EUMeTrain event week on Aviation Meteorology

3-7 December 2018
Agenda

To register to a session simply click on the session either in the schedule below or in the schedule on the next page

	Monday	Tuesday	Wednesday	Thursday	Friday
10 UTC	Introduction and System Testing	The high IWC (Ice Water Content) Hazard for aviation and satellite retrieval Jean Marc Moisselin Meteo France	Clear Air Turbulence Peter Schmitt DWD	Volcanic Ash Fred Prata AIRES Pty Ltd	Space Weather and the impact on aviation and air traffic Roland Winkler Austrocontrol
13 UTC	Forecasting fog and low clouds in aviation weather service Jarkko Hirvonen and Elina Tuhkalainen FMI	Forecasting of turbulence and mountain waves for aviation meteorology purposes André Simon, Péter Salavec and Balázs Szintai OMSZ	Gravity wave pattern and tropopause fold detection as new products within the Nowcasting-SAF Andreas Wirth and Alexander Jann ZAMG	Forecasting for ballooning Ab Maas former KNMI	
			Analysis and Automated Detection of Convection-Induced Aviation Weather Hazards in Visible and Infrared Satellite Imagery Kris Bedka NASA		

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10 UTC	Session 0 Introduction	Session 2 Ice Water Content	Session 4 Clear Air Turbulence	Session 6 Volcanic Ash	Session 8 Space Weather
13 UTC	Session 1 Forecasting Fog and Low Clouds	Session 3 Forecasting Turbulence and Mountain Waves	Session 5 Gravity Waves and Convection Products	Session 7 Forecasting for Ballooning	

During the week we will focus on topics which are relevant for aviation meteorology. Among others turbulence, fog, convection, volcanic ash will be treated. The lectures will be broadcasted using the WebEx Training Center platform. Participation is free and available to all only registration will be needed. Each session comprised 1 or 2 presentations. The duration of a session will be **around 1 hour**.

Session 0

Introduction and System Testing

Session 1

Jarkko Hirvonen and Elina Tuhkalainen (FMI): **Forecasting fog and low clouds in aviation weather service**

In this presentation formation and dissipation of fog and stratus will be treated. The presenters will also address how these phenomena occur around the year and how they affect the services at the airports in Finland.

Session 2

Jean Marc Moisselin (Météo-France): **The high IWC (Ice Water Content) Hazard for aviation and satellite retrieval**

Large amount of ice particle may cause erroneous aircraft probe measurement and damage aircraft engines. The ice crystals are generally located near cores of deep convection and associated cirrus anvils, at high altitude and in tropical areas. The understanding of the phenomena, its forecast are a key issue for aviation. A recent paper in BAMS Inbox reviews several methods to detect clouds associated with ice crystal icing: MSG-CPP High IWC Mask, DARDAR, PHIWC, Alpha, RDT. A series of fields experiment in tropical regions have been conducted separately or conjointly by HAIC and HIWC projects.
RDT detects and tracks convective systems. During HAIC campaigns, RDT has been provided on an operational basis through dedicated Météo-France processing chains. First objective was to target the convective areas for the pilot research aircraft, with uplink of the product. Second objective was to study with the field campaigns data how far RDT can be a tool to detect high Ice Water Content areas. Qualitative and quantitative studies provided reasonably good results, especially in terms of probability of detection.
A new day-time attribute (adapted from MSG-CPP High IWC Mask algorithm) has been implemented in RDT v2016. Now RDT is produced globally by Météo-France using five geostationary satellites. Operational applications with other products increase. New generation of satellites, feedback on products performance will help to improve retrieval of the hazard and to define future research fields.

Session 3

Péter Salavec, André Simon, Balázs Szintai (OMSZ): **Forecasting turbulence and mountain waves for aviation meteorology purposes**

Turbulence represents a hazardous weather phenomenon for aviation and a challenge from the forecasting point of view. It is a typically small-scale phenomenon and its direct observations and measurements are relatively sparse, except of the surface layer of the atmosphere. The presentation shows one possibility of turbulence diagnostics with aid of the Turbulence Kinetic Energy (TKE) calculated from a high-resolution non-hydrostatic model AROME. This parameter is calculated from a prognostic equation and it is widely used in parameterizations of turbulence or wind gusts in the Numerical Weather Prediction (NWP) models, however, it is only rarely applied as an end-product in operational forecasting. We studied the distribution of TKE in various meteorological situations, with focus on the Visual Flight Rules (VFR) conditions. One of the most extreme cases was the severe windstorm of 29 October 2017, when gusts exceeding 100 km/h were recorded in the Transdanubian territory of Hungary and high TKE values were diagnosed. We also found significant turbulence in cases of strong flow above mountains and in mountain waves. Both advantages and limits of the TKE diagnostics are discussed. The cases with strong horizontal and vertical wind shear also open the question about perception of turbulence and turbulent flow in the aviation meteorology. High attention is also given to forecasting of mountain waves, which can have both positive and negative impact on the flight. Theoretical background of mountain wave dynamics is briefly explained. A development work based on this theory is in progress at the Unit of Aviation Meteorology resulting in new products for the mountain wave gliding branch of sport aviation. A further plan is a theoretical work for increasing ability to forecast mountain wave turbulence, as well as secondary phenomena, which is generally considerably underestimated in NWP models making it a major risk for mountain wave gliders.

Session 4

Peter Schmitt (DWD): **Forecast of Clear Air Turbulence (CAT) with Satellite Images and the ICON model, based on Eddy Dissipation Rate.**

Clear air turbulence (CAT) is the term for medium- or high-level turbulence in regions with significant wind shear. CAT is an important factor for the aviation safety.

In the first part of the presentation, I will show you typical parts of CAT in relation with the 300 hPa geopotential analysis. Furthermore you get an overview to the correlation between CAT and characteristic cloud patterns in satellite images. In many cases satellite images provide the first clue or a confirmation for the presence auf CAT.

The second part is dedicated the forecast of CAT in Deutscher Wetterdienst (DWD) with the ICON model. DWD has been applying a forecast method based on Eddy Dissipation Rate (EDR). This real property of atmospheric turbulence is the main sink term of Turbulent Kinetic Energy. In a case study you will see the typical working process in practice with consideration of the model output, typical cloud pattern in satellite image and the use of the conceptual model and the structure of geopotential field.

Session 5.1

Andreas Wirth and Alexander Jann (ZAMG): **Gravity wave pattern and tropopause fold detection as new products within the Nowcasting-SAF**

Two new satellite-derived products related to turbulence analysis have been developed recently in the frame of the Nowcasting-SAF. The first product (ASII-GW"Automatic Satellite Image Interpretation – Gravity Waves") objectively detects grating patterns in the water vapor 7.3 imagery which point to the presence of gravity waves. The second product (ASII-TF "Automatic Satellite Image Interpretation – Tropopause Folding") identifies the location of tropopause folds from satellite and NWP data. The algorithm is based on the logistic regression method.
In this presentation, we will talk about the selected algorithms and present cases from the official Nowcasting-SAF validation reports (to be released shortly) to illustrate the product performance.

Session 5.2

Kris Bedka (NASA): **Analysis and Automated Detection of Convection-Induced Aviation Weather Hazards in Visible and Infrared Satellite Imagery**

Current generation geostationary satellites are observing convection that is hazardous to aviation at increasingly high spatio-temporal detail. In recent years, commercial and research aircraft have collected automated turbulence and cloud ice water content observations that can be used to better understand exactly where within deep convection the turbulence and icing conditions are typically occurring. Ground-based weather radar and severe weather reports also identify locations of hail, downburst wind, and tornadoes. Research conducted at NASA Langley Research Center (LaRC), in collaboration with a number of U.S. and international partners, has resulted in geostationary-based analyses and automated detection algorithms that can denote where turbulence, icing, and severe weather conditions are likely. These
methods are applicable to any geostationary visible and IR imager across the globe and therefore can be used to map these weather hazards in near-real time, a capability that is especially valuable over regions without weather radars and other conventional observations of aviation hazards. This talk will describe this recent NASA LaRC aviation-related convective weather research.

Session 6

Fred Prata (AIRES Pty Ltd): **Volcanic Ash**

Volcanic eruptions occur frequently, often without warning and can spread ash and gases rapidly around the globe. Many volcanoes are situated in remote regions, are unmonitored and lack any historical data that might indicate their likely eruptive behaviour. Since the late 1970's earth-orbiting satellites have been able to observe the weather around the globe and provide quantitative information on cloud movements. These data have proved extremely valuable for tracking volcanic ash clouds and more recently allowing quantitative information on volcanic ash column amounts and also on SO2 gas – another potential hazard to aviation. Notable incidents between commercial aviation and ash clouds, several in Indonesia and Alaska, have occurred during the satellite era (~1960's onwards). In this talk, I will cover the methods used to identify, quantify and monitor volcanic ash clouds and frame this in the context of the potential hazard they present to commercial aviation. The topics will include:
Volcanoes: distribution, eruptions and hazards
Satellites: polar and geostationary systems for watching volcanoes – how to use the imagery
Infrared imagery: ash and gas detection
Some examples: Eyjafjallajökull, Puyehue, Kelut, and others
Warning systems: the role of satellite instruments
Conclusions and future systems

Session 7

Ab Maas (former KNMI): **Forecasting for ballooning.**

Aviation meteorology is a wide field in terms of forecasting and forecasting product. Not only is there a big difference between the civil aviation part and General Aviation (GA), but also in GA there are a lot of specific customers who needs specific forecasts; VFR forecasts for small planes, gliding, paragliding, ultra-lights, ballooning etc.
Ballooning forecasts can also differ, e.g. the commercial balloonists need other forecasts than balloonists in competitions and championships and gas balloons can fly in weather circumstances where it is impossible for hot air balloons.
In this presentation I will show you what items are of main importance for balloon forecast e.g. accurate wind forecasts, starting and dying out of thermals and convection. And also how, beside surface observations, radio soundings, satellite and radar information can be of help.

Session 8

Roland Winkler (Austrocontrol): **Space Weather and the impact on aviation and air traffic**

Space weather is becoming increasingly important in our society, which is changing from the industrial to the information age. Also in the field of aviation as well as terrestrial meteorology, the space component plays an increasingly important role. Due to economic factors, flights in the higher latitudes, respectively in the polar regions, continue to increase year by year. In my presentation, which I divided into three parts, I would like to explain briefly in the first part what is meant by the term of space weather or the cosmic radiation. In the second part, I will give a brief overview of the individual components of space weather. The third part, which at the same time represents the main part of the lecture, I will present why the number of flights in the polar regions is strongly increasing and which dangers by the space weather on the air traffic and the passengers or the cabin crews can arise.