Summary of papers presented at the Scientific Section of the OSTIV Congress, Uvalde TX USA, 14 August 2012

Reporter Prof. Emeritus Dr. Edward (Ward) Hindman, *Technical Soaring* Manager,
for Prof. Dr. Zafer Aslan, Chair, Scientific Section

Improving an atmospheric numerical model using meteorological and glider flight recorder data; E. Hindman. S. Saleeby, O. Liechti

E. Hindman

In the first presentation of the morning session, Ward Hindman reported an atmospheric numerical model is composed of the physical processes, in mathematical form, that control the weather. Given the initial state of the atmosphere through measurements and observations, the formulas, then, are solved on a digital computer producing weather predictions. Such predictions are routinely used at glider contests to help set the tasks. The top finishers at the contests best utilize the atmospheric conditions and, thus, their flight recorder data were compared to the predictions to validate the predictions. The Colorado State University Regional Atmospheric Modeling System (CSU-RAMS) was used to make the predictions. Meteorological data and flight recorder data from select 2006 through 2009 east coast USA glider contests were used to validate the predictions. The depths of the convective boundary layer measured by the recorders were compared with the predicted depths because the depths are directly related to the the surface temperature and dew-points. As a result, it was found the predicted surface temperatures and dew-points were systematically in error. The predictions were improved significantly by adjusting, in the RAMS, the surface radiation model and the surface flux model. This result demonstrates the usefulness of glider flight recorder data to improve an atmospheric numerical model.

An on-line meteorological self-briefing system for glider pilots; E.

Hindman

In this paper, Ward described an experiment that imported from Europe to the USA a unique, on-line meteorological self-briefing system for glider pilots. His colleagues, Drs. Olivier Liechti of Analysen und Konzepte of Winterthur CH, Ralf Thehos and Erland Lorenzen of the German Weather Service (DWD), developed the glider pilot self-briefing system. The system resides at the DWD (www.flugwetter.de). Using the system, a pilot is able to 'fly' a planned task through a numerical weather prediction (NWP) to determine the task's feasibility. After the flight, the forecast can be checked using the resulting flight-recorder file. During the 2009 soaring season, the system was operated for the East Coast USA and Colorado. The East Coast system was validated using flight recorder data from glider contests and, with a few qualifications, was found successful (no contests occurred in Colorado). This study was presented in the Ward's firdt paper at this Congress. In this paper, this revolutionary system was explained and demonstrated and the results of the USA experiment were reported. Thirty-four USA pilots signed up and six submitted the results of their evaluation. The evaluations were positive. Nevertheless, the system was unavailable for the 2011 season and remains unavailable as of this presentation because an operational USA NWP model is needed to replace the DWD model. For completeness, an on-line meteorological self-briefing system for the world's glider pilots, that mimics some features of the DWD system, is at *www.xcskies.com*.

OSTIV's Mountain Wave Project (MWP) – past, present and future research of the rotor-wave system through airborne measurements and outstanding glider flights; R. Heise, J. Hacker, K. Ohlmann

R. Heise

The first presentation of the afternoon session was given by Rene Heise. A general overview of the MWP objectives and project results from the successful exploration and research missions to the Andes, Alps and Pyrenees was given, including an outlook to the next challenge, to fly the Himalayan mountains. An analysis based on the combination of the Scorer-parameter and a 2-dimensional stationary linearized mountain wave model allowed a prognostic assessment of orographic turbulence in different mountain regions of the world, and of conditions favorable to mountain wave flying. A global, relocatable numerical weather forecasting model together with this analysis is the basis for an operational wave and turbulence forecast. The 2000km World Record Flight (FAI category Free Distance; OSTIV Kuettner Prize) of the MWP chief pilot Klaus Ohlmann demonstrated impressively the capability of this approach to use interpreted model-parameters in combination with a route optimization for outstanding glider flights. The availability of data from many wave flights enabled a verification of the meso-scale forecasting model and fine tuning/adjustment of the applied parameterizations. Of further value was an analysis of 130 MWP-flights during 1999-2011 to filter out structures of wave-climbs with mathematical and statistical data mining methods in GNSS-recorder files (IGC-files). With these results, an initial wave-climatology of the Andes was produced and was used to visualize a turbulence classification of the rotor-wave system for briefing products in general and commercial aviation in particular. The accuracy of the GPS-logger derived data (wave climbs) with airborne measurements of vertical velocity during the MWP-Expedition Mendoza 2006 was tested using a Geo Information System (GIS). The high resolution measurement flights into the lower stratosphere over the Andes near Mendoza were the first scientific measurements of turbulence (TKE) in that region and allowed a validation of indirect soundings of atmospheric parameters as well. A further example of the interdisciplinary co-operation of MWP with institutes and universities are the measurements of physiological measurements during flights such as at St. Auban in 2011. Physiological parameters such as heart frequency variability, pulse oximetrie and body temperature are measured using non-invasive sensor technologies. Typical applications were presented for such data: high altitude flight physiology preparations and recommendations for pilots ("Human Factors").

Mountain Wave Project

Proposal for an extended didactic approach to a coherent understanding of atmospheric gravity waves for glider pilots; J. Dummann

Ward Hindman presented the talk on Mr. Dummann's behalf. For many decades glider pilots have in mind a simplified conceptual model of mountain lee-wave vertical motion deduced from the picture of a balloon oscillating up and down in a stable layered air mass. The didactical reduction to such a simplified model was checked in this paper. The basic wave physics were reviewed through instructive animations of wave motions in fluids and gases. As a result, the conceptual model was expanded to reveal the lee-wave is created by a horizontal confluence of an accelerated and downward deflected air mass at the leeward valley floor producing a hydrodynamically generated high-pressure rotor-region which emits energy to the windward, causing stationarity of the wave, as well as a vertical and/or downwind emission in different proportions - leading to the emergence of a vertically propagating lee-wave, trapped lee-wave or mixed type of this, depending on the prevailing aerial stratification. All this allows an unconstrained explanation of the situation as well as coherent answers to all the questions the established model of a "ballooning air parcel" leaves open.

The role of atmospheric stability and the Wind Shear Exponent (Hellmann Coefficient) on soaring potential; Z. Aslan, A. Tokgozlu

Ward Hindman presented this study on behalf of the authors. Atmospheric convection and prediction of its characteristics are essential for planning gliding activities. Climate-change and the potential increase in the frequency of severe weather conditions, which greatly affect soaring activities, are the primary foci of their short-range forecasting and now-casting efforts in recent years. This paper presented an investigation, using temporal and wavelet analyses, of some stability parameters for predicting instability in and near the vicinity of Isparta, Turkey located in the hilly region just north of the Mediterranean Sea. The data were from morning and evening radiosonde launches and hourly measurements from a mobile wind tower for 2001 and 2002. The stability parameters were bulk Richardson number (Ri) and the Hellmann Coefficient (HC). The Ri defines the balance between instability (Convective Available Potential Energy, CAPE) and wind shear (speed and directional shear with height) in an environment conducive to the formation of thunderstorms. The wind profile over flat and reasonably homogeneous terrain is well modeled using the logarithmic law where the power law exponent is a function of atmospheric stability and is called the HC. In their detailed hourly, daily, monthly and seasonal analyses of HC, temporal wind profiles were compared to stability variations defined by Ri to estimate HC values. Also, wavelet analyses were employed to extract significant characteristics from temporal variations of the Ri and the HC. Higher mean Ri values (slightly stable to extremely stable) occurred in the late afternoon. This work demonstrates that wavelet analysis can be used to study the inter-daily and the inter-annual variability of climate variables for a specific region.

Application and evaluation of the TOPTHERM model; E. Aydinöz, M. Kadioglu

Ward Hindman presented this study on behalf of the authors. The aim of this study was to test TOPTHERM forecasts with the Soaring index and actual meteorological data and reports for Munich, Germany. Java TopTask is licensed for web-based meteorological planning of soaring flights by the German Weather Service (DWD, www.flugwetter.de). Java TopTask (1) visualizes TOPTHERM weather forecasts on an interactive map and barograph, (2) plans and optimizes soaring flights in thermal, ridge and wave lift and (3) simulates recorded soaring flights with TOPTHERM weather forecasts (IGC flight recorder files). Data and methodology were as follows: Radiosonde data, Soaring Index, meteorological cards which states actual weather, diagrams and bulletins (METAR) were used to validate TOPTHERM forecasts. Munich was chosen because it is covered by TOPTHERM forecasts and its radiosonde data, meteogram cards and bulletins are available at the same time as the TOPTHERM forecasts. Output of TOPTHERM (such as T, Td, wind velocity, wind direction) shows information about the distribution of vertical velocity (i.e. glider climb rate) in convection, cloud formation, levels of possible cloud base and cloud top and weather forecast as a function of time-of-day. TOPTHERM forecasts were saved for 12 GMT and were used to compare with other data for seven days (01-07 January 2012). The results and conclusions of the study were (1) the TOPTHERM and Meteogram analysis with Temp (Skew-T Log-P) diagrams have major importance on flight plans of gliders, (2) Soaring Index estimates intensity of expected dry or moist thermal, (3) tests of statistical significance was not possible due to the small sample size (seven days). However, observations are consistent with Soaring Index results for the same time; the TOPTHERM forecasts and Soaring Index results were coherent, (4) more data is needed for the analysis of TOPTHERM reliability. In addition, this kind of study is advised for the Inönü /THK (Turkish Aernautical Association) region in which soaring flights are performed in Turkey.

Note:
The senior authors have been requested to submit their papers to OSTIV's quarterly, peer-reviewed, print and on-line journal *Technical Soaring*. The contact is Chief Editor Dr. Judah Milgram. Thus, soon you

will be able to study the complete papers.

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