SIG Aviation Meteorology
Newsletter, July 2012

The SIG has been active recently with the May 30, 2012 meet and issues arising out of it, various requests including an interview on ITCZ dynamics related to the Air France AF447 crash over the central Atlantic Ocean, a letter to the "Times" by one of our members.
This newsletter is also the first to be of a "non-internal" nature, with emails to SIGAM members dealing with internal SIG matters, and the newsletter designed for a more public viewing for inclusion in the RmetS website. As with any thing new, there will be bugs, and feedback is welcome at all times. The newsletter concept was initially considered for a quarterly basis, but it seems that three newsletters per year may be more feasible.

Air France Documentary:

We received the following request via email on the 8th of June, from Minnow Films:

"Your office kindly advised I ask you for some guidance for a Meteorology expert. We are working on a documentary about the Air France 447 accident, for Channel 4.

As part of the film, we would like to interview a meteorologist who could explain to us, in general, the weather systems in the Intertropical Convergence Zone. We are hoping to find a way to illustrate the characteristics of the area in a visually interesting and compelling way, explaining the composition of the clouds, the possible convection phenomena or anything that usually defines the weather within the ITCZ.

Basically, the kind of subject your institute [RmetS] excells (sic) in."

Michael de Villiers was the first to volunteer for the interview, did it, and subsequently wrote what happened:

The questions asked were much more wide ranging than I expected and a number of them I had to say they needed to get an answer from an expert in the relevant field. The interviewer asked questions on what is the ITCZ and its significance to aviation, mainly in the form of the thunderstorms that occur and therefore the primary issues of turbulence in strong up and down drafts (approximate speeds and up to 6000ft/min), icing and supercooled water droplets, mostly 0°C to -23°C, but can be to about -40 °C, that is, ±FL150-350. The BEA report concluded that the "presence of super cooled water at FL350 was not very probable and would necessarily have been limited to small quantities. Also questions about hail and hail damage, lightning, altimeter, Vertical Speed Indicator (VSI) errors & ASI fluctuations

Answers had to be kept simple as the documentary is aimed at the general public. So there was no interest in Coriolis Force and air flow deflected to the right in the Northern Hemisphere (NE Trades) and left in the southern Hemisphere (SE Trades) and Hadley Cell. Simply sun heating the earth and creating a belt of low pressure at the equator and migrated north and south of the equator and which is visible as a belt of cloud 2 slides were used to demonstrate this. The movement of the ITCZ is more noticeable over land and more intense and less noticeable over the oceans, but better defined with less migration and ocean temperature plays a greater role. Whereas diurnal heating over land plays an important role.

Aspects discussed from the final report were that the general conditions and the position of the ITCZ were normal for the month of June with characteristic Cumulonimbus clusters were present. Also that infra-red imagery analysis did not make it possible to conclude that the storms in the zone were exceptional in character, but that there was a "cluster of powerful Cumulonimbi along the planned path" and that there could have been notable turbulence. Also the forecast tops were FL450 with the tropopause at FL500.

Questions also related to the weather that the flight flew through and as mentioned in the various reports, including the final report, of which I had copies. These included static electricity and St Elmo's fire (an electric field causes ionization of air molecules) and the rushing noise heard in the cockpit due to ice crystals typical

in cloud at that height and the smell due to ozone. Ozone is produced during lightning strikes (the blue colour) producing nitrogen oxides within thunderstorms that react with other chemicals and the ozone tends to collect in the upper part of thunderstorms and in due course is a major source of replenishment of the ozone layer in the Stratosphere.

Other aspects discussed were that at about 02h00 when the captain briefed the crew prior to his rest break he and mentioned that they would there would be more of the same turbulence ahead (at 01h45 there was slight turbulence. A few minutes later it increased slightly) and that they cannot climb because the temperature was falling more slowly than forecast. He also mentioned earlier appearance of St Elmo's fire. After the captain left the pilot flying (PF) pointed out there was a little bit of turbulence ahead according to weather radar's image but they couldn't climb, pointing out the FMS indication of maximum possible cruise level of FL375. Also discussed was that 3 other flights, 12-37 minutes later, navigated the same area and diverted by 11 to 80 nm. Shortly after the pilot flying briefed the cabin crew that in two minutes they would encounter turbulence and they would be told when they would be clear. The turbulence increased (but no indication of severe) and at 02:08Z the pilot flying decided to turn left by 12 degrees. The PF remarked he would prefer to climb to FL360 (they were cleared to FL350 by Brazil's Atlantic air traffic control). Intensive weather radar observations followed, however, these were interrupted by a sensation of quick temperature increase and the appearance of an odour that distracted the crew for more than a minute. The PNF finally identified the smell as ozone (see above).

Also discussed, using 2 slides, from Aviation Herald (avherald.com), was the flight path relative to the CB cluster and that judging for the final ACARS report it looked as if the flight had already passed through the worst of the CB activity.

Questions were also asked that deviated from meteorology, but related more to my practical experience as a pilot, such as high speed and low speed stalls, what is it like flying an aircraft in turbulence, etc.

Letter to the "Times":

Our SIG Secretary, Bob Lunnon, wrote the following to the "Times":

Sir,

Your report "Aviation expansion plans grounded until autumn", 11/7/2012, highlighted some of the issues facing the government. Airport policy must reflect, among many other considerations, two specific constraints: aircraft noise and aviation emissions trading. Emissions trading is now EU law – airlines must buy permits and it should be assumed that the price of being allowed to emit CO_2 will increase in the future. For either the public sector or the private sector to fund significant airport expansion without taking emissions trading into account would be foolhardy.

Inevitably there are trade-offs to be made between aircraft noise and the emission of CO_2 and other undesirable gases. The European Clean sky project and other technological innovations will ensure that aircraft in the future are both quieter and less damaging to the planet, but some compromises are unavoidable. For example, to allow A380 aircraft to meet Heathrow noise requirements, all are fitted with a specially designed nacelle which has the side effect of increasing fuel burn and hence CO_2 emissions. An aircraft landing at London City burns more fuel on approach than when landing at Heathrow because a steeper trajectory is needed to meet noise requirements.

Emissions trading should have the effect of encouraging the employment of a range of different technologies whilst allowing people to continue flying. However, it can be assumed that surface transport, particularly electrified railways, will have a greater role than at present, and this will potentially improve noise issues as well. Already many of those travelling from central London will use electrified railways to reach Heathrow, Gatwick and Stansted. The government's commitment to build a high speed line from London to Birmingham, Manchester and Leeds creates opportunities for improved rail/air combinations, which will become financially more attractive for certain destinations once emissions trading kicks in. The construct of a major international airport near the heart of a centre of population, especially one where runway orientations force flying over particularly densely populated areas, will rapidly lose credibility.

Bob Lunnon
Secretary, Royal Meteorological Society Special Interest Group on Aviation Meteorology

Bob's letter connects well to the "Books of Interest" section later in this newsletter.

Subgroup News:

News involving the newly organized 6 subgroups in the SIGAM. The categories of subgroups, including the members of each subgroup, can be found in the minutes of the May 30, 2012 meet, available on the RmetS website. For space constraints we include here the ones with recent news.

General issues Sub-group:

A recent paper by the CAA regarding cold weather corrections to QNH altitudes did create some discussion amongst airlines. http://www.caa.co.uk/default.aspx?catid=1350&pagetype=90&pageid=12944

There's a discussion going on regarding what to do for cold temperature corrections, and how to standardize the procedure. Certain countries do their cold temperature corrections in subtly different ways, and due to an accident in Manchester involving a small aircraft there has been a renewed call in looking into this issue.

Flight Ops theoretical training:

Paul Hardaker 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).

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

Photos:

This section is new and on a trial basis, just to see how the reaction to having photos in the newsletter would look like. 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!

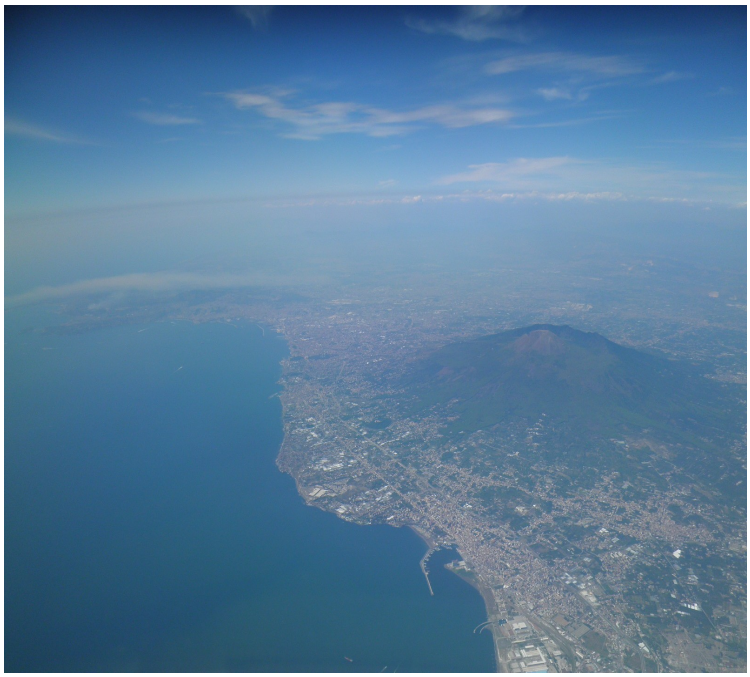

Fig. 1: View northwards towards Naples, on July 21, 2012 at around 1228 UTC. Vesuvius centre right.

Fig. 2: approach into Paris Le Bourget airport, from the east, Aug. 3, 2012 at around 1152 UTC.

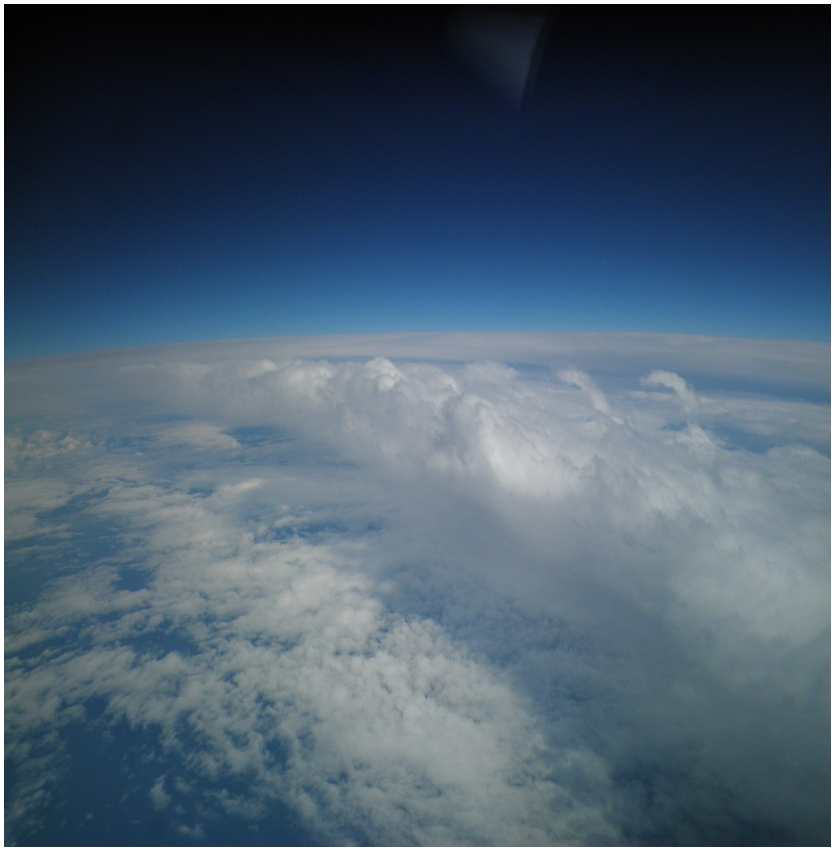

fig. 1: View from northwest towards the southern coast of the English Channel near Caen on July 13, 2012 at around 1047 UTC, the denser, taller clouds are at the fringes of a Jet Stream over the English Channel, and had a pronounced wave-like appearance. Aircraft flying in or near the area reported moderate turbulence, pronounced chop.

Articles of Interest:

AMS:
http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-11-00062.1

> Advances in numerical modelling and new observations are providing valuable information about turbulence near thunderstorms and are paving the way for the development of new turbulence avoidance and forecasting strategies for the aviation industry.

Books of Interest on the Subject of Aviation Meteorology:

The following was sent to the SIGAM by Peter McManners, Executive Fellow of Henley Business School, Reading University. The views expressed here are his own.

Fly and Be Damned
What now for aviation and climate change?
by
Peter McManners

Policy-makers face a dilemma, torn between supporting continued expansion of aviation and the need to address the sector's environmental impact. Social and economic benefits accrue from flying but the associated emissions are causing damage to the atmosphere. The looming dangers of climate change mean that this dilemma must be resolved. Looking through the lens of sustainability, there appears to be a policy stalemate that is preventing substantive progress. Dislodging the twentieth-century model of aviation, to launch twenty-first century green aviation, will require breaking this stalemate.

This is an extract from Chapter 11 – 'Green Air Vehicles'.

Learning from nature

To reduce the environmental impact of aviation, it seems appropriate to turn to nature for inspiration. This follows in the footsteps of Leonardo da Vinci, who used observation of the anatomy and flight of birds to help to sketch ideas of how a flying machine might work, and the Wright brothers, who derived inspiration from observations of pigeons in flight.

The early aviators had to advance beyond observation to understanding the dynamics of flight to be able to build machines that harnessed the principles. With knowledge of the science of aerodynamics, humans are now capable of designing a huge range of flying machines.

Modern aircraft design has moved beyond the lessons of nature to deliver supersonic and hypersonic aircraft. There are few lessons to draw from nature in such extreme flying. Nature has been left behind – and ignored. The environmental impact of flying is not a concern to most people and, until recently, reducing it has not been specified in the design brief given to aeronautical engineers. Fuel economy is a feature because it is an important metric in the economic operation of aircraft fleets, and no more important than that.

In navigating a sustainable future for aviation, biomimicry is becoming important again. Biomimicry is learning lessons from nature by careful observation and then recreating technical solutions using

the principles uncovered. The winglets that sprout from the wings of new aircraft, and are retro-fitted to older aircraft, are an example. These smooth the flow of air around the wingtips, reducing drag and improving fuel efficiency. Engineers working on the A380 claim to have drawn inspiration from the steppe eagle, a bird of prey native to Europe and Central Asia. The eagle's wings are perfectly shaped to maximize lift. It can manipulate the feathers at its wingtips, curling them to create a 'winglet', a natural adaptation that aids highly efficient flight.

Biomimicry will help the designers in the search for an aircraft that can soar above the clouds with the same grace as a steppe eagle, using thermals and atmospheric conditions to its advantage, with little more environmental impact than the birds. Instead of sticking to fixed routes and schedules and throttling up the jet engines to make headway despite the weather, flight planning will become much more complex, taking into account forecasts of wind speed and direction. Flying in tune with nature requires flexibility to work with the opportunities that weather systems provide and patience to travel at the most efficient speed for the conditions. Air traffic controllers and pilots will have to find ways to balance a complex system with few fixed parameters. Achieving this and retaining safe management of the airspace will require a new generation air traffic control systems.

As Charles Lindbergh noted before he died, the construction of an aeroplane is simple when compared with the anatomy of a bird. The complexity gap is going to close as computer-controlled green aircraft take to the skies flying like the birds, dependent on complicated cooperation between meteorologists, pilots and ground crew informed by satellite data in real time.

Comments, Feedback:

This section will be used for any comments to articles or reports in the newsletter, along with any additions or corrections. Since this is the first of these newsletters in this format this section presently is not large, but I can imagine it may become larger, especially when discussions come into play.

Thanks for your interest. Next newsletter to be expected around the latter half of autumn, around November or December.