Four of these are presented below with flight paths in graphics provided by Aviation Herald.

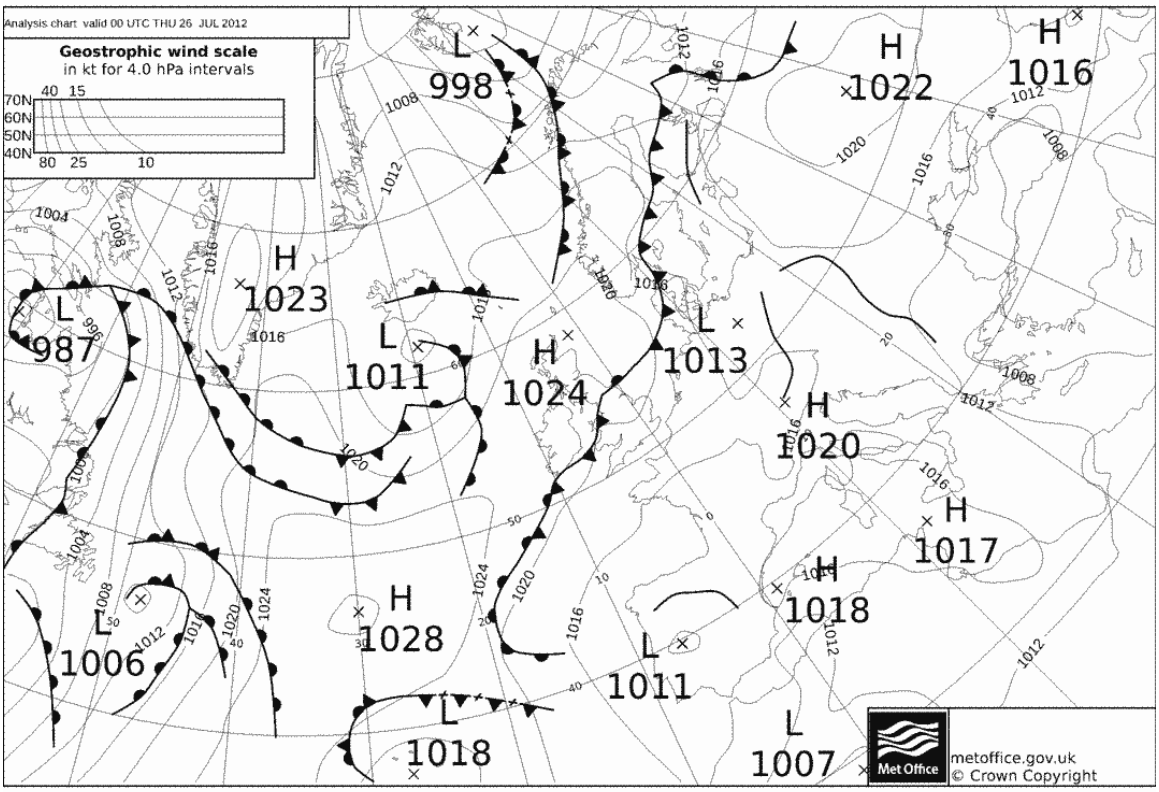
A Ryanair Boeing 737-800 flight FR5389 from Stockholm Skavsta (Sweden) to Madrid (Spain) was approaching Madrid, levelled at FL100 at 20:06Z and received delay vectors until 20:38Z (32 minutes), when the crew decided they needed to divert to Valencia and could no longer risk to wait for the thunderstorms clearing (Madrid resumed landings at 20:48Z). The aircraft climbed to FL240 for the diversion and was on approach to Valencia at FL150 south of Valencia crossing the coast at 21:06Z, when another set of radar vectors delayed landing until the crew declared an emergency. The aircraft landed safely in Valencia at 21:23Z with 1228 kg/2705 lbs of fuel remaining (minimum fuel reserve 1090 kg/2400 lbs), 77 minutes after aborting the approach to Madrid.

A Ryanair Boeing 737-800 flight FR5998 London Stansted (UK) to Madrid (Spain) aborted the approach to Madrid at FL078 at 20:12Z, climbed back to FL100 and followed delay vectors until 20:33Z (21 minutes), when the crew decided to divert to Valencia reaching Valencia at 21:07Z descending through FL100. Following unexpected vectors guiding the aircraft out over the Valencia basin the crew declared emergency and landed safely at 21:18Z with 1160 kg/2555 lbs of fuel (minimum fuel remaining required 1119 kg/2465 lbs) about 66 minutes after aborting the approach to Madrid.

A Ryanair Boeing 737-800 flight FR2054 from Palma Mallorca (Spain) to Madrid (Spain) was on final approach to Madrid's runway 18R when the crew initiated a go around from about 2700 feet MSL at 20:00Z. After being fully stabilized for the approach 18R the aircraft encountered a wind shear prompting a wind shear warning from the GPWS, the crew therefore initiated a go-around in compliance with standard operating procedures. During the go-around the aircraft was struck by lightning and a "Window Overheat" master caution illuminated. The relevant checklists were completed while climbing the aircraft to 10,000 feet southwest of the aircraft as instructed by air traffic control. The aircraft climbed back to FL150 and received delay vectors until 20:27Z (27 minutes), when the crew determined they could no longer wait and needed to divert to Valencia. The aircraft climbed to FL270 and reached Valencia descending through FL100 south of Valencia at 20:59Z. When the aircraft was vectored through extended centreline to the north the crew declared emergency as landing above final fuel reserve was no longer ensured and received immediate vectors back to the aerodrome, where the aircraft landed at 21:07Z with 1029 kg/ 2266 lbs of fuel remaining below the minimum fuel reserve required of 1104 kg/2432 lbs about 67 minutes after going around in Madrid.

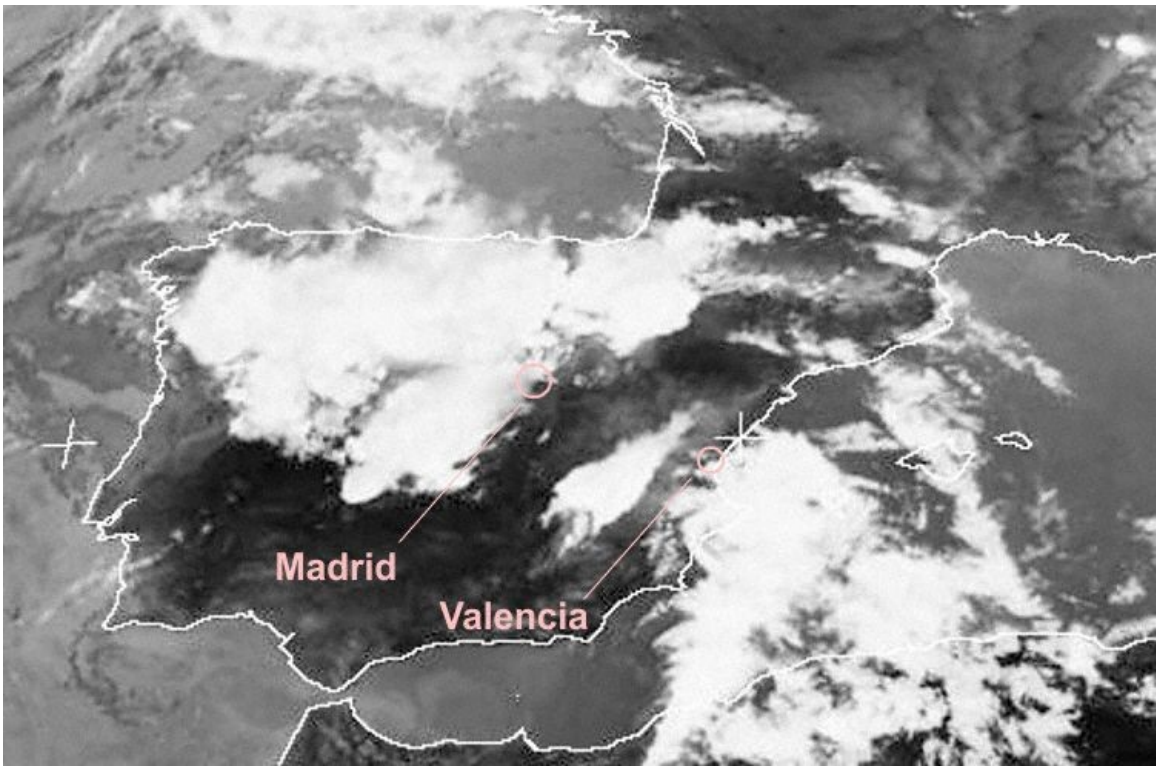
A LAN Airlines Airbus A340-300 flight Frankfurt/Main (Germany) to Madrid (Spain) was on final approach to Madrid's runway 18L when the crew went around from about 4000 feet MSL at 20:02Z. The aircraft climbed to FL120 and followed delay vectors until 20:22Z (20 minutes) when the crew decided to divert to Valencia. Still on a westerly heading in opposite direction to Valencia the aircraft climbed to FL280 before turning east to Valencia. On descent towards Valencia the crew declared Mayday reporting being low on fuel. The aircraft reached Valencia descending through FL100 at 21:09Z and subsequently lost an engine. The aircraft landed in Valencia at 21:16Z 74 minutes after going around in Madrid with 1300kg/2860lbs of fuel in the left wing tank and

800kg/1760lbs of fuel in the right wing tank remaining substantially below the required minimum final fuel reserve of about 2800kg/6170lbs (Aviation Herald 2012-08-21 1221Z).



METARS:
LEMD 262200Z 29003KT 260V040 9999 FEW050CB BKN075 24/17 Q1014 NOSIG
LEMD 262130Z 25009KT 200V290 9999 VCTS SCT050CB BKN075 24/14 Q1014 BECMG NSW
LEMD 262116Z 25012KT 210V280 9999 -TSRA SCT050CB BKN070 23/15 Q1014 NOSIG
LEMD 262100Z 22017KT 7000 TSRA SCT050CB BKN070 23/18 Q1014 TEMPO TSGR
LEMD 262030Z 25015G25KT 220V280 7000 TSRA SCT040CB BKN060 24/15 Q1013 TEMPO TSGR
LEMD 262014Z 21017KT 5000 2400NE +TSRA SCT040CB BKN060 23/16 Q1013 TEMPO TSGR
LEMD 262000Z 12019KT 5000 TSRA SCT050CB 24/16 Q1012 TEMPO TSGR
LEMD 261952Z 14013G36KT 090V170 9999 TSRA SCT050CB 31/15 Q1011 TEMPO TSGR
LEMD 261930Z VRB05G17KT 9999 SCT050CB 33/10 Q1011 TEMPO TSRA
LEMD 261900Z 18004KT 130V220 9999 SCT050TCU 33/11 Q1010 TEMPO TSRA SCT050CB

Meteosat infrared satellite image 26th July 2012 18:00Z (copyright EUMETSAT 2012 via Aviation Herald):

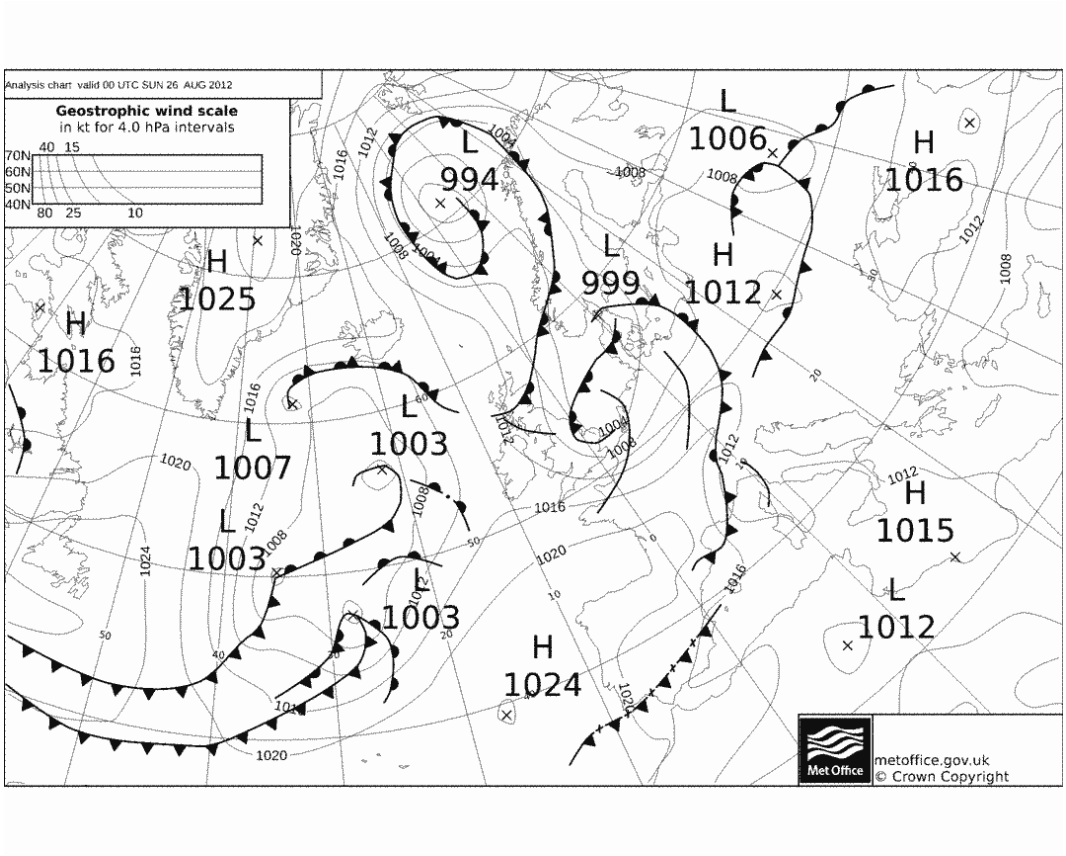


Map of LAN Airlines Flight(Graphics: AVH/Google Earth):

Map of Ryanair flights (Graphics: AVH/Google Earth):

6 Two lightning strikes near Stockholm 26th August 2012

Two Scandinavian Airlines (SAS) Boeing 737-600 were struck by lightning while climbing from Stockholm airport. One was bound for Lulea (Sweden) and levelled at FL260 before returning to Stockholm about 30 minutes after departure. The other flight was bound for Umea (Sweden) and levelled at FL220 before returning about 30 minutes after departure. Apparently both were at about the same location, but at different altitudes (source Aviation Herald 2012-05-26, 1907Z and 1914Z).

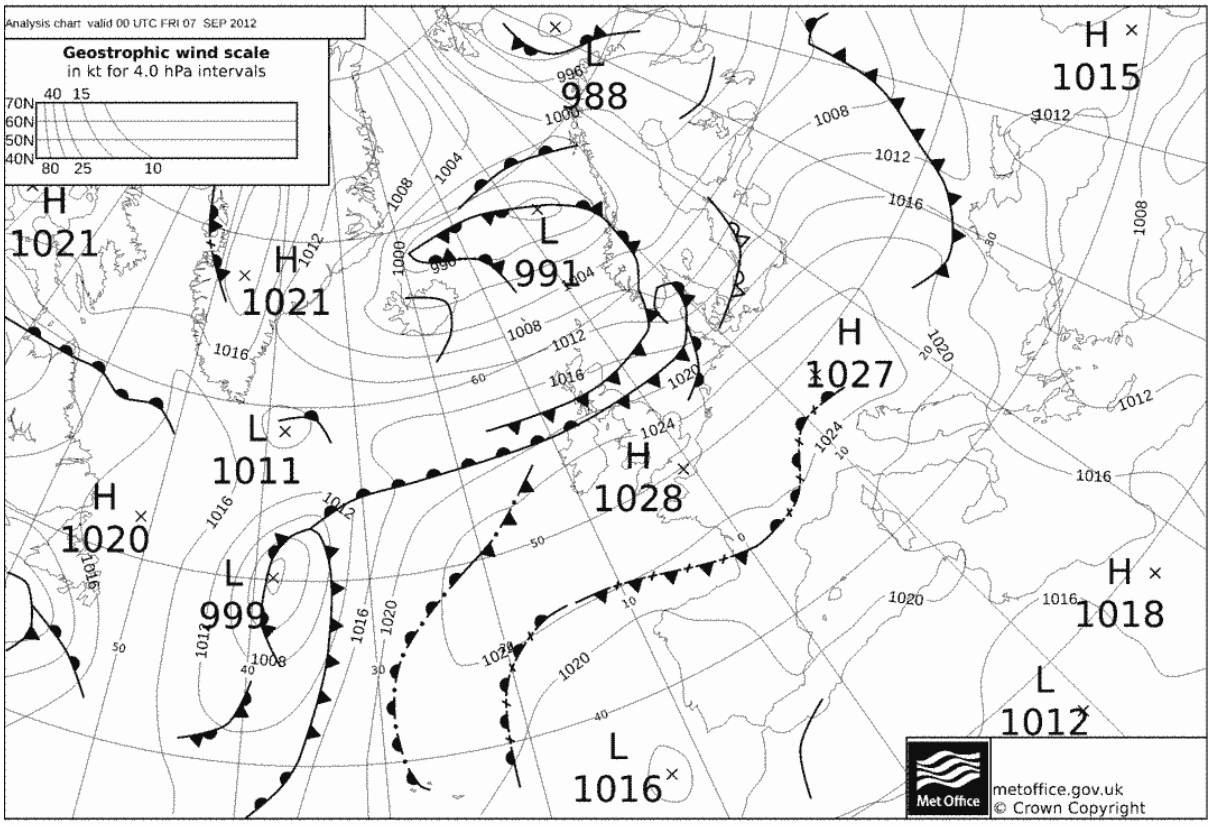


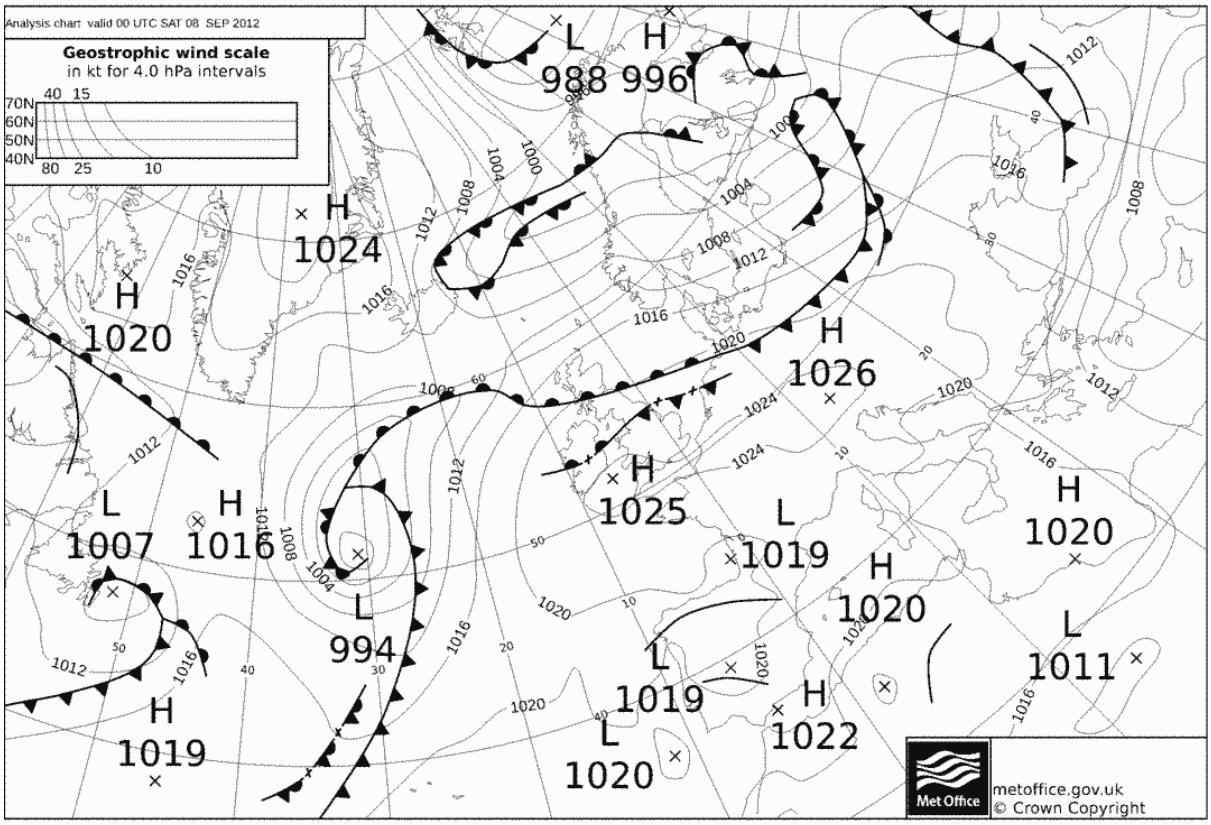
7 Turbulence near Dublin 7th September 2012. Flight attendant injured

An Aer Lingus Airbus A320-200 flight Milan Malpensa (Italy) to Dublin (Ireland) was descending through FL140 to Dublin at about 21:38L (20:38Z) when the crew reported that a cabin crew member had fallen and received a bad fracture of her ankle. The aircraft landed about 12 minutes later. After landing the crew reported three other flight attendants needed medical attention as well. Satellite images indicated no convection activity in the vicinity, which is supported by the METARs around the time of the incident.
EIDW 072100Z 26007KT 9999 FEW017 BKN030 18/16 Q1023 NOSIG
EIDW 072030Z 27006KT 9999 FEW017 BKN030 18/16 Q1023 NOSIG
(Aviation Herald 2012-09-08 1748Z).

A reader stated that at Dublin there was the "best display of altocumulus lenticularis for a long time" (Aviation Herald 2012-09-08 1748Z). So, the cause of the turbulence appears to have been due to low level mountain (or gravity) waves.

The charts below indicate high pressure to the south with a WSW to SW surface flow. While the upper air sounding at Valentia at 1200Z (bottom below) indicates stable air with the wind almost perpendicular from the west off the Wicklow Mountains inland to the south of Dublin. This would have generated mountain waves across the path of the aircraft in a descent from the SE.




Analysis chart valid 00 UTC SAT 08 SEP 2012
Geostrophic wind scale
in kt for 4.0 hPa intervals
40 15
70N
60N
50N
40N
80 25 10
L 988
H 996
H 1024
H 1020
H 1026
H 1025
L 1007
H 1016
L 994
L 1019
H 1020
L 1011
H 1019
L 1019
H 1022
L 1020
Met Office
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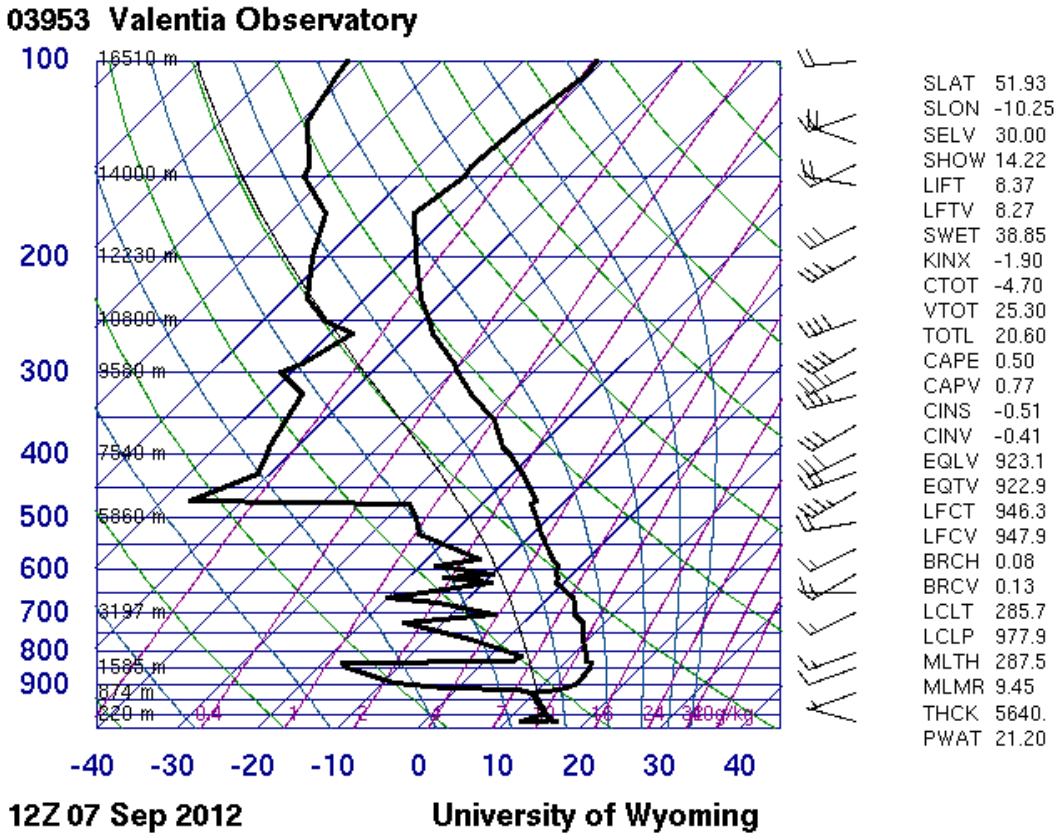
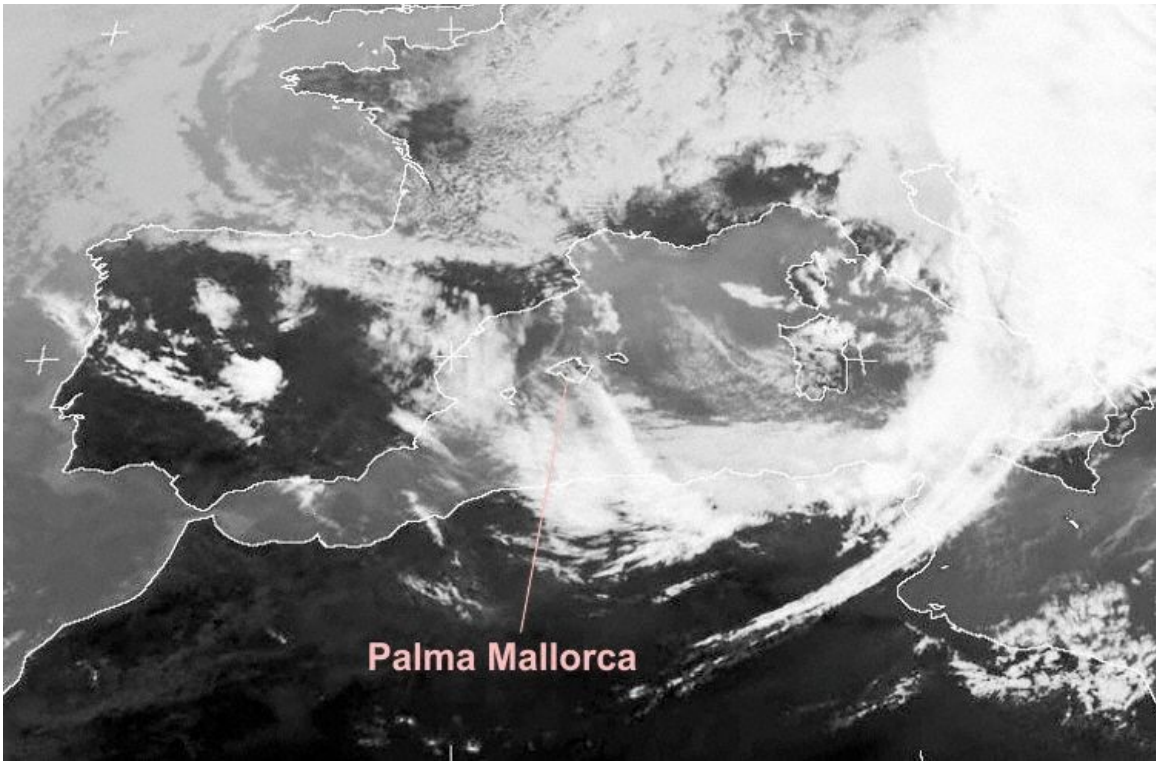

03953 Valentia Observatory
100
200
300
400
500
600
700
800
900
16510 m
14000 m
12230 m
10800 m
9580 m
7540 m
5860 m
3197 m
1585 m
874 m
320 m
-40 -30 -20 -10 0 10 20 30 40
12Z 07 Sep 2012
University of Wyoming
SLAT 51.93
SLON -10.25
SELV 30.00
SHOW 14.22
LIFT 8.37
LFTV 8.27
SWET 38.85
KINX -1.90
CTOT -4.70
VTOT 25.30
TOTL 20.60
CAPE 0.50
CAPV 0.77
CINS -0.51
CINV -0.41
EQLV 923.1
EQTV 922.9
LFCT 946.3
LFCV 947.9
BRCH 0.08
BRCV 0.13
LCLT 285.7
LCLP 977.9
MLTH 287.5
MLMR 9.45
THCK 5640.
PWAT 21.20

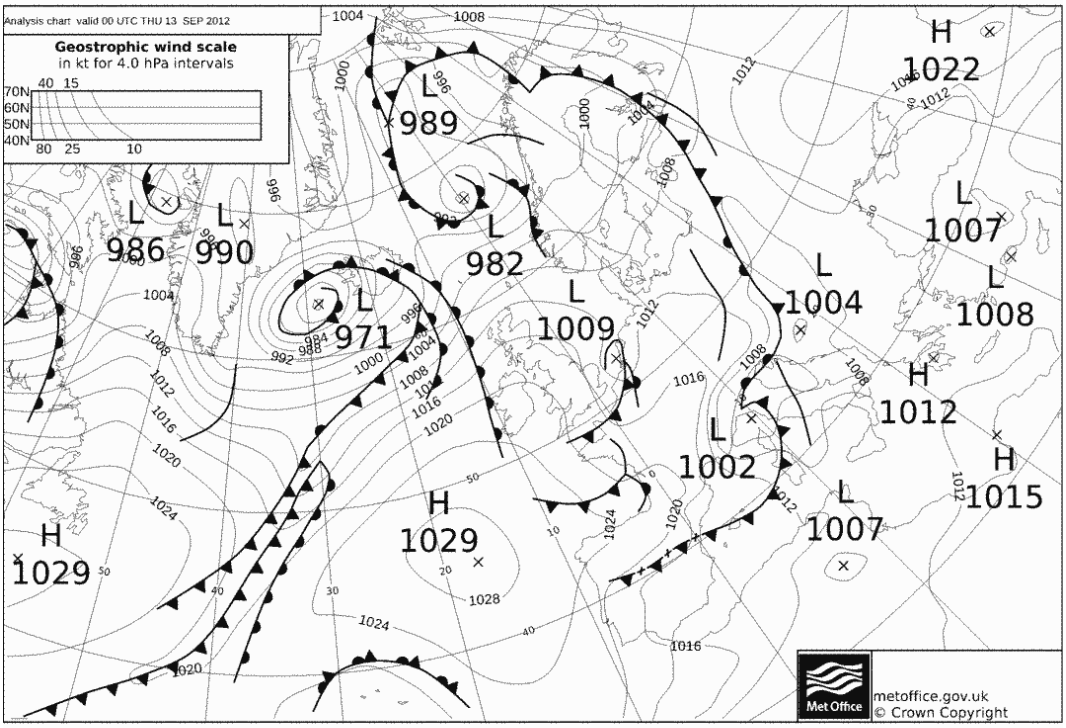
8 Turbulence near Palma 13th September 2012. Three injured

A Ryanair Boeing 737-800, flight from Dusseldorf Niederrhein (Germany) to Palma Mallorca,SP (Spain), was on approach to Palma when the aircraft encountered severe turbulence causing injuries to two cabin crew and a passenger. The three injured were treated for bruises at the airport Metars around the time of the incident were:
LEPA 131300Z 23010KT 200V260 9999 FEW022TCU SCT035 23/16 Q1014 NOSIG
LEPA 131230Z 23009KT 190V260 9999 FEW025 SCT040 23/15 Q1014 NOSIG
(Aviation Herald 2012-09-13 2210Z).

Meteosat Infrared Satellite Image copyright EUMETSAT 2012 at 1200Z 2012-09-13 courtesy of Aviation Herald).



The report does not give the flight level of the aircraft. As they usually do and it is stated that the aircraft was on approach, one can perhaps assume that it was below 5000ft. In which case the turbulence was probably due to northerly winds following the cold front (shown in the analysis charts below) and between the low pressure cell in the vicinity of vicinity of the Gulf of Genoa and high pressure over the Bay of Biscay. The implication is that the aircraft could have descended into a Mistral wind, which occurs over the Mediterranean between Corsica and the Balearic Islands (and which includes Mallorca).


Analysis chart valid 00 UTC THU 13 SEP 2012
Geostrophic wind scale
in kt for 4.0 hPa intervals
70N
60N
50N
40N
40 15
80 25 10
L 989
L 986
L 990
L 982
L 971
L 1009
H 1022
L 1007
L 1004
L 1008
H 1012
L 1002
H 1015
L 1007
H 1029
H 1029
H 1027
1028
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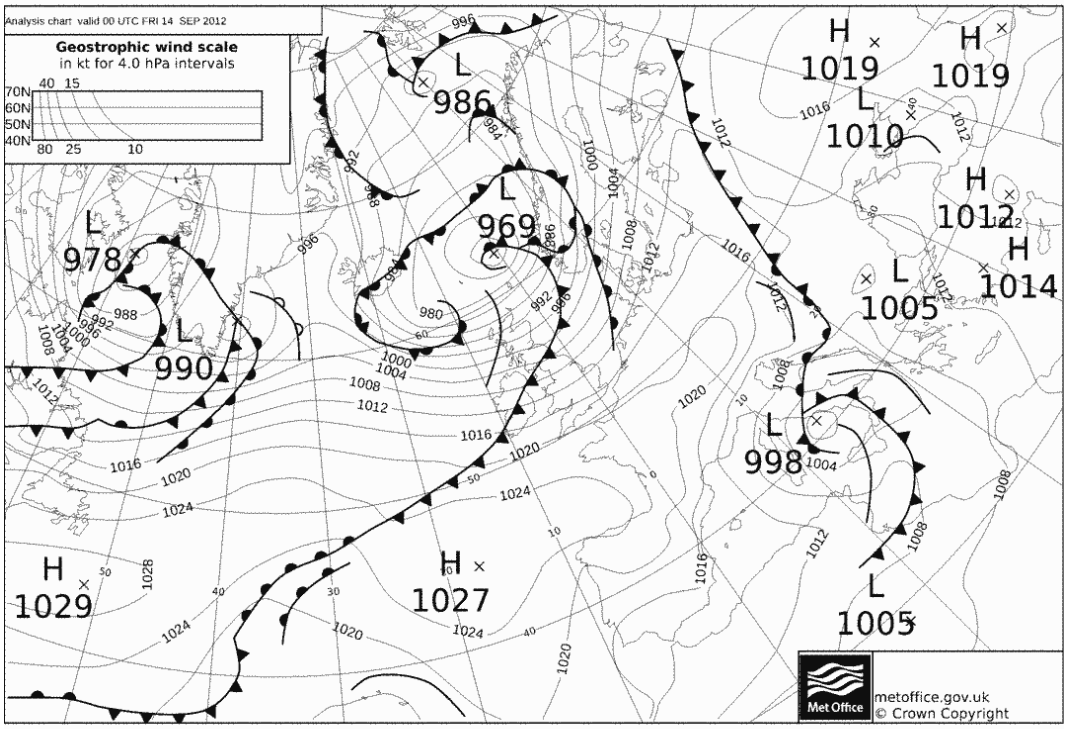
Analysis chart valid 00 UTC FRI 14 SEP 2012
Geostrophic wind scale
in kt for 4.0 hPa intervals
70N
60N
50N
40N
40 15
80 25 10
L 986
L 969
L 978
L 990
H 1019
H 1019
L 1010
H 1012
H 1014
L 1005
L 998
L 1005
H 1029
H 1027
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Next SIG meet:

Before the next newsletter members of the SIG will be emailed regarding organizing the third annual SIG meet, most likely in Reading. Considering what was discussed last year, we will try to use Skype or other form of web contacting for those who can't make the trip but still wish to take part in the meet. We wanted to try this out at the first meet, but emphasis was more on meeting rather than trying out technology.

Articles of Interest:

Austrocontrol's Guenther Mahringer gave a presentation on the role of verifying meteorological forecasts in aviation at the MeteoSwiss research colloquium 2012 on Nov. 22, 2012 in Zurich.
http://www.meteoschweiz.admin.ch/web/en/research/events/archive/foko_2012_1.Par.0018.DownloadFile.tmp/9mahringeraustrocontrol.pdf

Continuing discussion on cold temperature corrections to minimum sector altitudes and ATC surveillance minimum altitude chart altitudes:
http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=5273

From the Bulletin of the American Meterological Society (BAMS), October 2012:, Forecast-based decision support for summer low stratus periods at San Francisco Airport:
http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-11-00038.1

Comments, Feedback:

One feedback from John Greetham came with regards the Air France video, pertaining to the decision to fly through the cumulonimbi (Cbs) rather than around them.

Jake's viewpoint (should be considered as such) is that it is difficult to understand what went through the pilots' minds at that moment, and retrospect while sitting and typing away in a comfortable room is hardly the cockpit environment. When Cbs are isolated and clearly visible, flying around is a “no-brainer”. When the Cbs are embedded or along a line, not clearly visible, at night, with lightning all over the place in front of you, things get more challenging.

In the Apennine region of Italy, flying from Milan to Florence on an actively unstable summer day, for example, you can change course for hundreds of miles around a wall of Cbs to get to destination, or what may occur is to find the areas where radar returns are the lightest (on board weather radar areas depicted green) and go through. These Cbs may not extend to 50000 feet, but they are active nonetheless, mainly due to Mediterranean and Apennine influences on water supply and orographic effects, etc. The way the pilot(s) reacts to the situation will be dependent on several factors, not exclusively restricted to experience, theoretical knowledge, commercial pressure, safety focus, operational focus, ATC inputs, and the list goes on.

The discussion is not over with only two paragraphs, if anything the discussion may even be enhanced by what is written here.

Thanks for your interest. Next newsletter to be expected around April of 2013.