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Auszug:
- Programm
- Abstract Plenarvortrag
- Abstracts von 5 Vorträgen und 3 Postern
der DLR-IPA Mitarbeiter *Gerz, Schäfer, Volkert*

Abstracts / Résumés

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The World Weather Open Science Conference
August 16 – 21, 2014

Preface

This volume of the World Weather Open Science Conference 2014 edition contains all available WWOSC 2014 submitted abstracts for:

Plenary Sessions
Panel Sessions
Parallel Session presentations
Poster Session presentations

The content of this book is available in electronic format only via the internet.

Foreword

The organizers of WWOSC 2014 are proud to present this collection of abstracts during the World Weather Open Science Conference, held the vibrant city of Montréal (Québec, Canada) from August 16 to August 21, 2014.

This electronic collection of abstracts contains all valid submissions to be presented as oral or poster presentations at WWOSC 2014. Abstracts noted as WITHDRAWN represent abstracts to be included, however; the authors or presenters were not on-site participants.

Abstracts are presented as they were submitted. The organizers take no responsibility for the content or grammatical mistakes or errors in the texts.

Abstracts presenters in the Oral program may have consented to include their PowerPoint content to interested conference participants. This content will be made available on the WMO website.

Sarah Jones & Gilbert Brunet
Co-Chairs, Science Program

Brian Mills & David Rogers
Co-Chairs, User, Application and Social Sciences (UAS) Program

Montreal, Canada

The World Weather Open Science Conference
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Joint Plenary Session

WW-JPL01.01 - A Vision of Earth-system Research, Prediction and Services in the 21st Century

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We stand at the threshold of accelerating advances in the prediction of high-impact weather and the complex interaction between the physical-biological-chemical Earth-system and global societies. As the way forward, the WMO World Weather Research Program seized upon the timely opportunity to convene the inaugural World Weather Open Science Conference that "brings together the entire weather science and user communities to review the state-of-the-art and map out the scientific frontiers for the next decade and more". This plenary lecture, during the Opening Ceremony of the Conference, will: i) highlight selected accomplishments at the forefront of the current state-of-the science, and its socioeconomic and environmental applications and assessment; ii) identify the foremost challenges to continued advancement; iii) present a vision of future advances in our science of the atmosphere and anticipated deliverables and benefits to society. This perspective draws upon input from colleagues at the forefront of the key elements of the science and its derived services. It spans observations, data-assimilation, dynamical prediction, socioeconomic applications and assessment, emerging super-computer capacity and visualization integration of geophysical and societal information. We begin with a synopsis of the foresight of Vilhelm Bjerknes, Jule Charney and Edward Lorenz, who, among others, charted the course of our journey to our current knowledge and prediction of the Earth system. The subsequent accomplishments represent one of the most significant scientific, technological and societal achievements of the 20th century. We follow with notable examples of the current state of our weather enterprise and foremost challenges before it, guided by the Conference Session Themes. We conclude with our vision of Earth-system research, prediction and services in the year 2020 and beyond.

Keywords: Earth-System, Prediction

Parallel Session

SCI-PS115.03 - Results of airborne observations in the framework of THORPEX and an outlook to T-NAWDEX 2016

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Over the past years airborne observations constituted an important component of THORPEX. The research aircrafts Falcon and recently the new airborne platform HALO participated in several airborne campaigns that directly originated from THORPEX or that provide a strong link to relevant topics. This presentation shows selected results of past campaigns with a focus on observations that are used to investigate the importance of diabatic processes for the predictability in the extratropics. A case study shows water vapour lidar observations in the inflow of a warm conveyor belt and highlights the sensitivity of the structure of the extratropical cyclone and the dynamics at upper levels to the low level humidity. Additionally Lagrangian observations in WCBs over Europe are presented that aimed at quantifying diabatic processes along WCBs. First data of the HALO aircraft performing flights in weather systems over Europe highlight the new potentials for aircraft observations of cyclones from synoptic to meso-scales. In addition, we will give a brief outlook to the internationally coordinated field experiment THORPEX North Atlantic Waveguide and Downstream Impact Experiment (T-NAWDEX) in September and October 2016 whose science objectives are strongly motivated by the results from the previous campaigns. Flights with HALO will be conducted over the North Atlantic to investigate the triggering of disturbances along the North Atlantic wave guide, their subsequent evolution and the associated downstream impacts over Europe. We give an outlook on the plans, strategy and instrumentation for the Swiss / German contribution with HALO.

Keywords: HALO, lidar, T-PARC

Parallel Session

SCI-PS115.04 - An interactive method to predict warm conveyor belt occurrence for aircraft-based field campaigns

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We propose a method to predict a probability of warm conveyor belt (WCB) occurrence for use in flight planning during aircraft-based field campaigns. The method is based on Lagrangian particle trajectories computed on the forecast wind fields of the ECMWF ensemble prediction system. By filtering the trajectories according to a user-specified ascent-criterion and by gridding the filtered trajectories, three-dimensional probability fields are derived. Despite data volumes of multiple GB of trajectory data per time step, we are able to enable the user of our method to interactively adjust the ascent-criterion as well as several gridding parameters. This allows to on-the-fly explore the sensitivity of the derived WCB probability to these parameters. The probability fields can be visualized in the context of the ECMWF ensemble forecast in the interactive 3D forecasting tool “Met.3D”. Flight tracks can be planned in direct relation to the predictions. In this presentation, we explain the method and discuss its sensitivity to trajectory seeding and grid resolution. Our method will be used to support flight planning during the internationally coordinated field experiment “T-NAWDEX” (THORPEX North Atlantic Waveguide and Downstream Impact Experiment), which is scheduled to take place in September and October 2016. T-NAWDEX will use the German research aircraft HALO to conduct flights over the North Atlantic. Here, we demonstrate our method's capabilities by revisiting flight planning cases from the former “T-NAWDEX-Falcon” field campaign, which preceded the 2016 T-NAWDEX campaign in October 2012.

Keywords: warm conveyor belts, research flight planning, uncertainty visualization, ensemble prediction

Parallel Session

SCI-PS118.02 - Stationary orographic cloud bands: Dynamic and sportive interests link satellite observations with mesoscale modelling

Hans Volkert[1]
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75 years ago, Joachim Kuettner first published a study which linked a regular series of up-draughts and down-draughts in the lee of the mesoscale mountain range “Riesengebirge” at the Polish-Czech border with distinct cross-mountain flow. Data had been collected during a regional gliding contest by no less than 22 sailplanes. Horizontal wavelength amounted to around 10 km and vertical velocities exceeded several meters per second. Such lee waves, which can lift sail planes to high altitudes, were hypothesized to fill the entire troposphere in the lee of any mountain range under suitable atmospheric conditions. On 1 February 2014 stationary clouds bands were visible in imagery of both, polar orbiting as well as geostationary satellites, in the entire region from the main crest of the Alps towards the medium height ranges as Riesengebirge some 500 km further north. Horizontal wavelengths varied between a few and 15 km. The case is used to test the ability of current high resolution mesoscale model simulations to infer the relevant patterns of vertical velocity and clouds depending on the horizontal grid size. The poster presentation aims to put the 75-year old and the recent findings into perspective with studies made after the MAP special observation period of 1999, a research and development project under the auspices of WWRP.

References: *Küttner, J., 1939: Moazagotl und Föhnwelle. Beiträge Physik der freien Atmosphäre 25, 79-114. Volkert, H. et al., 2003: Gravity over the Eastern Alps: a synopsois of the 25 October 1999 event combining in-situ and remote-sensing measurements with a high-resolution simulation. Quart. J. Roy. Meteorol. Soc. 129, 777-797.*

Keywords: Satellite observations, Mesoscale modelling

Parallel Session

SCI-PS174.04 - Interactive 3D ensemble visualization for weather forecasting

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We demonstrate the feasibility of interactive 3D visualisation of ensemble weather predictions in a way suited for weather forecasting during aircraft-based atmospheric field campaigns. Research flights with high-flying aircraft require the flight route to be planned several days in advance, hence, being able to assess the uncertainty of the forecast on which a flight is based is very valuable. Since the targeted upper-level features are of an inherently three-dimensional nature, it seems natural to aid their identification with three-dimensional visualization methods. We present "Met.3D", a novel forecasting tool that makes recent advances in 3D and uncertainty visualization available to the forecaster. Interactive 2D and 3D visualization elements, displaying forecast meteorological fields and uncertainty measures derived from the ECMWF ensemble prediction system, enable the meteorologist to quickly identify atmospheric features relevant to a flight and to assess their uncertainty. Application of Met.3D is demonstrated with a case study from the 2012 T-NAWDEX-Falcon field campaign, a project that aimed at taking in-situ measurements in warm conveyor belts (WCBs). To predict a 3D "probability of WCB occurrence", p(WCB), a method based on Lagrangian particle trajectories computed on the ensemble wind field is proposed. We discuss major challenges of our work: efficiently computing uncertainty measures from the terrain-following ECMWF model grids varying with each ensemble member, finding the best compromise between p(WCB) accuracy and computational demand, exploiting available graphics hardware to compute visualizations from the prediction data at interactive frame rates, and building a "bridge" from 2D views familiar to meteorologists to 3D views.

References: *Rautenhaus, M., C. M. Grams, A. Schäfler, and R. Westermann, 2014. GPU based interactive 3D visualization of ECMWF ensemble forecasts. ECMWF Newsletter, 138 (Winter 2014), pp. 30-34.*

Keywords: 3D visualization, uncertainty visualization, ensemble weather prediction, warm conveyor belts

Parallel Session

SCI-PS251.01 - Mitigating the impact of weather hazards on aviation

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"How can aviation become safer, greener, and more efficient?" This is a key question in aviation industry today. Meteorology plays a key role in answering that question since no other industry is more sensitive to weather than the aeronautical industry. Decision makers in air transportation will have to rely more and more on precise, on-demand and tailored information on weather and weather-related hazards in order to fulfil the requirements of the airspace users and passengers for a smooth, undisturbed, safe, and punctual flight. But which meteorological information is required by the aviation stakeholders? How can such information be extracted from observation and prediction data? The information must be unambiguous, on-time and easy to understand. How can it be tailored to the user's needs? The hazardous phenomena vary from a few tens of metres and seconds for wake vortices to several thousand of kilometres and days for volcanic ash. How to prepare and harmonize that information for system integration? DLR is developing an integrated advisory system for adverse weather, climate protection and disruptive events for a future air traffic management. Candidate phenomena include hazards like in-flight icing, thunderstorms, turbulence, snow and ice, wake vortex, volcanic ash, and sensitive areas of noise abatement and high climatic impact. The aim is to characterize such phenomena by objects, coded in xml/gml format. The system is seen as an enabler for Common Information Sharing and Collaborative Decision making.

Keywords: detection, tracking and prediciton of weather phenomea, unambiguous, taillored information, from wake vortices to volcanic ash clouds

Poster Session

SCI-POS1084 - T-NAWDEX-Falcon: Lagrangian observations of warm conveyor belt air masses

Andreas Schäfler[1], Maxi Boettcher[2], Andreas Dörnbrack[1], Christian M. Grams[2], Stefan Kaufmann[1], Marc Rautenhaus[3], Christiane Voigt[1,4], Heini Wernli[2]

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The transport of water vapor in coherently ascending Warm Conveyor Belt (WCB) airstreams within extratropical cyclones governs large parts of diabatic processes in the mid-latitudes. These processes associated with latent heat release due to phase transitions of water, surface fluxes or radiative effects are highly relevant for the evolution and intensity of northern hemispheric mid-latitudes cyclones and the dynamics at the tropopause. Still, the representation of diabatic processes along WCBs is considered to be a limiting factor for the predictability of cyclones and downstream weather. In October 2012 the T-NAWDEX-Falcon (THORPEX-North Atlantic Waveguide and Downstream Impact Experiment) took place over Europe and nine research flights were conducted in WCBs. The aim was to quantify the transport of moisture and the net latent heating along the WCB. We present an overview on the efforts that were made to carry out Lagrangian matches of two consecutive flights. The Lagrangian connection between the performed flights and the observed data during different stages of the WCB is discussed. Besides in-situ observations of wind, temperature and humidity to characterize the thermodynamic structure of the WCBs, data of a set of dropsondes is shown to gain a complete view on the complex structure of the WCB.

Keywords: diabatic processes, water vapour

Poster Session

SCI-POS1085 - International cooperation and technological advances pave the way: from GARP (1967-1982) to THORPEX (2005-2014)

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Jacob BJERKNES declared 50 years ago: "But yet I would give highest recommendation to the less narrow and more basic field or meteorology which still is our first duty to society: WEATHER FORECASTING." He applauded the advent of satellite observations, but rejected the naive belief that reliable forecasts would be a by-product of Earth-observation from space. Conception and conduct of THORPEX profitted from a sequence of international field campaigns during the previous decades, e.g. the First GARP Global Experiment (FGGE, 1978/79) and ALPEX (1982) within the Global Atmospheric Research Programme (GARP), the Fronts and Atlantic Storm Track Experiment (FASTEX 1997) or the Mesoscale Alpine Programme (MAP, 1995-2005), all under the auspices of WMO and, since 1997, its World Weather Research Programme (WWRP). A mixed participation of meteorological services, university institutes and research laboratories was characteristic to all endeavours, while repeated participation of the same groups and key personalities provided continuity. Novel observational techniques (inter alia radar networks, dropsondes, lidar profiles) as well as specialized airborne and spaceborne platforms regularly provided extra motivation for the planning of campaigns. The growing integration of research suites at operational centres (e.g. ECMWF, NRL) much aided the digestion of the non-routine data, either post festum or increasingly near real-time. The presentation provides some highlights from previous campaigns and attempts to underscore generalities of large international fields experiments, sometime dubbed "particle accelerators" of the atmospheric sciences. So presentations on the various THORPEX campaigns are put into a tradition and their specific achievements obtain backcloth.

References: *Bjerknes, J., 1964: Half-a-century of change in the meteorological scene. Bull. Amer. Meteorol. Soc. 45, issue 6, 312-315. Thorpe, A.J., 1999: Editorial to special issue on FASTEX. Quart. J. Roy. Meteorol. Soc. 125, 3129. Volkert, H. and T. Gutermann, 2007: Inter-domain cooperation for mesocale atmospheric laboratories: the Mesoscale Alpine Programme as a rich study case. Quart. J. Roy. Meteorol. Soc. 133, 949-967.*

Keywords: Field experiments, WWRP, WMO

Poster Session

SCI-POT1176 - **Impact of the inflow moisture on the evolution of a Warm Conveyor Belt**

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During a THORPEX-PARC (Pacific Asian Regional Campaign) aircraft mission that was conducted east of Japan on 19 September 2008 the humidity structure in the inflow of a Warm Conveyor Belt (WCB) was observed by a high resolution Differential Absorption Lidar. The comparison of observed humidity profiles with ECMWF analysis fields showed an overestimation of the low level moisture content. To investigate the sensitivity of the forecast of the cyclone, the associated WCB and the downstream weather evolution to the diagnosed uncertainty of the moisture fields, the water vapour profiles were assimilated into the European Centre for Medium Range Weather Forecasts (ECMWF) Integrated Forecasting System (IFS). In this way the inflow moisture humidity in the analysis could be corrected. Two ECMWF model runs are compared which are initialized from the operational observations and the analysis with additionally assimilated high resolution lidar water vapour observations. The reduced transport of moisture into the WCB affected the latent heat release along the WCB as well as the PV production at lower levels which subsequently caused a lower WCB outflow height and a reduced tropopause height. This led to a weaker ridge building and reduced jet stream wind speeds downstream. Comparisons with the operational analysis show that the better representation of the initial humidity field in the inflow region leads to an improvement of the forecast. Although the impact on the developing surface cyclone was small, improvements of the PV structure as well as of the kinetic energy could be identified.

Keywords: T-PARC, differential absorption lidar, data assimilation