REPORT FROM THE 7th INTERNATIONAL WINDS WORKSHOP
AND
PREPARATION OF THE 8th INTERNATIONAL WINDS WORKSHOP

The paper summarises the outcome of the 7th International Winds Workshop (IWW7). This workshop, originally planned for October 2003, took place in June 2004 in Helsinki, Finland; i.e. after the last CGMS. The paper presents the response of IWW7 to actions from CGMS in the Annex.

The second part of the paper addresses the upcoming IWW8 in Beijing in April 2006. In particular it is suggested to stimulate and re-enforce research on the derivation and use of Atmospheric Motion Vectors (AMVs); to this end the paper lists specific issues that should be addressed.

CGMS 33 is invited to discuss the suggestions made and place pertinent actions on and make recommendations to IWW8.

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1 INTRODUCTION

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2 7TH INTERNATIONAL WINDS WORKSHOP

The 7th International Winds Workshop took place in Helsinki from 14 - 17 June 2004 in Helsinki, Finland, following an invitation of the Finnish Meteorological Institute.

In preparation of IWW7 the Working Group III on 'Satellite Derived Winds' at CGMS XXXI had formulated various actions which were taken up by the Working Groups at IWW7. Annex I provides a summary of the 7th International Winds Workshop and Annex II provides the reports from the three Working Groups which specifically refer to the actions from CGMS.

Highlights of the discussions in the working groups can be summarised as follows:

1) New and innovative approaches are needed to generate products that capture the smaller scale features observed in animated imagery, i.e. in that area satellite information is clearly under-utilised. The NWP community is encouraged to continue and enhance mesoscale modelling development so that the evident information in high-resolution, rapid-scan imagery can be utilised in a quantitative manner.
2) Satellite operators are encouraged to revisit their methods and algorithms with the goal to better characterise the errors of AMVs. This should be done, in particular, for the height assignment.
3) Height assignment of AMVs has again been identified as an area of improvement.
4) The potential gap in the supply of a water vapour wind product over the polar regions once MODIS is no longer active has been noted. Efforts are encouraged to close the potential gap with a new mission, e.g. in a highly elliptical orbit.
5) It has been suggested to invite a presentation on passive, polarised microwave observations for ocean surface wind retrieval for IWW8.

3   SUGGESTED AREAS FOR RESEARCH ON AMVS

This section lists scientific and technical areas that should be addressed at IWW8 with the goal to establish coordinated and sustained research activities by satellite operators and NWP users, but also within the academic research community.

It is emphasised that there is an immediate pressure to arrive at significant improvements resulting in a better use of the data for numerical weather prediction and other applications. Otherwise it is conceivable that the usefulness of AMVs might degrade over the next 5 – 10 years. This clearly suggests that there is a need for an increased research effort and for new ideas. It is disconcerting that some of the outstanding issues (e.g. height assignment) have been around for more than a decade without significant progress, although the first decade of AMV production and utilisation has seen some good progress in this area. With the advent of Meteosat-8 the possibilities to study the various height assignment techniques in detail have greatly improved, because all established techniques (e.g. CO_2-slicing and water-vapour-intercept methods) can be studied with the same data set.

An excellent summary of recent innovations in deriving AMVs from satellites has been presented by Velden et al. (2005) in the Bulletin of the American Meteorological Society. This paper is essential reading for an active participation in the upcoming discussion at CGMS in Working Group II and at IWW8. Here I will only recall the salient points of the Section entitled 'Pending advances' by Velden et al.:
a) Observing system simulation experiments (OSSEs) have been conducted by NASA GMAO to investigate the impact of space-based lidar wind profiles. Results show substantial improvements in forecast quality from the assimilation of simulated space-based lidar winds.
b) As a logical sequel of the above it is necessary to put a focus on research and utilisation of winds from the ESA Atmospheric Dynamics Mission (ADM).
c) Research and development activities have been pioneered at CIMSS/University of Wisconsin to study wind profile information that can be derived from hyperspectral imagers/sounders in geostationary orbit. Aircraft measurements along with radiative transfer calculations provide the basis for studies. The goal is to produce 'altitude resolved' AMVs providing vertical profiles of wind vectors from tracking water vapour features at different altitudes. Interestingly the approach also takes care of the current notorious problem of adequate height assignment. The proof of concept has been demonstrated and pertinent reports are expected at IWW8.

In addition to the above points from Velden et al. the following provides a list of issues that should be considered in norder to stimulate the research and development work on winds from satellites with a focus on AMVs. The list does not claim to be complete and WGII at CGMS 33 is invited to amend the list of topics as required:

Height assignment

i.   Improve the height assignment of AMVs, especially at high altitudes and mid-level. This call is not new but rather around for more than a decade. However advances in satellite technology make it possible to address the matter in a much better way, e.g. the different established multi-channel height assignment methods from Meteosat-8 provide a basis

for such studies. SEVIRI on MSG provides the opportunity to test the established methods of height assignment (CO2-slicing and water vapour intercept) and their variations with a consistent data set. This should help to comparative studies with the goal to find out which method works best under specific conditions.

ii. Efforts should be made to go beyond descriptive analyses of results for the height assignment in terms of simple statistics. Instead it is vital to understand the physical reasons for discrepancies between e.g. CO2-slicing and other methods.

iii. CO2-slicing and water vapour intercept methods could also be tested for temporal consistency using the frequent images from SEVIRI.

iv. Radiative transfer simulation tools are needed to investigate the height assignment of AMVs. The models must include realistic treatment of clouds (microphysics and vertical variability). Specifically they could provide guidance on the use of channels in multi-spectral methods (e.g. use of 10.8 µm or 12 µm channel together with the 13.4 µm channel). Although the benefit of such studies will not be realised immediately by all satellite operators, the new imaging missions on future satellites will capitalise on those results.

v. The radiative transfer simulations will also tell how sensitive the height allocation is to radiance bias errors. This may trigger the need for bias corrections of satellite radiances. This in turn calls for an improved operational satellite calibration, an activity currently pursued under the WMO Space Programme.

Nowcasting applications

vi. Software packages (some from industry), which include AMVs or displacement vectors, are being used operationally at national weather services for nowcasting. The application seems to be quite valuable to forecast the displacement of mesoscale systems. It appears that there is no rigorous attempt being made to distinguish between system displacement and local wind field. It is suggested to scrutinise the derived displacement vectors and study, in a systematic manner, the relationship between 'target area for the cross-correlation' and 'representativeness of the vector for the local wind field or for a system displacement'.

vii. A broader scientific question to be addressed is the relationship between spatial scale of feature displacement and apparent/true wind.

NWP

viii. Investigate the error characteristics of AMVs and develop a quality indicator for the height assignment. Current Quality Indicators do not explicitly denote confidence in the height assignment.

ix. Valuable studies on the error correlation of AMVs (essential for NWP) have been performed over recent years and reported at the IWW. The result is a correlation of errors over hundreds of kilometers. It is suggested to revisit those studies and also address the 'spatial information content' that is being captured by AMVs. It may well be that current NWP models have difficulty to assimilate this evident information. However other studies seem to support the notion that the spatial variability of the wind field does indeed contain information of value to NWP models.

x. Capabilities to infer spatial derivatives of wind fields (e.g. divergence patterns) directly from satellite image data should be explored further. They provide a basis for i)

diagnostic studies addressing the performance of convective schemes in NWP models and ii) new information to be considered for assimilation.

xi. It may be of value to revisit simple structure function analyses of state-of-the-art AMVs products (e.g. from high resolution VIS channels and from clear-sky WV winds) to infer the horizontal correlation of the wind fields.

xii. NWP centres are requested to provide guidance on the priority of efforts to be made in order to improve AMVs and CSR (clear sky radiance) products.

xiii. High-resolution NWP models provide the possibility to calculate synthetic spectral satellite images from the model data. Tracking could be performed in those images to address and understand the fidelity of clear-sky AMVs from WV channels.

xiv. Reprocessing of winds in support of re-analyses: Here the efforts of JMA and EUMETSAT in support of re-analysis projects at NWP centres are recalled. Other satellite operators are invited to conduct similar activities.

General topics

xv. At IWW8 both the NWP user community and satellite wind producers should revisit the current applications and perform a critical review of recent progress with the goal to identify areas where the AMV data have most to offer; i.e. where the return on investment is highest.

xvi. A general recommendation refers to the transfer of research into operations: Existing experience proves that research and development work benefits from a close proximity to the operational system/code. Ideally R&D are performed within a software system that mirrors the operational code. Benefits include a more rapid transition from research to operations and a better feedback from operations to research. Efforts should be undertaken to realise such a fruitful proximity of research and operational systems.

xvii. The AMV-community is relatively small and CGMS and IWW pretty much embrace all relevant players. Therefore it appears straightforward to improve and/or revive the international collaboration. A simple starting point is the comparison of AMVs in the overlap areas of geostationary satellites. Discussion of those results should lead to a healthy, cooperative competition.

4 CONCLUDING REMARKS

Working Group II at CGMS-33 is invited:

- To discuss the response of IWW7 to the actions from CGMS (see Annex II)
- To discuss the suggested areas for research listed in section 3.
- To formulate questions, actions and recommendation for the next International Winds Workshop (IWW8) to be held in Beijing from 24 – 28 April 2006.

5 REFERENCES

Velden, Christopher, Jaime Daniels, David Stettner, David Santek, Jeff Key, Jason Dunion, Kenneth Holmlund, Gail Dengel, Wayne Bresky, and Paul Menzel (2005). Recent innovations in deriving tropospheric winds from meteorological satellites. American Meteorological Society, February 2005, 205-223

ANNEX I:

Summary of the Seventh International Winds Workshop

The Seventh International Winds Workshop (IWW7) was held in Helsinki, Finland, from 14-17 June 2004. The workshop was organised jointly by the Co-operative Institute for Meteorological Satellite Studies (CIMSS), EUMETSAT, and the Finnish Meteorological Institute (FMI). FMI provided support for the venue and for local arrangements, which were expertly handled by Mrs. Pirkko Pylkkö of FMI. The event was co-sponsored by the World Meteorological Organisation (WMO), the Japanese Meteorological Organisation (JMA), and the National Environmental Satellite Data and Information Service (NESDIS) of NOAA. These organisations provided travel support for a limited number of international participants. The workshop was originally foreseen to take place in Beijing, China, in October 2003. Due to concerns related to Severe Acute Respiratory Syndrome (SARS) in Beijing, it was decided in May 2003 to postpone and relocate the meeting.

The IWWs provide an established forum for satellite data providers, users and the science community to portray advances and exchange ideas on the use and interpretation of Atmospheric Motion Vectors (AMVs). They also provide the WMO with a synopsis of AMV advances, issues and recommendations from which action items may be drafted for consideration by the international community.
The IWW7 was attended by 53 scientists from 15 countries. All operational satellite data centres producing AMVs were represented, as were most global numerical weather prediction (NWP) centers.

The workshop was opened with a series of welcome addresses, by Prof. Petteri Taalas (FMI), Dr. Tillmann Mohr (EUMETSAT), and Dr. Paul Menzel (NOAA). It proceeded with seven plenary sessions, focussing on topics relevant to the processing and utilisation of AMV, as well as other satellite-based observing platforms which are producing, or are planned to produce, wind information. A novelty was a session that was completely devoted to polar winds in general and MODIS data in particular.
During and after the meetings there were working group sessions on four issues related to AMV topics: (1) methods, (2) data assimilation, (3) height assignment, and (4) MODIS winds. The working groups considered, among others, the issues and recommendations offered by the WMO Co-ordination Group on Meteorological Satellites (CGMS).
IWW7 concluded with a plenary session that reviewed the working group findings and recommendations, and that discussed the achievements of the workshop.

Among the highlights from IWW7 were the encouraging results from two new geostationary satellites, Meteosat-8 (EUMETSAT) and Kalpana-1 (India). Several presentations discussed the impact of the Meteosat-8 winds on NWP output, showing mixed results, and leading to a recommendation to modify the height assignment methodology for the Meteosat-8 AMVs. In the last two years the use of MODIS winds quickly moved from an experimental phase to an early operational phase. Three meteorological centres (ECMWF, JMA, and NASA GMAO) use the MODIS data-sets now operationally; many other institutes are running experiments with the data. Scatterometer winds have also proved very successful and are assimilated by a growing number of meteorological centres. In addition there are very promising prospects of

AMV data from space-based lidar profilers and from hyperspectral imaging and sounding instruments.

The detailed reports of all seven plenary sessions and four working group sessions are provided in the following pages.
The general feeling was that IWW7 was a very successful workshop and that future workshops should be continued in their current format. The next IWW is planned for 2006 in Beijing, China.

Kenneth Holmlund
Arthur de Smet
EUMETSAT

Chris Velden
CIMSS

ANNEX II:

Report from the Working Group on Methods (WG-I)

Chairperson: Jaime Daniels

This working group discussed a variety of topics related to the methodology used to generate Atmospheric Motion Vectors (AMVs) from existing instruments aboard both operational and non-operational satellites. The group also discussed the need for new innovative approaches for deriving estimates of atmospheric motion from hyper-spectral instrumentation which will be available in the near future. A number of recommendations based upon these discussions and results presented at the workshop are described below. The working group was also directed to address a number of CGMS XXX-XXXII action items (30.31, 30.33, 31.33-31.35).

The CGMS XXXI-XXXII Action Items that were addressed by the group are presented below with pertinent discussion items and subsequent recommendations.

Action 30.31) **The co-chairs are requested to invite representatives of the regional modeling community to IWW7. What is the perspective for regional models?**

The IWW7 co-chairs solicited invitations to modeling groups to present Atmospheric Motion Vector (AMV) impact studies and results at the IWW7. Session IV of the IWW7 focused on regional and mesoscale applications involving the use of AMVs. The mesoscale model impact results reported at the IWW7 and IWW6 have generally been positive. Rapid scan imagery has often been used to generate the AMVs used in these model impact tests. Despite these successes, however, the information revealed in rapid scan imagery is very much under-utilized in regional and mesoscale models.

Recommendation (IWW7_WG1_1): New ideas and innovative approaches are needed to generate products from smaller scale features observed in animated imagery which could be used in mesoscale models. Examples of such products include upper-level divergence and complex smaller-scale wind motions.

Recommendation (IWW7_WG1_2): The Numerical Weather Prediction (NWP) modeling community is encouraged to continue mesoscale model development so that complex, smaller-scale motions evident in high resolution, rapid-scan imagery, can be utilized to improve short-term forecasts

Action 30.33) **NOAA/NESDIS is invited to present a paper on AMVs from MODIS instruments on the Terra and Aqua satellites.**

Several presentations were given at the IWW7 which addressed the derivation of AMVs from MODIS measurements aboard the Terra and Aqua satellites. Numerous other presentations

were also given at the IWW7 which demonstrated the positive impact that the MODIS wind products were having on forecast skill. Plans are underway at NOAA/NESDIS for routinely generating MODIS AMV products and making them available to the NWP community via an anonymous ftp server and to the Global Telecommunication System (GTS).

Recommendation (IWW7_WG1_3): The NWP community expressed concern about the timeliness of the MODIS AMV products at the IWW7. This issue was discussed by this working group (WG). The WG encourages NOAA/NESDIS to look at ways to improve the timeliness of the MODIS AMV products. Furthermore, the WG encourages organizations that have the means, to help with the problem of making MODIS imagery available via direct broadcast access methodologies.

Recommendation (IWW7_WG1_4): Serious consideration should be given to support ongoing efforts aimed at acquiring a satellite in a highly elliptical orbit (HEO). A satellite in this type of orbit could significantly improve the observational coverage over the polar regions. Current efforts by satellite operators to generate AMVs from Low Earth Orbiting (LEO) satellites should continue and should be expanded to include AMV derivation from HEO, if and when available. A pilot study is suggested in order to perform algorithm studies to simulate data from an HEO in order to understand and characterize issues such as parallax, varying footprint resolution with time, and feature tracking. Investigate the possibility of using older GEO satellites for the collection of "training" datasets to support such a pilot study.

Action 31.33) **Address the topics of Polar Winds, Re-Analysis of AMVS, and Image Pre-Processing on the basis of IWW7 papers and presentation**

Recommendation (IWW7_WG1_5): *Polar Winds:* The WG strongly recommends the inclusion of a water vapor channel on the VIIRS-3 instrument based upon the unprecedented success of the MODIS water vapor winds on NWP forecast accuracy. The WG encourages a validation campaign aimed at intercomparing MISR AMVs with other AMVs from other satellites (GEO and LEO). Satellite operators should take advantage of geometric height software tools available to validate their wind products. Comparisons should be done between MISR geometrically determined tracer heights and other GEO/LEO temperature determined tracer heights for the same tracers.

Recommendation (IWW7_WG1_6): *Re-Analysis of AMVs:* Satellite operators are encouraged to build the capability to reprocess satellite winds from imagery residing in their agency's data archive. The WG recognizes that such a reprocessing capability is resource intensive, but that such an effort could significantly contribute to re-analysis projects.

Recommendation (IWW7_WG1_7): *Image Pre-Processing:* Satellite operators are encouraged to investigate the impacts of the following on the derivation of AMVs: i) Image enhancement ; ii) Adaptation of cloud classification schemes within AMV processing schemes; iii) Tracking in derived product imagery or combinations of imagery.

Action 31.34) **NESDIS is requested to consider submission of a paper to IWW7 on prepatory work on the derivation of AMVs from high-spectral resolution IR sounding instruments (e.g. GIFTS).**

Two presentations were given at the IWW7 which addressed the issue of AMV derivation from hyper-spectral imagers/sounders.

Recommendation (IWW7_WG1_8): While the concept of deriving AMVs from hyper-spectral instruments has been demonstrated, more work is needed. High resolution AMVS are not truly feasible at this time given the availability of data. The WG recommends that higher spatial resolution data (ie., full resolution AIRS soundings) be made available to support further studies involving the development of methodologies for the derivation of AMVs from hyper-spectral instruments.

Action 31.35) **CGMS request that the Windsat Coriolis evaluation be performed in a manner similar to AIRS (with distribution of data sets for outside evaluation as soon as possible) as a matter of urgency.**

Recommendation (IWW7_WG1_9): The WG encourages the IWW chairs to invite a talk at the next IWW on the use of passive, polarized microwave observations for retrieval of surface winds.

A WG discussed a number of other topics related to AMV derivation that prompted the following recommendations.

Recommendation (IWW7_WG1_10): In order to improve the exploitation of satellite-derived AMVs in NWP data assimilation systems, satellite operators are encouraged to go back to the drawing board to quantitatively characterize all errors resident in their AMVs. Error sources include: correlated errors, height assignment, navigation, calibration, and tracer tracking. Once these errors are characterized, satellite operators are encouraged to assign error bars to vectors and height assignments attached with their AMV products. The WG encourages increased collaborative efforts between the satellite centers that generate AMVS and NWP centers that assimilate these AMVs. The WG encourages the IWW co-chairs to formulate an action plan to address this issue.

Recommendation (IWW7_WG1_11): Further development of new feature tracking techniques, such as the optical flow technique. Compare performance of such techniques to the standard tracking techniques used today operationally.

Jaime Daniels, Chairperson of Working Group I
NOAA/NESDIS, Washington D.C.

Annex II

REPORT FROM THE WORKING GROUP ON DATA ASSIMILATION

Chairperson: Mary Forsythe

1. Introduction

The working group on data assimilation focused on concerns that we are not seeing the full benefit of satellite wind data in NWP.   Topics relating to actions from CGMS XXX-XXXII were also discussed and recommendations made.

2. CGMS Actions

Action 30.31) **What is the perspective of satellite wind data for regional models?**

Recommendation (IWW7_WG2_1): NWP centres to consider modifying quality indicator thresholds for regional data assimilation.

Recommendation (IWW7_WG2_2): Satellite operators to consider re-tuning quality indicators for mesoscale wind products.

It was also noted that use of MODIS polar winds would be very restricted in regional models due to the tighter time constraints.

Action 30.32) **What else is needed for height assignment methods beyond an inventory?**

An inventory of height assignment methods was considered useful. In addition 2 recommendations were made.

Recommendation (IWW7_WG2_3): Satellite operators to work towards providing an estimate of height uncertainty with each wind.

Recommendation (IWW7_WG2_4): Satellite operators to use a decision tree rather than an averaging technique for the final height assignment.

Action 31.34) **Discussion on hyperspectral imagers/sounders**

The working group agreed that this was a promising approach and we would support further research in this area.

3. Are we seeing the full benefit of AMV data?

The working group agreed that we are seeing positive benefit from operational AMV assimilation, particularly in the tropics and southern hemisphere. However, there was also general agreement that we are not yet seeing full benefit from the AMV data. Discussion of this problem was prompted by an email from John Eyre (Met Office) before the Winds Workshop. In the follow-up e-mails and in the working group discussion it was agreed that progress in this area would benefit greatly from increased collaboration between NWP centres and satellite operators.

Recommendation (IWW7_WG2_5): NWP centres and satellite operators to collaborate with the aim of improving impact from AMV data in NWP. Initially results of investigations should be emailed to the CGMS winds list server, but other options include using a separate email list or linking results to a web page.

There are various reasons why we may not be seeing the full benefit of the AMV data in NWP. These include:
1. Height assignment errors.
2. The targets tracked may not accurately depict the real wind.
3. The AMV errors are poorly represented in data assimilation. This is partly due to a poor understanding and characterization of the errors, but also because the spatially and temporally correlated error is not allowed for directly in the assimilation.
4. Model dependence introduced at some stages of the derivation system.

To approach this problem, WGII recommends:

Recommendation (IWW7_WG2_6): NWP centres to investigate AMV-model differences (through the NWP SAF satellite wind monitoring report) and to run case studies. The aim is to gain a better understanding of the errors and identify whether they are seasonally, geographically or synoptically dependent.

Recommendation (IWW7_WG2_7): Satellite operators to re-examine the physics and to work towards producing physically-based estimates of the vector and height error with each wind.

Recommendation (IWW7_WG2_8): Satellite operators to produce winds with simpler errors where possible. In part, this may be achieved through reducing the dependence on model forecast data.

To maximize the benefit to data assimilation, WGII recommends:

Recommendation (IWW7_WG2_9): NWP centres and satellite operators to concentrate on areas where the AMV data has most to offer. Examples include regions where other data types provide poor coverage or are problematic and in physically important regions such as near jets, tropical cyclones and in areas of rapid growth.

Recommendation (IWW7_WG2_10): Further work is also recommended to improve the data assimilation of AMVs. Ideas include:

1. Development of bias correction schemes, for example Bormann et al., 2002.
2. In the short-term, development or use of more realistic observation errors along the lines of Le Marshall et al., 2004. In the longer-term, consideration of how to use estimates of vector and height error in data assimilation.
3. Improvement in the treatment of correlated error, possibly through the use of estimates of the correlated error and lengthscale, which may soon be provided within the BUFR (Le Marshall et al., 2004).
4. Investigations into using model independent quality indicators and data that is more independent of NWP models.
5. Improvement to quality control including re-assessment of blacklisting and thinning options.
6. Re-evaluation of the observation operators, particularly for CSWV winds, for example Rao et al., 2002 and work in progress by Lüder von Bremen at ECMWF.
7. Evaluation of alternative assimilation strategies e.g. assimilation of wind derivatives including upper level divergence fields (e.g. Schmetz et al., 2004) and gradient wind fields.

4. General Discussion

From the general discussion, two further recommendations were proposed.

Recommendation (IWW7_WG2_11): ECMWF to carry out assimilation experiments to compare the use of CSWV winds to the use of CSWV radiances.

Recommendation (IWW7_WG2_12): Satellite operators and NWP centres to consider the best way to approach the varied requirements of the user community. Some centres do not have the resources to optimize assimilation and would prefer to receive a best final product. Other users would prefer to receive data with simpler errors that can be modeled more accurately in the assimilation. Increased collaboration between NWP centres and satellite operators is required to share expertise and to negotiate the best course of action.

5. References

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Schmetz, J., Borde, R. & König, M., 2004. Upper level divergence field in a tropical convective system observed with Meteosat-8. *Proceedings of the Seventh International Winds Workshop, Helsinki, Finland.*

Mary Forsythe, Chairperson of Working Group II
Met Office, UK

Annex II

Report from the Working Group on Height Assignment (WG-3)

Chairperson: Arthur de Smet

Working group 3 discussed several topics related to height assignment.
The first part of the working group session focused on the following CGMS action:

Action 30.32) IWW7 is invited to establish an inventory of all height assignment methods used for low-, medium- and high-level AMVs.

The working group agreed that such an inventory is highly useful and will be beneficial to all of those working with Atmospheric Motion Vectors (AMVs).

Recommendation (IWW7_WG3_1): All AMV production centres are encouraged to make an inventory of all height assignment methods used by them. The inventory should include the following information for each height assignment method:
a) A complete description of the method,
b) A description of the spectral channels involved,
c) The constraints applied to the method (when to use it, when not),
d) A description of the quality control applied to the method,
e) A description of the error analysis, if available,
f) A summary of the (operational) experience with the method.

The aim is to generate a tabular overview of height assignment methods, e.g. on the EUMETSAT website, that can be accessed by anybody who is interested.

EUMETSAT has initiated a study to validate the height assignment of its Meteosat-8 AMV data. The full title of the study is "Validation of cloud top pressure derived from MSG-SEVIRI observations through a comparison with independent observations" and the members of the consortium performing it are the Free University of Berlin (Germany), the Institute of Geodesy and Photogrammetry in Zürich (Switzerland), and the Appleton Rutherford Laboratory (United Kingdom). The aim of the study is to compare the Meteosat 8 AMV heights with independent observations and methodologies, including MODIS and MERIS data (CO_2 slicing, oxygen A-band), MISR and AATSR data (stereo heights), as well as data from Lidar, Radar and radiosonde instruments. There will be two analysis periods of approximately one week.
EUMETSAT will look into the possibility of providing the data used in this study to other parties that are interested. If this is feasible, others are encouraged to use the data sets for comparison studies.

Recommendation (IWW7_WG3_2): EUMETSAT to investigate the possibility of providing the data used in the cloud top pressure validation study to third parties.

In the near future EUMETSAT will start trials with the so-called "infrared-two-water-vapour" (IR-two-WV) height assignment method, which applies one infrared channel and two water-vapour channels. This method is much less dependent on forecast profiles than other methods.

Sine the assimilation of AMV data into NWP models suffers from the dependency of height assignment on forecast profiles, this method may become very important in future.

Recommendation (IWW7_WG3_3): Explore different ways of height assignment in order to reduce the dependency on forecast profiles.

The working group then discussed various topics, mainly based on the individual presentations. This prompted a number of further recommendations.

Recommendation (IWW7_WG3_4): In the validation and verification of height assignment data it is very useful to investigate the level of best fit, using both radiosonde and analysis data.

Recommendation (IWW7_WG3_5): When comparing radiosonde data with AMV height assignment data it is important to take into account the balloon drift to get the radiosonde location right.

Recommendation (IWW7_WG3_6): There should be more emphasis on absolute geometry to explore stereo height assignment.