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Cover: “Explosion maritime”
Dangerous waves breaking on the French Riviera
Introduction

Dear readers,

Trying to put together a mental picture of striking severe weather events since our 16th edition (May 2011) makes me feel a little confused! The only thing that comes to mind immediately is the 2011/2012 winter in Europe. From late January until early February 2012 we were really in the grip of extreme conditions. From The Ukraine, via the Balkan region and Italy, then towards the United Kingdom and the Low countries, extreme low temperatures and heavy snowfall ended a winter that had been relatively mild until then. Many people died or were injured in the cold spell. Beyond this, I cannot recall many extremes. Have I forgotten the weather events of 2011 entirely? That could very well be due to the ‘meteorological memory overflow’ from which I necessarily suffer in order survive the vast amount of data that come to forecasters daily? Or it might be the case that we really did encounter fewer big weather events during this period. And yes looking at the internet I feel relieved, with only some relatively small heat waves during the 2011 summer and some major rain and river flooding events in France, Italy and Ireland from late October to early November.

Writing this introduction for the 17th edition of the European Forecaster I am well aware that this will be my last one. During our upcoming meeting a new Chairperson will take on this post and I realise that this will end a long period for me. I have had more than 10 years of direct involvement with the Working Group, and to be honest not much has changed in terms of the ‘spirit’ of the group. Of course within our forecasting business huge progress has been made by the use of ensemble techniques and also from the new non-hydrostatic very high resolution models. Meteoalarm has made us change and improve our warning systems on the national level. And the way we communicate with our colleagues from Civil Protection during severe weather events and the way we make use of New Media is bringing a lot of change. But the spirit within our WGCEF seems to be very stable, devoted and directed towards improving our working abilities by sharing best practice examples and by having discussions on topics of common interest.

We consider ourselves as the professional representatives from the community of European weather forecasts, and Eumetnet, the European network of co-operating weather services, has got an eye on us because of that. This can be seen as a major compliment on all the work that has been done and will continue in the WGCEF. For this we will discuss our future relation with Eumetnet during our upcoming meeting in October.

And now it is reading time. This nice edition of the European Forecasters’ newsletter again reflects all the topics discussed in Bergen during our 2011 meeting. I call on all of you to recommend this edition to your colleagues. I also call on all readers to send in new contributions for the next (18th) edition. All articles were reviewed by Will Lang (from UKMO). Bernard Roulet and Météo France made it again possible to present the high quality edited and printed edition. Thanks to André-Charles Letestu (Météo Suisse) our website www.euroforecaster.org is updated with actual information on the Working Group. Our web archive shows the previous editions of the Newsletter.

I wish you inspiring reading hours and hope to see you during our next WgCEF meeting in Vilnius, Lithuania, on Friday 5th October 2012.

Frank Kroonenberg
Chairperson of WGCEF
Introductions

Karen-Helen opened the meeting and welcomed the group to Bergen. Noting the heavy showers outside, she stressed that she could not guarantee the weather, but also that it was very changeable so at least some fine conditions could be expected, if only briefly.

Frank thanked Karen-Helen on behalf of the group for her hospitality, and for her and her colleague Vibekke Maeland for organising the meeting. He then extended a warm welcome to new (or long absent) members of the group: Lola, Christian and Alessandro.

The Chairman then recalled his last visit to Bergen, 30 years previously, on board the Dutch weather ship 'Cumulus'. The ship was usually stationed at position 'Mike' at 66N, 02E. Bergen had proved to be a welcome and beautiful sight, and skies had remained blue during his stay.

Frank passed on the apologies from group members unable to attend the meeting:

Manfred Kurz, Merike Merilan, Teresa Abrantes, Stefano Micheletti, Tessy Eiffener, Chryssoula Petrou and Panagiotis Giannopoulos.

The agenda was agreed.

Actions from Last Meeting

These actions – to organise the current meeting, to update the website, and to produce the newsletter – had all been completed.

Chairman's Report

Frank noted that the year since the 2010 meeting in Dublin had seen some very significant weather-related events. In particular the earthquake and tsunami in Japan had been a concern for many European National Met Services (NMSs). There had been much collaboration, particularly in the field of dispersion modelling and forecasting.

The economic situation continues to cause uncertainty within many NMSs. At KNMI in the Netherlands, there is ongoing discussion around further
privatisation. Commercial activities at KNMI ceased in 2000. Current civil protection customers remain very happy with the service they receive, but the recession brings increased pressure to cut costs within government organisations.

**Newsletter and Website**

Frank encouraged all members and their colleagues to contribute to the WGCEF Newsletter. Bernard confirmed that Meteo France were happy to continue to publish the journal, and it was agreed that the group should send a formal message of thanks to Meteo France directors for their support for the group over the years. Alessandro noted the importance of maintaining a ‘hard copy’ version of the newsletter. It was felt that its appeal to forecasters would be diminished if it were to become ‘on-line only’ like many other journals.

Andre-Charles presented several options for a revamp of the www.euroforecaster.org. These were well-received, and a preferred option was chosen. The updated site will be based on website formats commonly used for blogging, and the group agreed that this approach would encourage more regular use and interaction between group members. Evelyn and Knud-Jacob volunteered to assist Andre-Charles in further exploring and implementing options for the updated site. Other suggested improvements to be investigated by this WGCEF subgroup would be new logo, and the ability to access the site from smartphones.

Andre-Charles, Evelyn and Knud-Jacob agreed to form a WGCEF Website Group and report on progress at the next meeting.

**Round Table Discussion on NHMS Developments**

Group members were each asked to briefly describe significant changes to their organisations and their roles as forecasters.

**Will (UK)**
- The Met Office remains a ‘government agency’, but has transferred from the Ministry of Defence to the Department of Business, Innovation and Skills.
- This change will entail a renegotiation of our relationship with military customers.
- There is a current pay and recruitment freeze at the Met Office as a whole, but despite this we have been able to recruit new forecasters.
- The 24/7 operational and computing facilities at the Met Office have made it a key component of several initiatives to build partnerships between government and scientific organisations. As an example, the Natural Hazards Partnership seeks to combine expertise in many different fields to be able to warn for phenomena as diverse as volcanic ash, floods and enhanced solar activity.

**Jean (Belgium)**
- New procedures for forecasting thunderstorms have been developed.
- INCA is being used experimentally.
- Forecasts for Fukushima were produced using UKMO and Meteo France dispersion models.

**Alessandro (Italy)**
- The Italian Air Force is being reduced in size, so some organisational change is possible due to a review of civil and defence responsibilities.

**Evelyn (Ireland)**
- 300 people visited Valentia Observatory to celebrate 150 years of observations.
- Staff numbers have reduced to 190.
- The general and aviation forecasting offices have been amalgamated.
- 4 senior forecasters have been lost, so 3 new forecasters have been recruited with a modelling background.
- Government agencies including Met Eireann are joining together to form a National Emergency Centre. A strong forecasting component is required.

**Bernard (France)**
- A new Vigilance procedure has been introduced for storm surge.
- Aviation forecasting is now centralised in Toulouse.

**Andre-Charles (Switzerland)**
- Meteo-Suisse’s status is changing.
- Regional offices are being reorganised.
- There is a need to exploit commercial potential, so a new product management department has been created.
- 20 jobs are going.
It has been agreed that data is to be made freely available, though it is still not clear what this means in practice.

Meteo-Suisse is the ‘Single Official Voice’ for the most severe (‘Level 4 and 5’) weather warnings, which it issues on behalf of the government.

Christian (Austria)
- 50% of ZAMG comes from government, but the rest must come from commercial activities.
- 2 forecasters have been lost in the past year, with the number of forecasters in the Vienna office reduced to 12.
- Some scientists have been used for operational forecasting work, though they may not be available for duties at nights and weekends.

Zoran (Croatia)
- No major changes so far this year, though the upcoming election may well result in less money for the met service.
- Staff continue to be lost through retirement, and they are unable to recruit new staff.
- There is a shortage of scientists and mathematicians available to the service.

Antti (Finland)
- A new radar (doppler + dual-polarisation) has been installed.
- There are new warnings for water level and wave height.
- The Finnish government has required that FMI do all aviation observations.

Janoz (Slovenia)
- Elections are expected soon, so it is uncertain what will happen next year.
- No new meteorologists have been employed.
- A new model is now operational (as described at last year’s meeting).
- There is increased use of first-guess model input to products, allowing more time for forecasting.

Klaus (Germany)
- Staff numbers at DWD are now reduced to 2400.
- 3 regional offices are no longer open at night.
- The AUTOWARN system is due to become fully operational in 2015.
- There will be more automated observing.

Knud-Jacob (Denmark)
- Danish and Swedish airspace join together from 1st January 2012, so the aviation sectors of the two met services are joining forces.
- DMI has been appointed to provide tsunami warnings to Denmark, the Faroes and Greenland.

Karen-Helen (Norway)
- The yr.no website continues to be a big success, with 4 million users per week. It has become the main channel for forecasts in Norway.
- There is an ongoing process to ensure that the site uses the best data, and makes best use of forecaster intervention where required.

Lola (Spain)
- There is a new organisation of forecasting into forecasting centres.
- New systems, using digital forecasting techniques, are enabling increased automation.

Frank (Netherlands)
- Only one manual observation remains in the Netherlands, at Schipol Airport.
- A decision on further privatisation is due in 2012.
- 17.5% cuts to the KNMI budget are expected over the next 4 years.

Presentations

Members then gave presentations on the following topics:

“Communication from NHMSs towards Media and Civil Protection”.

“How to improve environmental protection through better use of probabilistic forecast data”.

Chairperson Nomination for Next Meeting

Having been Chair/Vice-Chair for the group for four years, Frank announced his intention to step down before the next meeting. Will Lang, current Vice-Chair indicated that he would be glad to serve as Chair from next year – an offer which was agreed by the rest of the group.

The position of Vice-Chair would then become vacant at the next meeting, so members were
asked to consider proposing themselves for this role.

**Date and Place of Next Meeting**

Karen-Helen and Frank stated that Vida Raliene (Lithuanian) had confirmed her offer to host next year’s meeting, and the group provisionally agreed to meet in Vilnius on 5th October 2012.

**Topics for Next Meeting**

The group agreed the following topics for presentations at the 2012 meeting in Vilnius:

- Severe weather case studies.
- Examples of how we can improve our services even given current financial and staffing restraints in many of our organisations.

**Any Other Business**

Will thanked the members of the group who had contributed to his work on the WMO PWS Service Delivery Strategy earlier in the year. Members provided examples of service delivery metrics used in their organisations, several of which were quoted in the final version of the strategy.

**Close of Meeting**

The Chair and Vice-Chair again thanked the members for their participation, wished them well for the coming year, and formally closed the meeting.

*Will Lang*  
*18th October 2011*
On the 22nd November 2011, intense and persistent rain affected the province of Messina in Sicily - especially the areas along the Tyrrhenian coast - and Calabria in the south of the Italian mainland. The municipalities most affected were Saponara, Villafranca Tirrena, Rometta and Barcellona Pozzo di Gotto (Fig.1), with 4 dead and about 700 displaced persons (data from Protection Civile). Strong convective precipitation fell in these areas, with hourly precipitation amounts of the order of 60-100 mm, and total cumulative values around 150 mm (data from the observational network and the Civil Protection rainfall network).

The event was associated with a so-called V-shaped storm (named after the shape of the convective system) within a baroclinic area, a deep cyclonic circulation at high altitude, combined with a significant warm anomaly in the lower layer, activated by strong sirocco winds. The 500 hPa Potential Vorticity and the wind at 300 hPa on November 21st showed a large anomaly in the dynamic tropopause over the Strait of Sicily 24 hours later, with a jetstreak further south between Tunisia and Libya (see Fig. 2).

The precipitation forecast by the ECMWF model and COSMO ME gave a clear signal for very high values over small spatial scales equivalent to a maximum of 60 mm (ECMWF) and 220 mm in 12 hours (COSMO ME; see Fig. 3) These values were extremely localized on the Sicilian Ionic coastal area and did not give similarly strong signals for Calabria.

The evolution of weather conditions on the evening of Monday 21st and the morning of Tuesday 22nd confirmed the risk of strong convective activity in Sardinia, and the localised nature of precipitation forecast for the island by the models compares well with the actual precipitation distribution.
On Sicily, however, the shift of the anomaly in the altitude over the intense southern moist flow allowed the development of a supercell (V-shaped storm), which had its southern peak in Messina and spread to Calabria, as is clear from the composite satellite/radar/lightning image in Fig.4.
Summary

In the UK, the organisations responsible for flood prediction and warning have joined forces to deliver joined-up flood forecasting services to government and to emergency responders. In the Flood Forecasting Centre, a team of experienced and multi-skilled operational hydrometeorologists from the Met Office and the Environment Agency has been created to aid the design of and to use new models, tools and techniques in flood forecasting for England and Wales.

Background

The summer of 2007 saw unprecedented rainfall across the UK. 13 people died in the resulting flooding, which also caused billions of pounds worth of damage to communities, homes and critical infrastructure. The subsequent independent review of these events – the Pitt Review - highlighted the need for a much more integrated response to flooding across both national and local government and the other agencies responsible for warning for and responding to flood risk. In particular, the review recognised the importance of creating a joined-up operational flood forecasting service between the Met Office – responsible for weather warnings for the UK – and the Environment Agency (EA) – responsible for flood warning in England and Wales. The Pitt Review also recommended that probabilistic approaches to flood forecasting should be employed, using warnings with longer lead times to allow a proportionate and risk-based response.

At the same time, the Met Office was restructuring its Public Weather Service to ensure its alignment with the requirements of the UK Civil Contingencies community at both national and local levels. There was a move towards use of impact-based warnings and advice, instead of just pure meteorological guidance.

The Flood Forecasting Centre (FFC) was created in 2009. Now located at the Met Office headquarters in Exeter, the Centre is run and operated by both Met Office and EA staff and provides a focus for the hydrometeorological forecasting and development within both organisations. A 24/7 operational roster is staffed by EA hydrologists who have been trained as meteorologists, and by Met Office forecasters who have undertaken flood forecasting training; all are now regarded as hydrometeorologists, who are skilled in both disciplined. They form a highly effec-

![Figure 1](The Flood Forecasting Centre, based within the Met Office Operations Centre)

1 - Separate arrangements exist for Scotland and for Northern Ireland. For example, the Met Office works with SEPA in Scotland to deliver the Scottish Flood Forecasting Service.
tive communication and decision-making link in the flood forecasting process.

The Role of the Flood Forecasting Centre

Until recently, ultimate responsibility for flood forecasting as a whole was unclear in the UK. The EA issues Flood Warnings and Alerts for sections of rivers and coasts, but there was no national-scale monitoring, modelling or forecasting. The Met Office issued heavy rainfall warnings, though these were issued based on accumulation threshold exceedance rather than the expectation of flooding from surface water. In Summer 2007, both sources of flooding were significant, and it was unclear who was responsible for a consistent message.

So a principle strategic aim of the FFC is to provide a centre of expertise and authoritative advice for all sources of flooding; from the rivers, the sea, groundwater, and from ‘flash flooding’; associated with intense rainfall.

This is an ambitious objective, which has become reliant on building a very strong partnership between the two organisations involved. And now the strength and effectiveness of this partnership is being used as a model for further and more complex collaboration across government and science bodies, notably the UK’s Natural Hazards Partnership (NHP).

In addition to operational activities, the FFC’s Services team seeks to work across both organisations to co-ordinate development and implementation of new flood forecasting science and systems. Their work has proved invaluable in acting as an ‘expert customer’ which can steer science and technical strategy in the wider EA and Met Office.

Services for Emergency Responders

Given the diversity of the emergency responder customer base, FFC flood risk products are designed to be as simple and useful as possible. The Flood Guidance Statement (fig 2) consists of ‘traffic-light’ coloured maps of England and Wales for the next five days, accompanied by explanatory text and (when necessary) graphics. Each local authority or county is assigned a flood risk of either GREEN, YELLOW, AMBER or RED for each day, consistent

![Figure 2](image_url)

**Figure 2**

An example Flood Guidance Statement
with NSWWS warnings issued by the Met Office. The FGS is issued routinely at 1030 local time each day, but its content is under constant review and can be updated and reissued when ever flood risk is deemed to have changed significantly. The product is issued in PDF format, either by email directly to a customer, or to be viewed via ‘Hazard Manager’, the Met Office’s web portal available to emergency responders.

Flood risk is calculated using a matrix of likelihood versus impact (fig 3). Note that there are times in which the FGS colour state will not in itself distinguish between ‘low likelihood, high impact’ and ‘high likelihood, low impact’ events. In these cases there is need for careful clarification and communication of the nature of the risk.

Hydrometeorological Forecasting and Impact Assessment

FFC Hydrometeorologists (‘Hydromets’) are trained in both operational meteorology and hydrology, and therefore are able to contribute their expertise throughout the flood forecasting process. They are often able to advise the Chief Forecaster on quantitative precipitation forecasting, particularly in situations which can give rise to intense or prolonged rainfall. They are also familiar with the mechanisms by which coastal flooding occurs, and are trained to identify potential storm surge scenarios many days in advance.

Having influenced the meteorological aspects of the forecasting process, the Hydromets then take responsibility for determining the likelihood of flooding. A range of tools are available to guide their assessment.

For river flooding, the FFC makes use of the Grid-to-Grid (G2G) model developed at the UK’s Centre for Ecology and Hydrology. G2G uses gridded NWP and observational data in a grid-based runoff and routing model, allowing 1km resolution river flow forecasting anywhere in England and Wales, even for ungauged catchments. High resolution NWP data are now available to 5 days ahead, and high resolution ensemble data blended with radar output now offers the prospect of reliable probabilistic rainfall forecasts for use in hydrological models.

In the case of coastal flooding, the FFC uses surge and wave models in conjunction with astronomical tide predictions to derive changing sea levels at a number of reference ports. These forecasts are then used by regional flood forecasting teams to assess the potential for flooding and the need to activate flood defences.

For surface water flooding, or for ‘flash flooding’ from rapidly responding small catchments, the FFC looks to combine access to the best observational and forecast data with conceptual models and with tools calibrated using past events. The ability to identify a location particularly at risk from very heavy rainfall, and to distinguish between mere ‘heavy rain’ situations and those conducive to intense rain and flooding is paramount – especially when this guidance can be communicated as soon as possible to local responders.
Knowledge the likelihood of extreme rainfall or of increased river or sea levels only represents parts of the FFCs forecasting process. As with NSWWS, most FFC forecasts and warnings rely on an assessment of impact. Prior to an event, there will be extensive consultation with regional EA flood forecasting teams and their Met Office counterparts to discuss and agree the effects of flooding at a local level. This dialogue is informed by reference to standardised definitions of impacts related to factors such as number of properties affected or by areal extent of disruption.

During a flood event, it can be difficult to make an objective assessment of impact, so FFC staff undertake real-time monitoring of news reports and social media to accurately gauge the scale of events as they unfold. This information is stored along with forecast and observational data to aid the post-event review process.

**Future Developments**

The FFC Development Programme has oversight and influence over new model and observational capabilities and aims to exploit them as soon as possible. A challenge in the coming year will be to make best use of high-resolution ensemble NWP models in both river and surface water flood forecasting. A new wave ensemble capability will soon enhance our coastal forecasts too.

We aim to further empower our Hydromet team, increasing their expertise and influence so they are recognised as leaders in the field of hydrometeorology, both in the UK and internationally.

A greater understanding of impacts remains a key goal for the Centre, with the view to developing a more rigorous and objective method of impact assessment.

Looking further ahead, the FFC is contributing to a Joint Forecasting Strategy between the EA and Met Office, which looks to further integrate national-scale models and services, and to extend this joined-up modelling capability to include multiple natural hazards.
The installation of a new supercomputer has enabled KNMI to finally start running the mesoscale model HARMONIE on a regular basis. In this article we will describe the setup of the system, our first experiences with the model in severe weather conditions and some of the postprocessing designed to make optimal use of the possibilities of the mesoscale model.

The HARMONIE/AROME Mesoscale Model

The HARMONIE (HIRLAM ALADIN Research on Mesoscale Operational NWP In Euromed) model environment is a system which encompasses (amongst others) the AROME model and a script environment that enables the easy running of the model of choice. The mesoscale model is run on a Lambert grid of 800x800 points and has a resolution of 2.5 km with a timestep of 60 seconds. The model is currently driven by the regional model HIRLAM at the boundaries and uses 3D-Var for data-assimilation. Every three hours a forecast is made to 24 hours ahead. In the near future we will start making forecasts out to 48 hours, as the users of the model like to work with a single model for the whole forecasting period of 36 to 48 hours.

The main reason for running a high-resolution mesoscale model like HARMONIE is the ability of mesoscale models to represent severe convective weather well. As the most severe cases with deep convection over the Netherlands usually develop over France and Belgium, these countries have to be included in the model domain. If the model domain is too small, then the convection can already have some organization when the model domain is entered. In the model driving the mesoscale model the convection will be parameterized and the dynamic state of the convection will not be present. The convection and the organization of the convection will then start to build from the boundary, lagging behind the real development and organization by hours. This has a significant impact on the speed of advance of the convective complex and may cause the modelled convective complex to lag behind the real complex by hours, as an organized convective system can advance much quicker than the initial disorganized convection.

One example of such a case is the convective system that crossed the Netherlands on 14 July 2010. Very strong gusts associated with this convective system caused caravans to be blown over, causing two fatalities on a camping site in the small village of Vethuizen. When re-running this case on a small domain of 300x300 points the model showed very strong deep convection (see figure 1). The comparison with the radar, however, shows that the modelled convection lags behind the observed one by 3-5 hours. This is caused by the fact that this convective system already developed over France, outside of the model domain. Therefore the convective system was already in some state of development and organization, while the air mass containing the convection entered the domain through the boundary. But in the model the convection only started to develop when the unstable air entered the model domain, lagging behind the real development and organization. And it is this organization that makes the convective system develop and advance faster than individual cells, which develop initially in the model close to the boundary.

A second experiment, with the southern boundary moved south by about 500 km, provides a much better fit to the observed precipitation. Figure 2 shows the rain, cloud water and cloud ice distribution at the same time as figure 1. It shows that the rain in the HARMONIE experiment is still lagging behind the observed rain, but the distance between the observed and modelled rain is much smaller than with the small domain, and also the organization of the precipitation, with a bow echo on the most northeastern part of the convective system, is present in the run on the large domain.

The difference is large, especially at the back end of the convective system. In figure 1, the build-up of the convection starting close to the boundary is clearly visible with convective towers rising slowly from the southern boundary to the North. Figure 2...
shows a full-grown and organized system already at the place where the boundary is in the first experiment. It is this organization, present in the experiment on the large domain whereas it clearly is not on the small domain, that shows that you cannot make the model domain too small, else you may miss or erroneously represent cases where the convection is already present in reality at the boundary of the mesoscale model domain.
First Operational Experiences With HARMONIE

From 7 December 2011 HARMONIE has been running on a regular schedule with 24-hour forecasts every three hours. During this time a few interesting situations have arisen, showing the potential of the model and the additional value for the forecasts of KNMI. Three of these situations involved the passage of a cold front with line convection, something that usually happens once or twice every year, but in this case occurred three times in one month.

Line convection is very interesting as it produces a very narrow band with intense precipitation that can be accompanied by strong wind gusts. In this article we describe one of these cases, 3 January 2012. On this day a deep cyclone moved over Scotland and the northern part of the North Sea to the East (see figure 3). The cold front associated with this system passed the Netherlands between 13 and 17 UTC. A narrow band with strongly forced convection, the line convection, was clearly visible in the radar images over the UK. It was forecast by HARMONIE to break up when it approached the Netherlands, but it was still intact at 13 UTC.

However, between 13 and 14 UTC it did start to break up and figure 4 shows the situation around 14 UTC. The line convection, or what is left of it, is situated over the Northwest of the Netherlands. Some extreme wind gusts were observed on this system with maximum gusts of 94 knots at the Dutch West coast (IJmuiden) and 80 knots observed at one of the Wadden Isles (Vlieland).

HARMONIE forecast the breakup of the line convection quite well in a qualitative way, and the model also forecast that the strongest gusts would be associated with the line convection that was breaking up. But the maximum gusts were forecast to be close to 70 knots, well below the maximum observed gusts of 80 and 94 knots. These extreme gusts were probably very localised, as these gusts are among the strongest ever reported in the Netherlands and widespread significant damage was not reported.

One of the issues with the output of mesoscale models is the very small-scale features that are present in these runs. These are so small that it is sometimes hard to distinguish in the plots that are used in the forecasting office, even when zoomed in on a small country like the Netherlands. Therefore we now also have another way of plotting the wind gust forecasts. For this we divide the country into three areas, water (sea), the coastal area ranging from the coastline to approximately 50 km inland, and the inland area. Then we plot the maximum instantaneous gust at each output time step for these areas. To compare with the observations we also plot all the observations, color coded in the same way as in the three areas.

Figure 5 shows the forecast of the maximum instantaneous gusts at each output time step for the three areas.
wind gust based on the forecast from 03 UTC on 3 January 2012. It shows that the maximum gust is forecast over the sea (close to the coast, not shown here) around 13 UTC (03 UTC + 10 hours). In the observations it is shown that the maximum gusts are observed on 13.30 and 14.00 UTC, so about one hour later than was forecast.  

Forecasting Lightning Intensity With HARMONIE

The hydrometeors in HARMONIE, prognostic rain, snow and graupel, which are not present in HIRLAM, have the advantage that new forecasting tools can be developed based on these parameters. Until
now the forecasting of, for example, the chance of lightning or the chance of reaching a certain lightning intensity threshold was based on statistical methods that needed a significant number of cases to get the correct probabilities. Also, these methods had the drawback that they included the model errors (differences in timing and placement of convection), meaning that the maximum thresholds for which the forecasts could be made was less than what was needed. In the Netherlands the weather alert criterion for lightning is 500 discharges in 5 minutes over an area of 50x50 km², or smaller, but the statistical methods can only be derived for lightning thresholds of 200 discharges in an area of 60x90 km².

The addition of graupel to the prognostic model parameters enables us to use this parameter, which is one of the most important factors responsible for charge separation in thunderstorms, to make forecasts of lightning intensity. Eight cases with thunderstorms were used to find a relation between the lightning intensity and the graupel. Four of these cases were with very intense thunderstorms and four with limited lightning intensity. For all these cases a whole day was used in deriving the relation, so periods with no or only a small amount of graupel are included in the derivation of the relation.

By first trying to find a relation between the total graupel in the model over the lightning observation area, and then trying to make it applicable on the smaller areas that are used in the issue of weather alert, we were able to find a relation between the forecast graupel and the lightning intensity for areas of 25x25 km². In this derivation we have excluded the cases where there was a clear difference between the model and the observations and tried to account for changes in phase. By doing this a very clear relation can be found between the vertical integrated graupel and the lightning intensity.

Figure 7 shows the result of this relation for the case of 30 April 2012. On this day warm air was present over the Netherlands, Belgium and Germany, causing the destabilization of the atmosphere. Thunderstorms, developing on a cold front over France and Germany, moved into Belgium and the first very intense thunderstorms of the convective season 2012 started to form. The model forecast these thunderstorms in more or less the right place and time, indicating that the lightning intensity could be as high as 150 discharges per 5 minutes in a 25x25 km² area.

Note the method that is used here is a ‘perfect prog’ method. This means that it does not take into
account the cases where the model convection forecast is bad (where showers develop in reality but not in the model, or the other way around). So when the forecast of convection is bad, this method will give a bad lightning forecast, whereas a statistical method will still give some signal that should point in the right direction. One other issue that has to be raised is the fact that the relation is only valid for HARMONIE. The method can be used for any model (it was first used on WRF) but our experience suggests that the graupel is very differently represented in the different mesoscale models.
Introduction

While the Deutscher Wetterdienst (DWD) had over 3000 members of staff just after unification with the weather service of the German Democratic Republic in 1993, it continued to contribute to the ongoing, nation-wide process to reduce costs of the civil service while still achieving a high level of efficiency. The main challenges in this context were: concentration on core tasks, greater use of the opportunities provided by information technology as well as process optimisation and quality management. At the same time competition with private weather companies increased more and more. This lead to a reorganisation of DWD’s weather forecasting services, especially in collaboration with civil protection authorities and the media after the year 2000.

Organisation of the Forecasting Service at DWD

Currently weather forecasting at DWD is done at the Central Forecasting Office in Offenbach and at 6 Regional Forecasting Centres (Fig 1) throughout Germany.

Service for Civil Protection Authorities

Weather warnings are issued at regional forecasting offices guided and co-ordinated by the Central Services of DWD (Deutscher Wetterdienst) for Civil Protection Authorities and Media

Klaus Bähnke, Deutscher Wetterdienst/Offenbach

Figure 1

Figure 2

The forecasting process is guided and co-ordinated by meteorologists at the Central Forecasting Office in Offenbach. Based on numerical products and breaking the forecasting process in to three time stages - medium range, short range and nowcasting - the Offenbach meteorologists work with the Regional Offices to achieve a ‘Single Voice Policy’ for the forecasts. This applies especially to early warnings (lead time 7 – 2 days), prewarnings (48 – 12 hrs) and actual weather warnings (Fig 2).

During the reorganization of the forecasting service after 2004 the main objectives were newly redefined, while DWD concentrated on its core tasks. This meant the forecast and warning business area was restricted to its main target customers. They were redefined into 7 groups (Fig 3). These customers should be supplied with forecasts and warnings by a state-owned authority in a reliable way based on the principle of protection of life and property.
Strategy of DWD – Restriction of forecast products for key accounts:

- Disaster + technical relief organisations, fire brigades
- Military
- Public
- Aviation
- Marine shipping
- Energy suppliers
- Road winter services

Dissemination of the warning information:

- Deutscher Wetterdienst Central Forecasting Office
- Deutscher Wetterdienst Regional Forecasting Centres

Dissemination of Severe Weather Warnings and Information

Information of general public and disaster management

www.dwd.de
www.fewis.dwd.de

Figure 3

Figure 4

Figure 5
Forecasting Office for the main target customers like fire brigades, technical relief organization (THW) et. al. In case of severe weather warnings, forecasts are disseminated to the Operational Centre of the federal government as well as to the joint information headquarters (GMLZ) (Fig 4).

DWD has two main tools for the dissemination of weather warnings: unrestricted information by www.DWD.www especially for the general public, and FeWIS (FeuerwehrInformationsSystem) for fire brigades (Fig 5).

FeWIS supplies a closed circuit group with online weather information. Users get information about the present weather status (Fig 6) over the whole of Germany. Fire brigades in bigger cities can be provided with their area warning status (Fig 7) broken down into smaller districts.

In cases of severe weather warnings caused by heavy convective thunder and showers, customers have access to DWD’s radar tracking-system KonRaD (Fig 8).

Disaster management authorities are assisted by a special dispersion model in case of dangerous chemical accidents (Fig 9).

During droughts and when there is a danger of forest fires, authorities are provided with the results of a forest fire model (Fig 10).

DWD arranges trainings and exercises for customers and authorities. User conferences and workshops as well as feedback meetings are performed following very extreme weather incidents like the “Kyrill”-storm.

Currently FeWIS is the most important severe weather information tool for disaster management in Germany. In recent years the number of users has risen to over 1450.

Service for Media

With restriction to its core tasks in 2004, Deutscher Wetterdienst decided to issue only standard forecasts for the media. This meant the production only of basic numerical forecasts, basic weather charts as well as occasional radio forecasts and interviews (Fig 11).

Since then DWD only delivers those media forecasts that usually can be expected by a national weather service. This means products like standard national weather forecasts, a daily “Top Story of the Day”, a newsletter, special media information in case of severe weather and a statement on Facebook (Fig 12). These information services are freely disseminated via the internet on www.DWD.www. Oral statements are only provided on special request but not regularly. Forecasters support DWD’s public relation and press department on request (Fig 13).

Summary

- Deutscher Wetterdienst provides weather forecast products for its key accounts, i.e. civil protection authorities, fire brigades et. al. The main dissemination tools are the website www.DWD.www and the closed use circuit online tool FeWIS.
- Media services are issued on a limited basic level.
- Value added forecasts are not produced regularly.
Figure 10

Figure 11

Figure 12

Figure 13
The Forecasters' Contribution to the Impact Assessment in Weather Warnings at the Royal Meteorological Institute of Belgium (RMIB)

Jean Neméghaire, assistant and forecaster at the RMIB, Belgium with the cooperation of Karim Hamid, forecaster

Foreword

At the last WGCEF meeting in Bergen, three issues were presented concerning Belgium. Firstly, outputs from the short-term high-resolution ensemble GLAMEPS (0) were verified against the ECMWF and Aladin model outputs. Also, it was reported how efforts are made to contribute to severe weather management communications with media and Civil Protection through a federal Crisis Centre.

In this newsletter we discuss the third issue presented: the short range weather warnings issued by our forecasters.

Introduction

The severity level of weather warnings relies on a potential impact matrix which is illustrated here for some frequent weather events. The warning levels are determined by forecasters and produced using a colour and associated symbol(s). These warnings are issued in alignment with Meteoalarm objectives and criteria, using four colours to identify and describe the severity of the potential impact of weather events.

This potential impact estimated by forecasters depends both on specified quantitative and/or qualitative thresholds and on an evaluation of the risk to reach or exceed these thresholds. Some potential impact matrices built on thresholds (columns) and risk assessment (rows) are presented below.

For winds (gusts), snow/ice, freezing rain, and rainfall amounts associated to severe weather events, quantitative thresholds based on mean return periods have been defined.

For thunderstorm warnings the thresholds are mostly qualitative and the risk is evaluated using different tools such the probability scores derived using an interactive checklist focused on the potential for development of convective weather events. More details on the interactive checklist currently based only on one regional model (ETA) can be provided by the author on request. Furthermore other data are used like the analysis and forecasts of meteorological fields issued from numerical models. SAF Nowcasting products (cloud, precipitation and rapidly developing thunderstorm products), satellite images derived from RGB compositions (like the severe convection product), radar images and the lightning detection system (SAFIR) are mostly interpreted for nowcasting (very short range forecasts up to 1 or 3 hours ahead).

For cold spells and heatwaves, threshold values for surface temperatures (minima and maxima) and the number of consecutive days of an event are calculated to assess the potential impact. For heatwaves, the weather criteria along with an ozone concentration above a critical value are required to issue a red level warning in co-operation with the Ministry of Public Health.

All weather warnings issued by forecasters and reported here have a validity period of up to 48 hours ahead. They are forecast for the whole country and/or on a regional basis in accordance with nine Belgian provinces and a coastal area. For the Belgian maritime area only gale or storm warnings are currently issued.

Below we focus on the assessment of the potential impact for a selection of weather events forecast at short ranges. The methodology takes advantage of the meteorological expertise of forecasters using their analysis and their assessment of the most probable scenario. Furthermore a fine-tuning of the warning level(s) tends to take human and economic factors into account.

Example 1. WIND WARNINGS

The potential impact matrix below is based on gust forecasts. Columns show gust thresholds and rows the estimated risk levels. The icons with symbols and colours represent the potential impact level assessed by forecasters.
The risk level is evaluated as a complex function of several factors:

- Meteorological factors – the particular weather situation, the scale and location of the weather systems involved, and the effects of these factors on gusts. The gust forecasts are derived from several NWP deterministic models (a poor man’s ensemble).

- Surface and soil factors - including surface roughness, soil moisture and vegetation type.

- Human and economic factors – including population density, economic sensitivity, time of day, week or year, traffic, or leisure activities.

The summer season is defined as when a large amount of trees are still in leaf. The thresholds are
adjusted and there are five columns for the summer season. Otherwise the risk level is evaluated as in winter.

**DECISION to forecast the potential IMPACT level**

The potential impact level depends both on the forecast gusts reaching or exceeding the threshold values AND on the evaluation of the risk level. Different threshold values are provided in the two previous tables, respectively for the winter and summer seasons.

The impact level is then tuned by forecasters:

**A/ the level is increased when**

- the timing of the expected maximum gusts corresponds to peak hours (morning/late afternoon or early evening),
- the location corresponds to densely populated areas,
- people are unused to and unprepared for storm events in the location forecast,
- a long duration storm event is expected (eg due to successive troughs or frontal waves),
- the gusts are associated with unstable air.

**B/ the level is decreased when**

- gusts are forecast in the coastal area.

**Example 2. RAINFALL WARNINGS**

The potential impact matrix is based on precipitation amounts forecasts with thresholds for a showery regime (high rates but a shorter period given by amount in mm/6h) not associated with thundery activity OR for longer lasting episodes with heavy and continuous precipitation given by accumulation in mm/24h:

- Columns in the matrix show precipitation rates, and rows the estimated risk levels. The icons with symbols and colours represent the potential impact level assessed by forecasters.

The risk level is evaluated as a complex function of several factors:

<table>
<thead>
<tr>
<th>No significant precipitation expected</th>
<th>Significant precipitation ≥ 20 mm/6h or 25-50 mm/24h</th>
<th>Significant precipitation high rate ≥ 30 mm/6h or ≥ 50 mm/24h</th>
<th>Significant precipitation very high rate ≥ 60 mm/6h or ≥ 100 mm/24h</th>
<th>Significant precipitation very high rate ≥ 30 mm/6h or ≥ 50 mm/24h with saturated soil or risk of river flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 90 %</td>
<td>![Symbol]</td>
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<td>70 – 90 %</td>
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<td>20 – 50 %</td>
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<tr>
<td>&lt; 20 %</td>
<td>![Symbol]</td>
<td>![Symbol]</td>
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<td>![Symbol]</td>
</tr>
</tbody>
</table>
• Meteorological factors as above, but also considering the effects of stability, strong winds or rapid thaw.
• Surface and soil factors such as surface state and soil moisture along with river flow and height.
• Human and economic factors as above.

**DECISION to forecast the IMPACT level**

The potential impact level depends both on the forecast precipitation amount and rates exceeding the threshold values AND on the evaluation of the risk level.

The impact level is tuned by forecasters:

**A/ the level is increased when**

• the timing of the expected precipitation corresponds to peak hours (morning/late afternoon or early evening),
• the location corresponds to more densely-populated areas, in particular in valleys close to the rivers or in coastal and estuary areas,
• successive significant rain episodes are forecast in the short and medium range (ie. in the next 5 to 7days),
• there are strong river flows and high levels,
• soil is wet or saturated,
• rapid thaw from a dense and deep snow cover over a catchment area is expected.

**B/ the level is decreased when**

• the soil is dry,
• there are low river flow and level,
• no thaw is expected.

**Concluding Remarks**

The objective evaluation of risks remains a difficult task for forecasters and would be very helpful for the potential impact matrix. The development of ensemble prediction systems for short range forecasts (like GLAMEPS, or at a larger scale ECMWF-EPS) will be tested in the near future to get better meteorological fields and indices giving an indication of the spread of the forecasts and alternative scenarios. We also need the support and the cooperation of authorities and hydrological services to get a more objective assessment of the impact of weather events on society.

For (very) short range forecasts up to 6 or 12 hours the current INCA-BE system seems to be very promising for severe convective weather events, based on those forecast during the summer of 2011. Furthermore a more relevant use of remote sensing data like radar and satellite images (including SAF nowcasting products) is also required by forecasters for their analysis and their nowcasting and should be helpful to issue warnings.
Communications between the NMHS and Media and Civil Protection in Croatia
Zoran Vakula, National Meteorological and Hydrological Service, Croatia

Introduction

For many years, cooperation of the National Meteorological and Hydrological Service (NMHS) with the media and the National Protection and Rescue Directorate (NPRD) - which the Civil Defence is one part - was at a very high level. The situation partially changed with the appearance of private weather companies, along with the strengthening role of the internet and the increasing number of weather forecasts on it. The NMHS maintains a significant role, although it is no longer the only source of meteorological information, especially not of the weather forecast itself, which is particularly evident when following the press, radio and television. However, for the NPRD, NMHS is still a "single voice" for forecasts and warnings, especially for dangerous weather phenomena. Also, television weather forecasts – especially those prepared and presented by NMHS meteorologists – are amongst the most popular shows on television.

The Structure of the National Meteorological and Hydrological Service

The NMHS of Croatia is the fundamental institution for Meteorology and Hydrology in the country. It was founded by decree of the Government of the People’s Republic of Croatia (PRC) on 27th of August 1947. Part of its staff (fifty employees) and equipment was taken from the Geophysical Institute and Ministry of Construction of PRC, which conducted some services in the fields of meteorology and hydrology (including observations and weather forecasts). Until Croatia became an independent state (in 1991), the NMHS operated as republic institution, and after that as state organization. Since 1992, Croatia has been a member of the World Meteorological Organisation (WMO), and the NMHS performs international cooperation on behalf of the state. Over the years, as required by the growing range and amount of work, the number of employees has increased to reach a staff of more than 440. The Institute’s internal organization and its scope have been constantly changing and adapting to the increasingly demanding set of requirements for hydrological and meteorological services to meet the demands of the economy, traffic and the environment.

For many people, the most recognisable part of the NMHS is the Weather Forecast & Analysis Division (WFAD). This consists of the Department of Maritime Meteorological Centre in Split, a branch office in Rijeka which specializes in Maritime Forecasts, and the Department of Weather Analysis and Forecasting in Zagreb.

WFAD issues a range of products in its area of expertise – nowcasting, short-range weather forecasts and medium range forecasts. There are also monthly forecasts (issued twice per month, on Tuesdays) and seasonal forecasts (once per month, issued around the 15th). For the general public there are forecasts for radio, TV, newspapers, web (including Facebook), SMS, MMS, and a telephone service. There are also special customers like civil services, fire departments, agriculture, roads, engineering, mine-disposal, water and power management and tourism.

Communication to the Media

Forecasts from WFAD appear daily in various media, from traditional media, such as newspapers, radio and television to newer media such as SMS and MMS messaging, web sites and Facebook. In 2010 the media accounted for about 52% of direct revenue. The largest part of this was from TV (60%), and the rest in equal proportion came from radio, newspapers and the web.

The NMHS on the Web

NMHS has had a presence on the web almost from its very beginnings in Croatia, in the first half of
the 1990s, and today has many domains: www.meteo.hr, www.klima.hr, www.prognoza.hr, www.vrijeme.hr, as well as forms without the www prefix. Numerous daily meteorological data – both observed and forecast, appear on the site. For example, there are subjective forecasts from forecasters in both textual and graphic form for the current and the next day for Croatia - and especially the capital Zagreb – as well as text forecasts for mariners. Also, there is a 3 day outlook in textual form, written by a forecaster. In addition to these types of subjective forecast, there are also objective forecasts - direct model output of models in various forms – for many locations in Croatia and for the country as a whole. Particular attention is paid to the warnings in the classic, text format in the Croatian language and textual-pictorial form in the Meteoalarm system. All warnings are subjective, written by a forecaster.

Newspapers

NMHS has several decades of experience in forecasting in the newspapers, since the days when there were only a few, to the newspaper boom a few years ago, until today, when sales are declining. NMHS does not prepare final products for newspapers; all that is required are some elements of weather reports, which are sent to the newsroom ready to be made suitable for printing.

According to market research between October and December 2010, which was conducted and published by De facto production company, there are 13 best-selling newspapers in Croatia over the last 12 years. Of these, 3 do not have forecasts. Of the remaining 10, 5 co-operate with HMHS, while the other 5 take forecasts from private meteorological companies. Counting the average number of daily newspapers readers in Croatia, the daily forecast reaches about 1/3 of readers. It is important to note that the most widely read and cheapest newspapers account for 44% of respondents to the survey, and these newspapers have forecasts from a private company. It is interesting to mention that 51% of readers older than 12 years at least read a newspaper, and that 22% of respondents do not read a daily newspaper at all.

Radio

Co-operation between the NMHS and radio also has a long life. Forecasts have been read by radio newsreaders since 1953, and expanded upon since 1966, when discussions about weather and forecasting started. Today many forms of co-operation and transfer of meteorological information exist – newsreaders reading forecasts, interviews with forecasters, or forecasters reading forecast. In the meantime, numerous radio stations have appeared, at the national and local levels, especially since 1995. According to research results and the radio market (also by De facto production, conducted between July and September 2011), 12 radio stations in Croatia have the most listeners. Of these 12, NMHS works with 6, which cover about 45% of respondents, of which the two most listened cover about 27% of the market. The forecaster now has 8-10 live radio broadcasts, depending on the day of the week, and 7 pre-recorded forecasts are broadcast on different stations throughout the day. Most interviews are done between 6:20 pm to 9:30 am. During these interviews – usually around 2 minutes but sometimes 10 minutes in duration – in addition to the forecast for the following days, forecasters often give a climatological summary of recent weeks, as well as forecasts for several weeks or even months in advance. If, during the daytime, an extraordinary meteorological event occurs, forecasters may appear on many different radio stations at their request, regardless of whether the stations have contracts with NMHS or not.

Television

The has been co-operation between the NMHS and Croatian Television since 1956, when meteorologists began periodic appearances. Regular forecasts in the evening began in 1968. From 1996 forecasters have also prepared reports for other television programmes at the national and local level, sometimes also appearing on them. Since 2005 the forecasters have started to work in shifts on television. Forecasters in the NMHS prepare forecasts for many media - newspapers and radio, and text and image reports for commercial television such as NOVA TV, currently the most popular station in Croatia. The forecasters at HTV prepare reports only for HTV, from 6h to 18h, every day, or in two shifts, with the first shift preparing programmes from 6h to 14h, and a second shift in the afternoon and evening. The meteorologists have a direct connection to the Intranet in the NMHS. They prepare all images and animations in the TriVis visualisation system, enter the text forecast in the iNews system and record themselves and run the visualization of images and animations.
There are many TV shows with weather information and forecasts. The total amount of weather information, mainly forecasts, during weekdays is about 16 minutes per day, and during the weekend is about 10 minutes.

The main weather TV show, just after 20h and the main news, is one of the top 5 most watched shows on Croatian television almost every day. The shows are visible on TV and on www.hrt.hr, where there are archives of the last 20 evening shows, so the forecasts can be verified.

Communication to Civil Protection

Civil protection is a part of the National Protection and Rescue Directorate, with which NMHS has a long term co-operation. There is a strict standard operating procedure, which includes provision of general and specific forecasts and warnings of hazardous weather events, all in text form, along with forecasts for the MeteoAlarm system. The Operative Department of the National Protection and Rescue Directorate (Centre 112) has recognized MeteoAlarm as being beneficial for information on their activities and as valuable supplement to our regular cooperation.

Warnings in Croatia have long history, for sea traffic warnings have been issued by the Maritime Forecast Department since 1947 via radio (WMO standards) and also via the internet today in several languages (Croatian, English, Italian and German).

Croatia officially joined the MeteoAlarm system (www.meteoalarm.eu) from 17th July 2009. Every day forecasters write warnings for 8 climatological areas and send them to www.meteoalarm.eu. The list of parameters that are warned about in Croatia are wind, rain, snow / ice, thunderstorms, extreme low temperatures, extreme high temperatures and fog. Integration of hydrological warnings in Croatia still not operational but is expected in the future.

Conclusions

The Meteorological and Hydrological Service of Croatia has a very strong relationship with National Protection and Rescue Directorate, including Civil Protection, and with majority of the main media in Croatia.

Cooperation between NMHS and Media and Civil Protection is very important for better understanding of weather information and warning people for hazardous weather events.
Introduction
Challenge or Necessity?

Life brings numerous new challenges, and experience shows that each of us goes before an audience and becomes a teacher – even if only briefly – on increasingly frequent occasions. I first heard of special training for meteorology trainers a few years ago, but this tended to focus on what should be taught, rather than how. In 2014, the WMO plans to organize training for trainers in the European region. In this article it would be useful to introduce the training objectives and the benefits for its participants. My own case has shown that meteorological professionals are really not aware of the nature of such training. We would like to invite other colleagues to dare to participate in them, because, despite the high stress and strain of training, the benefits are undeniable and obvious.

The WMO Education and Training Office – the Initiator of this Expansion in Learning

In 2010, I was lucky to participate in the WMO Education and Training Programme (ETRP) seminar 'Train the Trainers'. During two weeks in May, 20 meteorologists from meteorological services in 14 European countries and several universities gathered in the beautiful medieval town of Sibiu in Romania. This workshop was aimed at meteorologists of the WMO Region VI who were one way or another related to the training of professionals and students (Fig. 1).

My colleague Metaxa Konstantara from the Hellenic National Meteorological Service and I then presented the results of this workshop to the participants of the EUMETCAL VI Workshop held in Geneva, recommending that similar courses should be conducted in the EUMETCAL environment. We were glad that the trainer's competence matters were the main focus at the EUMETCAL VII Workshop held in the beginning of March 2012 at the Met Office headquarters in Exeter, United Kingdom. Specialist knowledge was imparted by experts in their field from WMO-ETRP, EUMETSAT, EUMETCAL and COMET, namely: Luciana Veeck, Jeffrey Wilson, Mark Higgins, Tero Silli, Ian Bell, Patrick Parrish, Roger Deslandes and others. The experts lectured, conducted workshops and talked with more than 50 participants from 23 countries, mostly from Europe.

I made a statement about the undeniable benefits of the WMO-ETRP workshops at the CALMET IX conference in Pretoria in 2011, in view of the upcoming training event for the African region. From feedback I can say that the conference helped doubting attendees decide to participate.

What is a Good Lecture?

Each meteorological service attaches increasing importance to the raising of its specialists' qualifications, because meteorologists face new challenges due to rapid technological development and the need to implement improved methods and applications. Unfortunately, financial resources are limited, and increasing use is made of distance or blended learning methods. They are cheaper, because they eliminate travel and subsistence expenses of the trainees. Participants only need to register, and to have a computer with specifically installed programs, headphones, speakers and microphone. A course presenter prepares a presentation - usually in ppt format - and posts it into a virtual environment. They then connect online to the session and the lecture is ready to begin. But is this really enough? Is it possible to apply the same methods in a remote lecture as to those delivered in the classroom and ‘live’? How can we make training not only useful but also interesting, and how should we overcome communication barriers and engage
the audience? How should we choose assessment criteria for the courses and present them in a form of questionnaire, and what is required of a slide presentation? In short, how does one become a competent trainer?

Experience shows that many lecturers are self-taught and that firstly they are experts in their respective fields, usually in meteorology. Unfortunately, to professionally conduct a lecture, in-depth knowledge of the subject and rich experience are not enough. It also requires pedagogical and psychological knowledge. You need to have knowledge of the audience - professionals or students, ethnic composition and cultural background; it also is important that the lecture is conducted in their native language.

Lecturers are often faced with a problem of how to focus students’ attention during the lecture (Fig. 2), by the use of elements of performance, presentation design, and so on. Visual and kinaesthetic communication (otherwise called ‘body language’) is very important during a face-to-face type of lecture. During this type of lecture it is easier to interest students and engage an audience, to achieve a deeper understanding of the material and make it memorable. ‘No emotions, no learning!’ might be the credo of such courses. Meanwhile, preparation for lecturing at a distance requires much more effort from the teacher – it is not always possible to show a video or animation online, and one must carefully select the layout and background of the slides and any presentation effects. Even with a camera connected to PC, it is hard to employ ‘body language’; so one should focus more on the voice including the intonation and pauses. However, this teaching method has its advantages - a lecture often is recorded, so both students and teachers have an opportunity to review the material carefully, objectively evaluate it, and avoid the discovered mistakes in the future. Quite often the success of a lecture is evidenced by abundance of students’ questions and their quality. A professionally delivered lecture satisfies not only the students’ curiosity, but also encourages them to further deepen their knowledge, and gives a lecturer personal satisfaction with the work and guide-
lines on how to improve the work and update the data (Fig. 3). It means that each presentation is a lesson for the trainer as well.

**Conclusion – Never Stop Learning!**

Clearly knowing how to create the best content of meteorological training is very important, but this is more related to raising of a specialist (usually a forecaster) qualifications rather than the instructor’s teaching skills. This article has another aim – to show the sources of, and techniques for improving, knowledge transfer techniques to achieve the objective of delivering a ‘good’ lecture. Relations between meteorologists in different countries are becoming closer and more varied, and the number of training courses and events is rapidly growing. So a logical question arises as to which methods to choose. My advice would be as follows: if you have to impart professional knowledge to colleagues, customers or students, but feel you lack knowledge of how to conduct your lectures, then ‘Train the Trainer’ workshops are meant specifically for you.
Introduction

Northern Atlantic atmospheric low frequency variability can be described as mainly evolving through a fixed number of recurrent states. (Vautard, 1990) identified four weather regimes which have a mean persistency about 10 days. Further studies have shown that these can aid comprehension of large scale dynamics, especially as when also considering interactions with the Atlantic jet (Riviere and Orlanski, 2007). In particular, periods of likely regime transitions may have high impact on the sequence and density of mid-latitudes cyclones (Michel and Riviere, 2011).

More recently, as concern on climate change impacts increases, weather regimes are central to new developments in statistical downscaling techniques. Weather regimes may be characterised by applying automatic classification tools over long periods reanalyses. It is then possible to identify local climate properties that occur specifically in association with particular regimes. Global climate models often suffer from a lack of resolution sufficient to describe regional to local atmospheric properties, but they may better reproduce weather regime distributions. An example of such approach is described in Nuisier et al. (2011) over Southern France, which shows that the conditional occurrence probability of high precipitation events can be deduced from given regime membership.

In the context of weather forecasting, weather regimes analysis in model forecasts could inform forecasters about the next days’ large scale evolution and likely elements of local weather predictability in a more synthetic way. The assumption is that when the regime prediction skill of a model is poor, the predictability of local weather is weak.

We present experimental results concerning the forecasting of the 4 Atlantic weather regimes with the operational ensemble forecasting system at Meteo France, PEARP. We also show the results of occurrence probability calculations of Heavy Precipitating Events (HPEs) over Southeastern France in one intense case of 2008 autumn season.

The PEARP Global Ensemble Forecasting System at Meteo France

The PEARP ensemble system runs twice a day at 06UTC (72h forecast range) and at 18UTC (108h forecast range). The horizontal resolution is T538c2.4, giving an approximate mesh size of 15 km over France and 90 km on the opposite side of the globe. In the vertical, the model has 65 levels. The ensemble is composed of 35 members; one unperturbed and 34 having perturbations in the initial state and in the physics of the model. The
initial perturbations combine Ensemble Data Assimilation (6 members and the assimilation ensemble mean) and singular vectors (TL95c1, 65 levels) targeted on different areas and using different metrics and optimization time windows according to the region (tropical or extra-tropical). The perturbation of the model is performed, for each individual member, by randomly choosing the physical parameterization scheme from a set of 10 different ones, with the constraint that each scheme is not used more than 4 times.

A range of products are provided to the forecasters. Some of them are very "classical" products: probability maps, quantile maps, postage-stamp maps and spaghetti plots. Fig. 1 shows an example of a 4-quantile presentation of one precipitation forecast for the very intense case on 1st Nov 2011. Others products are more specific, for example trajectories of mid-latitudes cyclones or tropical cyclones. Finally, some recently developed products are the result of collaboration with the research department and are dedicated to the detection of particular severe events.

The Atlantic Weather Regimes

During, the 1990s many studies were devoted to weather regimes characterisation. Over the Atlantic domain, major studies (Mo and Ghil, 1988; Molteni et al., 1990; Vautard et al., 1988; Vautard, 1990) identified quasi-stationary weather patterns based on clustering techniques. Then Michelangeli et al. (1995) reviewed the number of classes and proposed a classification scheme for the North Atlantic consisting of a 4 weather regimes. Within our process of regime calculation, a Principal Component Analysis is carried out over the whole reanalysis (ERA40) and the classification is then performed over the first several components retained. A distance criterion is then defined in the EOFs subspace. After some iterations that minimize the variance intra-cluster (k-means method), each day is allocated to a cluster. The centre of a cluster is defined as the variable average over all its members. Fig. 2 shows an illustration of the centres of the weather regimes we computed. Even though the Northern Atlantic Oscillation is constructed simpler like the projection onto the first EOF only, weather regimes patterns have similarities with the NAO ones. Two broadly equivalent classification scheme coexist then, the original Vautard names are pointed out in the figure, as well as the NAO one.

It may be possible to subjectively identify which regime a current meteorological situation resembles, but we propose here a more objective procedure. In order to estimate to which regime a model forecast should be allocated, we project the forecasts onto the ERA40 first representative EOFs (twenty EOFs correspond here to 97% of the total variance). Then we compute the correlation distance in the EOFs subspace between the forecast and the regime centres for each member at each forecast lead time. In. fig. 3, we can see the results we obtained when applying this technique to one PEARP forecast for 19 Nov 2011. A membership criterion has been validated on the reanalysis, showing that under a correlation threshold the regime membership is predicted with a
Figure 2
Northern Atlantic 4 weather regimes, composites of geopotential height at 500 hPa

Figure 3
Projection onto the 4 Atlantic weather regimes of the 18 Nov 2011 18h UTC PEARP forecast. The dashed line is the significance threshold for regime membership.

Figure 4
Evolution of the geopotential height at 500 hPa, ARPEGE analysis from 19 Nov 2011 00h UTC to 23 Nov 2011 00h UTC
85% score (shown by the dashed blue line). The panels in Fig. 3 show the projection onto each of the 4 regimes versus the lead time of the forecast. The 34 members of the ensemble are drawn in grey lines, whereas the control is the black line, and the mean of the ensemble is the red line. The lower the projection is, the closer the member is to the regime center. At the beginning of the forecast, the Blocking regime is observed. The Atlantic Ridge and NAO- are not likely to occur all along the forecast. We chose this situation because it is a good illustration of a transition between two periods of different regimes, here between Blocking and NAO+, which occurs between J+1 and J+2. Fig. 4 shows the corresponding evolution of the analysed geopotential height at 500 hPa, the blocking is clearly present at the beginning of the period over western Europe, but a strong zonal gradient develops towards Iceland by day 3.

On another hand, one can note that the spread of the ensemble is naturally increasing with time, and so does the uncertainty of the regime prediction. By the way, the increase in spread is not the same for all panels. The anticorrelation of the forecast with NAO- is very strong, with weak spread, whereas for the other regimes the spread is much larger from J+1. The spread then is not sensitive to the intensity of the correlation.

Forecasting the Occurrence Probability of Heavy Precipitating Events

The CYPRIM French research programme aimed to assess the predictability of HPEs that often hit the French southeastern region during the autumn season. One section of this programme was aimed at defining the large scale circulations (LSC) that favour the occurrence of HPEs. For this purpose, a statistical downscaling technique has been designed, a further description of which can be found in Nuissier et al. (2011). In this study, a classification is performed for the autumn days with significant rainfall and leads to four typical LSC classes. Two of them discriminate the HPEs pretty well: the probability of HPE occurrence increases as the EOFs distance to the center to the LSC is getting low. The composites of these two classes are shown in Fig. 5. Two configurations for humidity anomalies and strong low-level jet hitting the area of interest are underlined. Then, the ability of such atmospheric features to represent sufficient conditions for HPE to occur is assessed. A multivariate linear regression based on LSC distance and low level parameters shows that more than 25% of the HPEs (around two hundred between 1960 and 2001) coincide with such conditions with a skill score of 69%. In other words, when these conditions are observed in ERA40, a probability of 69% for an HPE to occur is found. We investigate here the application of this relation in one PEARP3 forecast. The regression is applied on each member of three successive forecasts (Fig. 6) to examine the persistence of HPE detection throughout the forecasts. The example on Fig. 6 is for the 1-2 November 2008 situation which is one of the most severe events in recent years. The left panel shows the ensemble member forecast terms which validate the criterion in red and the others in green. It shows that the event was detected since the 29 October 2008 18 UTC forecast and maintained in the two successive forecasts. In the last forecast, at the lead time corresponding to 2 nov 2008 12-18 UTC, all the members match the

\[ \text{Figure 5} \]

*The two patterns favouring HPE occurrence. Composites of geopotential height at 500 hPa (red lines), moisture flux anomalies at 925 hPa (shaded colours), and winds (over 5 m/s) at 925 hPa (blue arrows)*
Figure 6
Left panel: HPE index on each term of each member of the PEARP3 on 3 successive runs: red box, the criteria are true, green box the criteria are false.
Right panel: the overall HPE occurrence probability taking into account the HPEs index climatological probability and the ensemble probability

Figure 7
Precipitation daily amount between 31 oct 18 UTC. and 1 Nov 18 UTC
HPE criterion. As previously stated, the highest probability that can be reached with the criterion is about 70%. Then, assuming that the model reliably reproduces the downscaling function, it is possible to compute the forecast probability of HPE occurrence that compounds with the ensemble signal. It can be expressed as:

\[ P_{\text{HPE}} = P_{\text{HPE|Red}}^{\text{Clim}} \cdot P_{\text{Red}}^{\text{Ens}} + P_{\text{HPE|Green}}^{\text{Clim}} \cdot P_{\text{Green}}^{\text{Ens}} \]

where \( P_{\text{HPE|Red}}^{\text{Clim}} \) is the climatological probability for a day to have an HPE when the criterion is red (i.e. about 70%), \( P_{\text{Red}}^{\text{Ens}} \) is the probability for a term member for being red over the three forecasts, \( P_{\text{HPE|Green}}^{\text{Clim}} \) the probability for a day to be an HPE while the criterion is green, and \( P_{\text{Green}}^{\text{Ens}} \) the probability for a member term for being green over the three forecasts. The right panel of Fig. 6 shows the probability of HPE occurrence computed in this way. The theoretical maximum of this value is 69%, and in this case it is nearly achieved over the three forecasts. Of course, for other events the probability of HPE can be very weak, this “index” cannot be considered as an all-in-one predicting tool. However, considering that the technique is designed to detect quasi sufficient conditions it can be considered as a reliable pre-warning index for high impact HPEs.

These results have been derived for one season at this time, and analysed only roughly. However, the procedure has been extended experimentally to the rest of the year, and it might be interesting to extend the validation period to the whole year.

**Conclusion**

The projection of an ensemble forecast on the Atlantic weather regimes shows the possibility of quickly interpreting the main features of the large scale circulation and its associated predictability. It can help identify likely transition periods in advance, of which some may be associated with high impact weather. The synthetic view provided by this product could also make the comparison of several models easier, which constitutes a major part of the forecasters role.

The statistical discriminant LSC is explored in the forecast to show the possibility of computing the probability of occurrence of high impact weather. This computation shows a fair ability to anticipate the event detection. By means of an appropriate validation work by comparing with the observations, this HPE index could represent efficient pre-warning information for this kind of event in the medium range.

**References:**