IHOP_2002 Newsletter
Volume II

The purpose of the IHOP_2002 Newsletter is to provide the IHOP community with information on IHOP announcements, meetings, article submissions, instrument/data findings, etc. The newsletter will be produced on a quarterly basis.

If you would like to contribute, please send your submissions to tignor@ucar.edu. Figures and images are always appreciated

International H_2O Project
IHOP_2002

Upcoming Events:

10th Conference on Mesoscale Processes
23-27 June 2003 - Portland, Oregon
Conference Website: http://www.ametsoc.org/AMS/meet/fainst/10mesoscale.html

International Union of Geodesy & Geophysics 2003 General Assembly
30 June-11 July 2003 - Sapporo, Japan
Conference Website: http://www.iamas.org

International Geoscience & Remote Sensing Symposuim
21-25 July 2003 - Toulouse, France
Conference Website: http://www.ewh.ieee.org/soc/grss/igarss.html

AMS 31st Conference on Radar Meteorology
6-12 August 2003 - Seattle, Washington
Conference Website: http://www.ametsoc.org/AMS/

6th International Symposium Tropospheric Profiling
14-20 September 2003 - Leipzig, Germany
Special IHOP session!
Conference website: http://istp2003.tropos.de:8085/

Summary of Spring Science Workshop

An International H_2O Project (IHOP_2002) spring science workshop was conducted at the National Center for Atmospheric Research in Boulder, Colorado 24-26 March 2003. The purpose of this workshop was to present preliminary results, expand collaborations, and to discuss any data quality control issues. There were over 90 participants from the U.S., Canada, France, and Germany. Fifty presentations were given in the areas of Instrumentation, Intercomparisons, Atmospheric Boundary Layer, Boundaries and Bores, Convective Initiation and Modeling. Extensive collaborations are underway, and an effort is being made to coordinate the submission of comparable or related journal articles. Efforts are also in progress to establish special issues of journals and special sessions at annual meetings and conferences to target IHOP results. An IHOP data assimilation workshop is currently being planned for autumn 2003.

Spring Science Workshop Presentations:

http://www.atd.ucar.edu/dir_off/projects/2002/IHOPwsMar03/presentations.html

Publications:

Ehret, G., A. Fix, H. Flentje, C. Kiemle, G. Poberaj, M. Wirth:"High resolution airborne water vapour DIAL during IHOP", in Optical Remote Sensing, OSA Technical Digest, (Optical Society of America, Washington DC,2003), pp 54-57Quebec City

Flamant, C., F. Guichard, J. van Baelen, O. Bock, F. Couvreux, D. Parsons, T. Weckwerth, J. Pelon, P. Drobinski, K. Lhomme, M. Guenno and E. Doerflinger, 2003: 'La campagne IHOP'. La Météorologie, in press.

van Baelen, J., O. Bock, E. Dorflinger, J-P. Aubagnac, Ph. Collard, A.Walpersdorf, F. Masson, 2003: GPS/H2O, étude de vapeur d'eau atmosphérique: contribution française à la campagne IHOP, in préparation for La Météorologie.

Wang, J., D. Carlson, D. Parsons, T. Hock, D. Lauritsen, H. Cole, K. Beirle, and E. Chamberlain, 2003: "Performance of operational radiosonde humidity sensors in direct comparison with a reference-quality humidity sensor and its climate implication". Submitted to Geophysics Research Letter.
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPabstracts/wang_geophysreslet.pdf

Conference Papers:

"Observed convergence of water vapor prior to and during the June 12, 2002 Northern Oklahoma Storm Using the Global Positioning System" submitted by John Braun and Yuanfu Xie to the 10th Conference on Mesoscale Processes.
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPabstracts/braun_mesocnfrnc.pdf

"Observations of the finescale structure of 11 June dryline during IHOP 2002" submitted by Huaqing Cai to the 31st AMS Conference on Radar Meteorology. http://www.atd.ucar.edu/dir_off/projects/2002/IHOPabstracts/cai_lee_rdrwrkshp.pdf

"Assimilation of AERI data into MM5" submitted by Fleur Couvreux to the Atelier de Modelisation de l'Atmosphere.

"High resolution airborne water vapour DIAL during IHOP" invited talk by Gerhard Ehret to the Optical Remote Sensing Conference.

"The life cycle of a bore event over the US Southern Great Plains during IHOP_2002" submitted by Cyrille Flamant to the 10th Conference on Mesoscale Processes.
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPabstracts/flamant_mesocnfrnc.pdf

"The life cycle of a bore event over the US Southern Great Plains during IHOP_2002" submitted by Cyrille Flamant to the 6th International Symposium on Tropospheric Profiling.
http://www.atd/ucar/edu/dir_off/projects/2002/IHOPabstracts/flamant_istp.pdf

"An eye-safety radar for lidar operations" submitted by Grant Gray to the 31st AMS Conference on Radar Meteorology and the International Geoscience & Remote Sensing Symposuim.

"Analysis of water vapour variablility and its links with convection: some IHOP_2002 preliminary reults" submitted by Françoise Guichard to the EGS-AGU-EUG Joint Assembly.

"Multisensor study of a dual bore event observed during IHOP" submitted by Steve Koch to the 10th Conference on Mesoscale Processes. http://www.atd.ucar.edu/dir_off/projects/2002/IHOPabstracts/koch_mesocnfrnc.pdf

"Horizontal water vapor DIAL measurements in the atmospheric boundary layer over the South Great Plains during IHOP_2002" submitted by Karen Lhomme to the 6th International Symposium on Tropospheric Profiling.
http://www.atd/ucar/edu/dir_off/projects/2002/IHOPabstracts/lhomme_istp.pdf

"IHOP French GPS water vapour contribution" submitted by Joel van Baelen to the EGS-AGU-EUG Joint Assembly.

"GPS derived water vapour dynamics in convective initiation cases" submitted by Joel van Baelen to the 6th International Symposium on Tropospheric Profiling.

"Fine-scale radar observations of a dryline during the International H_2O Project" submitted by Christopher Weiss and Howie Bluestein to the 31st AMS Conference on Radar Meteorology.

12 JUNE 2002 RAPID WATER VAPOR TRANSITIONS DURING THE IHOP FIELD PROGRAM

by Wayne Feltz, Derek Posselt, & John Mecikalski CIMSS
Gary Wade & Timothy Schmit, NOAA/NESDIS/ORA

The International H2O Project (IHOP) was conducted in the Southern Great Plains (SGP) region of the United States from 13 May – 25 June 2002. A primary goal for the program was to measure water vapor variability at high temporal/spatial to study the mechanisms for convective initiation (CI) within the Southern Great Plains region. A fixed suite of ground based instruments composed of radars, lidars, an interferometer, and in situ meteorological instrumentation were installed at a location called the Homestead Profiling site (Fig. 1) to provide near real-time measurement of the atmospheric boundary layer and tropospheric atmospheric state.

On 12 June, a rapid oscillation within the atmospheric boundary layer (ABL) water vapor field was detected by an Atmospheric Emitted Radiance Interferometer (AERI) temperature/moisture profiling system (Fig. 2) and a Global Positioning System (GPS) receiver. The AERIplus retrievals (Feltz et al. 1998, 2002) indicate the water vapor mixing ratio field dried rapidly in time at approximately 0700 UTC, then moistened between 0900 – 1000 UTC and dried again between 1200 – 1300 UTC. The AERIplus and GPS total precipitable water (TPW; Bevis et al. 1994) amount fluctuated by greater than 30% (1 cm) three times during a ten hour period (Fig. 3).

These water vapor transitions were not detectable by surface moisture observations, and could only be resolved with high temporal remote sensing capability. If radiosondes had been launched from this location at standard synoptic times (0000 and 1200 UTC) the moisture perturbations would have also been missed altogether.

This mesoscale event provided a unique water vapor signal from which various remote-sensing instrument comparisons could be conducted. Hourly Geostationary Operational Environmental Satellite (GOES) sounder derived 10x10 km TPW measurements (Menzel et al. 1998) were compared to the AERIplus water vapor as well as to GPS TPW. From Fig. 3, the GOES-11 TPW tendency was consistent with the AERIplus and GPS TPW until 1100 UTC when the GOES-11 TPW amounts fail to capture the increase and decrease (likely due to the spatial resolution of the GOES sounder footprint).

In situ and remotely sensed IHOP data sets will be used to improve the initial analysis for the Penn State MM5 version 3.5 model specifically for this case study. Future work includes the analysis of MM5 model output and wind profiler data to understand the origin and interaction of the dramatic water vapor transitions remotely sensed over the Homestead site.

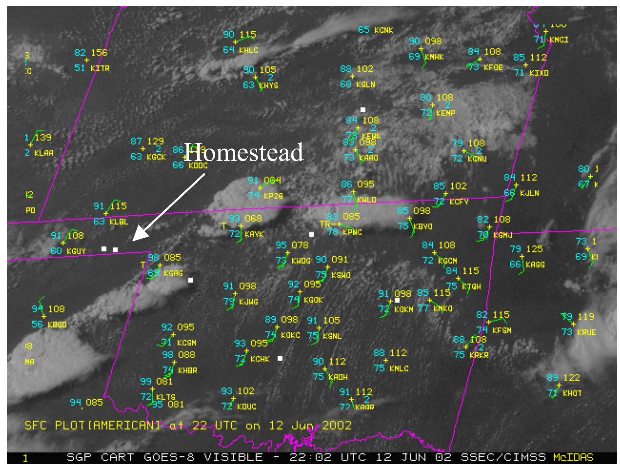

Figure 1: A GOES-8 visible satellite image of the IHOP field experiment domain. The white dots indicate locations of fixed ground based instrumentation supported by the DOE ARM program or IHOP. The location of the IHOP Homestead site is indicated.

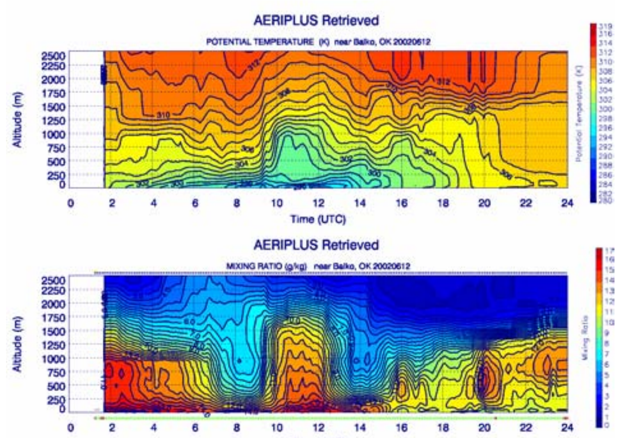

Figure 2: A time-height cross section of AERI derived potential temperature and water vapor mixing ratio from 12 June. A rapid water vapor fluctuation is apparent between 0600 and 1400 UTC.

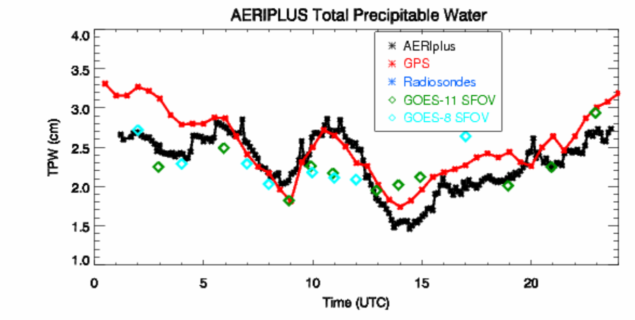

Figure 3: A time series comparison of all possible Homestead site TPW measurements on 12 June: AERIplus (black), GPS (red), radiosondes (dark blue), and GOES 11 (green)/ GOES-8 (light blue) SFOV.

REFERENCES

Bevis, M., S. Businger, S. Chiswell, T. A. Herring, R. A. Anthes, C. Rocken, and R. H. Ware, 1994: GPS Meteorology: Mapping zenith wet path delays onto precipitable water. *J. Appl. Meteor.,* **33**, 379-386.

Feltz, W. F., W.L. Smith, R.O. Knuteson, H.E. Revercomb, H.M. Woolf, and H.B. Howell, 1998: Meteorological applications of temperature and water vapor retrievals from the ground-based atmospheric emitted radiance interferometer (AERI). *J. Appl. Meteor.,* **37**, 857-875.

Feltz, W. F., H. B. Howell, R. O. Knuteson, H. M. Woolf, and H E. Revercomb, 2002: Near Continuous Profiling of Temperature, Moisture, and Atmospheric Stability using the Atmospheric Emitted Radiance Interferometer (AERI). *J. Appl. Meteor., Accepted for publication.*

Menzel, W. P., F. C. Holt, T. J. Schmit, R. M. Aune, G. S. Wade, D. G. Gray, and A. J. Schreiner, 1998: Application of GOES-8/9 Soundings to weather forecasting and nowcasting. *Bull. Amer. Meteor. Soc.,* **79**, 2059–2078.

IHOP Session from the AMS 2003 Conference

An Overview of the International H2O Project (IHOP_2002) (Invited Presentation)
Tammy M. Weckwerth, NCAR, Boulder, CO; and D. B. Parsons
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPamsAbstracts/weckwerth.pdf

Utilizing the IHOP 2002 data to study the variability in surface evaporation, runoff, and precipitation for the SGP
Fei Chen, NCAR, Boulder, CO; and M. A. LeMone, D. N. Yates, R. L. Grossman, T. Horst, R. H. Cuenca, D. S. Niyogi, and P. Blanken
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPamsAbstracts/chen.pdf

Mesoscale variability in CBL structure observed during IHOP: causes and implications for convective initiation
Kenneth J. Davis, Penn State Univ., University Park, PA; and K. J. Craig, A. R. Desai, S. Kang, N. L. Seaman, D. R. Stauffer, B. P. Reen, and S. J. Richardson
http://ams.confex.com/ams/annual2003/techprogram/paper_55715.htm

The Effects of Surface Heterogeneity on Boundary-Layer Structure and Energy Fluxes from Aircraft
Margaret A. LeMone, NCAR, Boulder, CO; and R. L. Grossman, F. Chen, K. Davis, and B. Geerts
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPamsAbstracts/lemone.pdf

Water vapor variations in echo plumes in the convective boundary layer
Bart Geerts, University of Wyoming, Laramie, WY; and Q. Miao
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPamsAbstracts/geerts.pdf

Large-scale water vapor, aerosol, and cloud distributions determined from airborne lidar (LASE) measurements during the IHOP field experiment
Edward V. Browell, NASA/LARC, Hampton, VA; and S. Ismail, R. A. Ferrare, S. A. Kooi, A. Notari, and C. F. Butler
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPamsAbstracts/browell.pdf

The Impact of GOES-11 Data on IHOP
Robert J. Kuligowski, NOAA/NESDIS, Camp Springs, MD
http://www.atd.ucar.edu/dir_off/projects/2002/IHOPamsAbstracts/kuligowski.pdf

Geopotential Height Correction for IHOP Dropsonde Data *(as of April 22, 2003)*

by By Junhong Wang and Kathryn Beierle, NCAR

1. Background

In the IHOP dropsonde data released in October 2002, the geopotential height values were calculated integrating from flight level down, using the hydrostatic equation, because unlike with dropsondes launched over the ocean the surface altitude of the land is unknown. We recommended not using geopotential height data in files from either the IHOP Falcon or the Lear jet for two reasons. First, there are uncertainties in the flight level heights which are used as a reference by ASPEN (our QC software) to integrate geopotential heights. Second, there are no flight level PTU data for any of the Lear jet soundings because there were no PTU sensors on board, and for Falcon soundings there is no flight level pressure data for 37 of the 88 soundings. For the Falcon soundings with flight level PTU data, the data were manually entered and therefore its accuracy is unknown.

A systematic ~200-300 m height difference was found between co-located dropsondes and radiosondes at the Homestead site by Ed Browell's group (see Fig. 1). We found that the ~200-300 m offset is due to the fact that ASPEN uses flight-level height, but first available pressure data for soundings without flight-level PTU data to integrate geopotential height from the flight-level to the surface. The first PTU data point in the file is available approximately 20 seconds after the launch of a sonde because of the time lag of the temperature sensor. The descending speed of the dropsonde is about 10-15 m/s which would explain the ~200-300 m offset.

2. Corrections

As suggested by Ed Browell, we obtained the 1-km elevation data from NOAA's National Geophysical Data Center, found the elevation of the dropsonde locations from the dataset, integrated geopotential height from the surface to the flight level and inserted the new geopotential height values into the data. The surface elevation can be found on line 12 ("Surface Elevation (m):") in the header of the dropsonde data. In this calculation, the last available dropsonde data point is assumed to be the surface data.

After corrections, the new data reduced the difference between co-located dropsonde and radiosonde geopotential heights to less than 30 m (Fig. 1). However, a time series analysis of dropsonde data for each mission showed that 27 of the dropsondes from the Lear jet lost data before reaching the ground, so integrating from the surface upward produced incorrect geopotential heights. For these soundings, the geopotential heights were available pressure measurement after launch in the raw data file, which most of the time is less than 2 seconds after launch, and manually inserted it into the flight-level data line. We were able to do this because the pressure sensor does not have the time lag error. The first available temperature and humidity after launch, from the ASPEN-QCed data at ~20 seconds, are assumed to be the flight-level data and were input into the raw file on the flight-level data line. The raw dropsonde data files were then re-run through ASPEN to produce the new corrected QCed data. (Note: the assumption of a constant temperature for the first 20 seconds has minor impacts on the geopotential height calculation). After corrections, a time series analysis showed reasonable patterns dropsonde and radiosonde soundings show good agreement and validate our corrections. of temperature for each flight (Fig. 2). Comparisons of geopotential heights calculated, integrating downward from the flight level, by incorporating flight-level PTU data using the following approach. We found the first from nine co-located dropsonde and radiosonde soundings show good agreement and validate our corrections.

3. Important Notes

After the extensive efforts, explained above, to improve the IHOP dropsonde geo-potential height data, some uncertainties remain about the accuracy of the data because of uncertainties in the elevation data and flight-level heights, and the assumption of a constant temperature for the first ~20 seconds. In addition, it is possible that the geo-potential heights for some of soundings may still have problems that have yet to be found. Therefore, we recommend taking caution when using the height data. We also recommend not using the flight level data (at time=0s) because of the modifications made to it which were described above. It should also be kept in mind that the data point at the lowest level in the final dataset does not necessarily represent the surface data because some soundings have missing data before reaching the surface.

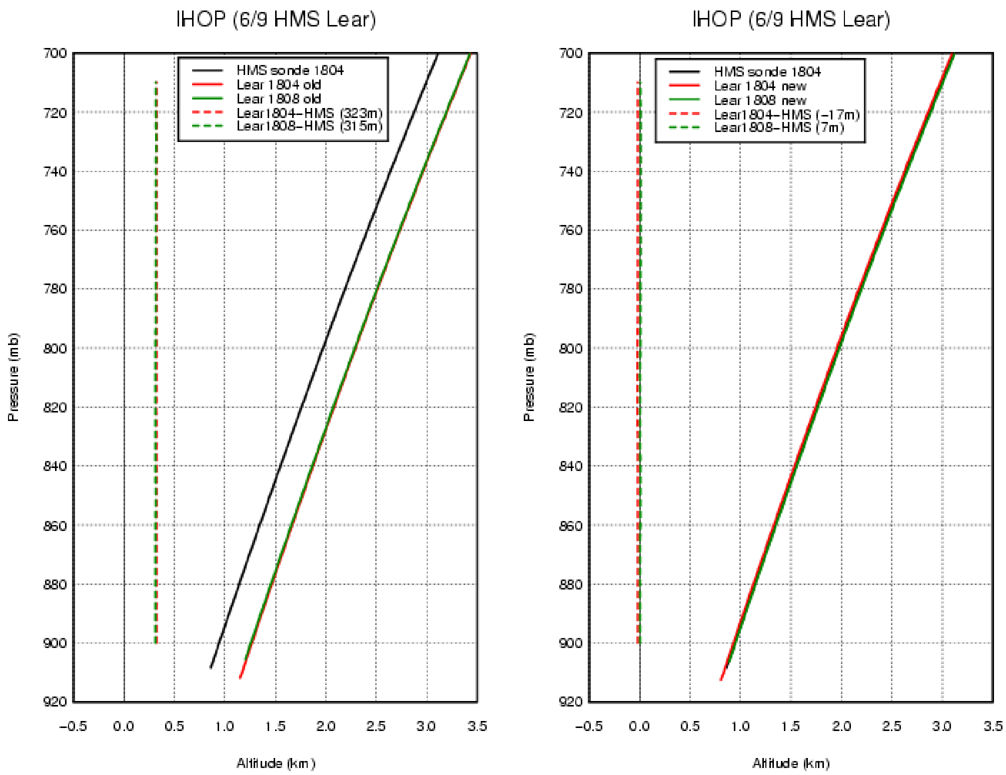

Fig. 1: Comparisons of geo-potential heights from Lear dropsonde data on June 9 at 18:04 and 18:08 UTC and radiosonde data at the Homestead site at 18:04 UTC before (left panel) and after (right panel) corrections. The dashed lines are differences between dropsonde and radiosonde data, and the mean differences are given in parentheses in legends.

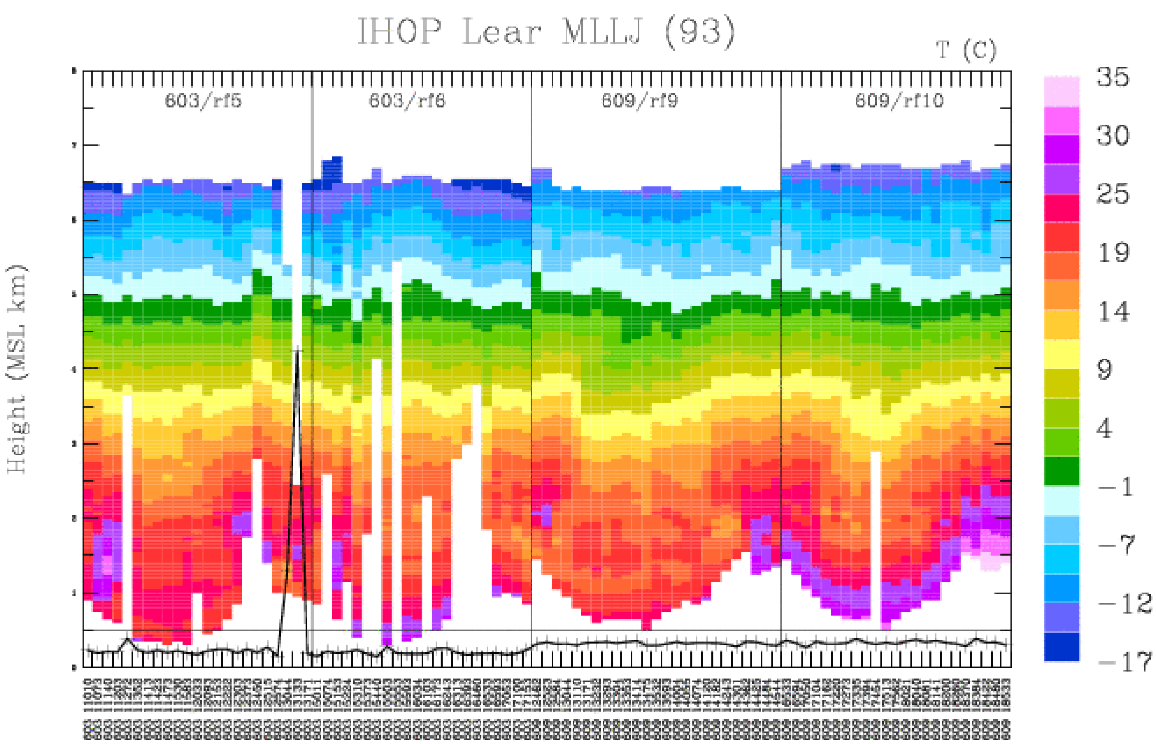

Fig. 2: Temperature profiles for all Lear MLLJ soundings. The black line shows the differences in geo-potential heights at the flight level and at the first available data point (~20 s). Vertical solid black lines separate each flight.