REPORT ON THE ACTIVITIES OF THE EUMETSAT-ESSL
CONVECTION WORKING GROUP

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Abstract
The focus of the Convection Working Group is to have a comprehensive inventory of the available applications in this field, with the aim to get deeper insight into the differences and commonalities of the available techniques and products, and their specific area of application. Another focus of the workshop is to foster research in this context.

The Convection Working Group exists since 2007 as a rather informal group of scientists and forecasters, i.e. no formal membership is required. Several Working Group meetings have been held since then (2007 in Krakow, Poland, 2009 in Landshut, Germany, 2012 in Prague, Czech Republic, and intermittent short meetings during the EUMETSAT annual conference or during the European Conference on Severe Storms, organised by the European Severe Storms Laboratory, ESSL).

The group’s web site (http://convection-wg.org) provides extensive information on the group’s activities, e.g. a number of case studies and links to relevant documentation. A group effort is to reprocess common test cases of convective outbreaks over Europe, using different algorithms and methods, for all stages of the convection process, i.e. the pre-convective environment in terms of instability indices, the convective initiation phase and the mature phase with its overshooting tops, together with a comparison to observations like radar.

The group also works on a “Best Practice” document which will provide a detailed overview of existing satellite based nowcasting techniques.

This paper provides an overview over the group’s activities and will specifically address the outcome of the latest Working Group Meeting in Prague (March 2012).
CWG ACTIVITIES

Best Practice Document

Research presented at the various CWG meetings has been captured in a Best Practice Document: This document is to be seen as a living document describing established convection nowcasting methods. The document is available from the CWG website (http://convection-wg.org) and will be updated at least annually.

CWG Website

As already mentioned above, CWG has a website at http://convection-wg.org. This website is the first point of contact for interested users, i.e. a subscription to the CWG mailing list is offered. The website offers links to presentations given at CWG meetings, documents a number of test cases, offers links to relevant publications – and is also a “living” website where future functionality enhancements can be expected.

Discussion Areas

CWG focuses on three main areas of convection forecasting and nowcasting:

1. The pre-convective environment (instability product, NearCasts, local wind field)
2. Convective initiation phase (especially if it provides lead time over radar)
3. Mature convective clouds: cloud top structures, cloud tracking, severity

ESSL Testbed

CWG supports the activities of the ESSL testbed and sees this as an important tool to beta-test products, i.e. to expose forecasters to new products, train them on the usage, and obtain feedback and some initial validation. A number of CWG members have actively participated in the first ESSL testbed in June 2012.

MSG Very Rapid Scans

In order to better understand the dynamics of convective storm tops, CWG proposed to EUMETSAT to do some 2.5 minute scans during the commissioning period of MSG-3, focussing on an area with active convective development. These scans were successfully performed on 11 September (and may be repeated in 2013).

Examples – Pre-convective Environment

Satellite products of interest here are the MSG Global Instability Index (GII) product, respectively the corresponding product from the Nowcasting SAF package (PDE013). Together with forecast fields, the information of the MSG IR channels is used to derive information on the atmospheric (in)-stability, expressed as a number of instability indices, and on the atmospheric moisture content, expressed in total precipitable water content in the low, medium and high troposphere. This information can only be derived over clear sky conditions and can be useful to delineate areas of high moisture content and high instability, which may be a first indication of convection to occur in the next 6-9 hours. Figure 1 gives an example.
Research at the University of Wisconsin (Ralph Petersen) has shown that it is possible to advect the derived vertical profile information in a Lagrangian sense, using model wind fields, to assess the anticipated change in stability patterns, producing so-called NearCasts. Collaboration e.g. on a tornadic case in Poland or concerning nocturnal convection over Lake Victoria have shown the additional value of this product. Figure 2 gives an example.

Examples – Convective Initiation

The aim of the Convective Initiation (CI) product is to detect growing Cu clouds at an early stage, preceding the first 35 dBZ radar signal. The CI processing is based on a number of IR temperatures, temperature differences and time trends. Recent activities have combined this product processing with the NWCSAF Cloud type and High Resolution Wind products. Figure 3 shows an example.
Examples – Mature Cloud Tops

A somewhat trivial, but nevertheless important, agreement of CWG was to use a common colour scale for colour enhancements of IR images (Figure 4).

A number of automatic detection algorithms (detection of overshooting tops, cold ring, cold U/V shape detection) have been developed by CWG members and have instigated good collaboration activities, e.g. on the question of the accurate height assignment of overshooting tops. Another important and widely used product is the “sandwich product”, which visually combines images of channels of different horizontal resolution – e.g. the 1 km HRV channel and the 3 km thermal infrared channel on MSG (Figure 5).
Another important CWG discussion item was the use of the WV – IR brightness temperature difference as a proxy for overshooting tops (which is widely used in weather services). Detailed analyses and examples have shown that this temperature difference does NOT delineate overshooting tops, but that it rather reflects the underlying IR temperature patterns (Figure 6). The CWG website provides a link to a comprehensive document that analyses the characteristics of this temperature difference.

Other mature cloud products under discussion within CWG are the Rapidly Developing Thunderstorm (RDT) product of the Nowcasting SAF, CbTRAM of DLR, and the COALITION project of Meteo Swiss.
CONCLUSIONS

This paper could only give a very brief overview over the CWG workshops and activities. For further information, the interested reader is referred to the CWG website and the CWG Best Practice Document.

It is very important to the author to stress the fact that CWG is a group effort, where many scientists and forecasters have contributed to (and could not all be mentioned as co-authors of this paper). Special thanks go to Pierre Fritzsche (DWD), Ralph Petersen (University of Wisconsin - Madison), Zsofia Kocsis (OMSZ), and Martin Setvák (CHMI) for providing the figures. Further special thanks go to John Mecikalski (University of Alabama – Huntsville) and Kristopher Bedka (NASA) for their support to the Best Practice Document and to Pieter Groenemeijer (ESSL) for his support on the CWG website.