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Coverage	Summary and conclusions from 4 th Annual EFAS meeting held at ECWMF, Reading, from 27-28 th January 2009
Status	Final

Location: ECMWF, Shinfield Park, Reading	Date of Meeting: 29-30 th January	Duration: 2 days
Recorder of Minutes: BP	Name:	
List of Attendees	<ul style="list-style-type: none"> • Bart Pannemans (BP, JRC) • Peter Salamon (PS, JRC) • Milan Kalas (MK, JRC) • Ad De Roo (AdR, JRC) • Jutta Thielen (JT), JRC) • Bao Trinh (BT, JRC) • F. Pappenberger (FP, ECMWF) • R. Buizza (FP, ECMWF) • R. Hagedorn (RH, ECMWF) 	External participants : See list of participants in Annex 1

Participation:

The attendance of this year's 4th EFAS workshop was high. In total 18 partner organisations (out of 26) attended, 3 had to cancel due to sickness and flood alerts, 3 notified the JRC that they could not participate and only 2 did not respond at all to the invitation. Other participants included researchers from King's College which run a study on communication of risk and uncertainty, the Finnish Environment Institute which gave a presentation on their EPS based forecasting system, and Atkins, which presented an update on the EU-FLOOD-GIS system. Three partner organisations did not respond at all to the invitation.

- The 18 partner organisations represented: BE (Flanders Hydraulics), BG (National Institute of Hydrology and Meteorology), CZ (Czech HydroMeteorological Institute), DE (Bundesanstalt für Gewässerkunde), DE (Global Runoff Data Centre), ECMWF, FR (Schapi), IT (ARPA-Servizio IdroMeteorologico), IT (ISPRA, ex APAT), LT (Vilnius University), NL (Rijkswaterstaat Centre for Water Management), HU (Vituki), PL (Institute of Meteorology and Water Management), RO (National Institute of Hydrology and Water Management), SE (SHMI), SK (SHMU), SI

(Environmental Agency of Rep. of Slovenia) , RS (Republic Hydrometeorological Service of Serbia)

- 3 partner organisations had to cancel the participation: DE-LUWG Rheinland-Pfalz (sickness), AT-BMLFUW Abt. VII/3, Lebensministerium (sickness), ES-SAIH-Ebro (Flood Alert)
- Partner organisations that notified the JRC that they could not participate: DE-Bavaria, DE-Hessen (too late notification from EFAS team), DWD
- Three partner organisations did not respond to the invitation: DE (Slug), DE (LUA Brandenburg), MD (Moldovia)
- Other participants: King's College, Finnish Environment Institute, Atkins

A detailed list of partners is attached in Annex 1.

Workshop organisation

This year's workshop was organised over two days. During the first day an overview on floods and EFAS developments during 2008 were given, while the second day was reserved for workshop exercises and presentations from partner organisations that are exploring EPS for their operational flood forecasting. D. Marbouty, the director of ECMWF, highlighted in his welcome speech the importance of hydrological applications for the meteorological services.

Results from 1st day

EFAS flood alerts during 2008: J. Thielen presented an overview of flood alerts during 2008. EFAS sent alerts for two major flood events in i) Sweden in April and ii) in Eastern Europe (RO, HU, SK) in July. For the Po two alerts were sent out, one of which was external (May, local flooding) and one internal in October, where the EFAS team suggested that high waters might occur but no flooding which was subsequently also confirmed. In addition to these alerts several external and informal alerts were sent out, e.g. for France and Spain. In total, 13 external and 10 informal alerts were sent, of which 15 can be counted as hits, 4 false alarms and 4 not known. The number of misses is not known and therefore not counted. Most alerts were sent during the spring and early summer months.

EFAS partner reports on the floods in their countries during 2008:

- The representative from SHMI (Sweden) reported on the long-lasting floods during April&May. EFAS alerts were received at the same day the SHMI had issued a flood warning.
- Representatives from Romania, Hungary and Slovakia reported in detail on the July floods which were particularly devastating in Ukraine. EFAS results were received and used as first indication of possible floods to happen. The representative from Poland pointed out that during this event also tributaries to the Vistula were affected, but only with localised flooding too small scale for EFAS.

- Representatives from Italy reported on two events where high water levels were observed but flooding took place only locally. EFAS alerts were received for these events.
- Other partners reported that only small scale flooding, often flash floods, occurred during the year (see Annex 2).

EFAS upgrades during 2008:

J. Thielen reported that the biggest change in 2008 was the inclusion of COSMO-LEPS in the operational EFAS forecasting chain since July 2008. COSMO-LEPS is being run but explored only experimentally. Other changes involved an update on the EFAS-IS interface taking into account some suggestions from the previous EFAS workshop, reprogramming of the system scripts resulting in a more robust and stable system performance with less delays and down times.

Research&Publications:

J. Thielen reported that the biggest emphasis during 2008 was put on research and the publication of results. During 2008 seven papers were published on EFAS case studies and the system itself -a list of the publications and reports is attached in Annex 3. New research focused on the potential benefit of seamless forecasting using monthly, VAREPS and COSMO-LEPS input data for a flood event in Romania (Thielen et al., accepted for publication in *Meteorological Applications*), as well as on sequential data assimilation of near real time discharge (Salamon and Feyen, submitted to *Journal of Hydrology*).

Data collection projects: EU-FLOOD-GIS and ETN-R:

A. Kemp from Atkins presented an update on the The EU-FLOOD-GIS project which is due to finish in March 2008. Much progress has been made on the system and data collection and except for a few countries where the meteorological services did not respond, the data collection is ongoing. Currently data for more than 1500 stations are collected in real-time, of which most have been incorporated already in the EU-FLOOD-GIS. The metadata catalogue is going to be published to the data providers in the next weeks. The project will be concluded by Atkins and then carried on by the JRC for at least the next 2 years.

U. Looser reported that the first phase of the ETN-R (GRDC) project was successfully finished in December 2008. Currently, real time data for about 550 stations is being collected with a stable and robust system. There was a steep increase in number of incorporated stations during the last months. The second phase of the ETN-R project will continue to be carried out by the GRDC where data for more stations from more countries will be collected and incorporated and the database completed with alert levels for each station.

Future developments of EFAS

A. de Roo gave a short report on the current status of the discussions on an operational EFAS. DG ENV and DG JRC have agreed to jointly finance EFAS until 2011 to keep running at the DG JRC. In the meantime discussions with DG ENTERPRISE and GMES

in particular are ongoing for future financing. A. de Roo reported that several partner organizations have approached the DG JRC in 2008 to propose an active role in an operational EFAS (SK-SHMU, SE-SHMI, NL-RIZA, IT-I.SP.R.A.(ex. APAT), ECMWF (for operational running only and not dissemination of results)). He highlighted that although a final decision on how an operational EFAS would be organized will depend to a great deal on the organisation financing the system, the DG JRC will put forward strong recommendations taking into account the wishes of all partners.

A. de Roo reported that according to the decisions made during the 3rd EFAS annual meeting, EFAS is now preparing new products for the DG ENV MIC service. In general, the aim of having these products is to enable the MIC to take preparatory actions (availability of staff and equipment) in case of a possible major flood in Europe, for which a country could ask for European assistance through the MIC. The EFAS products include the visualization of discharges exceeding critical levels at ETN-R stations as reported by the data providers. Only for those countries not yet reporting, information from EFAS will be shown and clearly labeled. Links to the national providers for more information are implemented. Other products include a simplified early flood warning product that is distributed via the MIC to the International contact points of the Civil protection only and not distributed on national levels. As was agreed in the previous annual meeting and in accord with the consultation, the criteria for this product are set very severe in terms of upstream areas affected, flood probability and persistence, so that this information will not be distributed more than once or twice a year and only for severe cases. J. Danhelka (CZCHMI) expressed concern that the authorities receiving these products are not sufficiently trained and informed as how to use this product. A. de Roo replied that there will be training organized for these authorities (already took place in Feb 2009, another training to following in April 2009) and also insisted that the receivers here are not the local civil protection but international civil protection that deal with a whole range of serious disasters. G. Balint (HU-Vituki) suggested that the information could be always distributed with a clear disclaimer and preferred actions to be taken based on the products.

J. Thielen presented planned future products for EFAS for better decision making. Some products that are present from the workshop onwards include probability maps of rainfalls exceeding certain thresholds for ECMWF-EPS and COSMO-LEPS as well as time series of temperature, rainfall and snowmelt, all probabilistic and shown at the reporting points. Further developments in the near future will include a new EFAS-IS interface which will be more user-friendly and better imbedded in general information, regular and systematic skill score calculations. Planned scores include Talagrand diagrams and ROC (B. Trinh).

Working groups

The participants were asked to sign up for 4 working groups on the following topics:

Group I	Pro and Cons of expanding EFAS to smaller national rivers and flash flood
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Group II	How would you see an operational EFAS fit into the national flood forecasting/CP strategy?
Group III	What data and specific services would the hydrological EFAS community like to have from the meteorological centres?
Group IV	What should an operational EFAS deliver for you?

Only few signed up for Groups III and IV , therefore the two groups were combined in one discussion group.

Results from Group I (discussion leader J. Thielen): J. Thielen presented to the EFAS partners the outline of the IMPRINTS project which is a RTD project funded by DG Research under FP7. IMPRINTS started in January this year and deals with flashflood and debris flow forecasting. The DG JRC participates in this research project to test if the EFAS methodologies of threshold exceedances can also be applied for smaller scale catchment when using the higher resolution COSMO-LEPS weather forecasting data. A first feasibility study was performed on this during the FLOODSITE research project, and will be taken further during IMPRINTS. The idea would be that based on COSMO-LEPS and EFAS methodologies downscaled to 1km an early warning on flashfloods – with high spatial and temporal uncertainties – could be communicated to the local partners that then develop much more precise early systems incorporating discharge and radar observations. J. Thielen made clear that although EFAS methodologies are being tested, the IMPRINTS project and its results and products are independent of EFAS.

- M. Casaioli (IT) expressed the opinion that extending EFAS to medium-sized national river basins was a “natural” development, at least for those that have already signed an EFAS MoU. However, it should be clear that the quality of EFAS forecasts for medium-size catchments differs from the ones for larger size catchments: the leadtimes are shorter and there is more uncertainty. Therefore J. Thielen suggested that in case EFAS incorporates medium-size catchments in the future, the alert messages should be clearly distinguished from the larger trans-national ones.
- All members of the discussion group agreed that flash floods are occurring in all countries with often severe consequences and potential loss of life. Therefore solutions to early warning on flash floods with lead times up to 24 hours were welcomed by all members. There was interest in being updated on the results achieved during the project.
- In addition to the benefit of the research, potential advantages of incorporating flashfloods into an operational EFAS in the future were seen mostly in additional information and backup solutions for the national flood forecasting centres. Exchange of data for proper flash flood forecasting (radar, gauge measurements) would not be feasible in the given time scale for a trans-national system and therefore must take place on local –national/regional– level.
- L. Jelonek (PL) suggested that instead of EFAS expanding towards smaller scales, the transfer of knowledge and methodology to the EFAS partners would be another solution. J. Thielen pointed out that all results of the project will be made available to the public, as it is a RTD funded research.

- In the plenary discussion when the results of the working group were reported, J. Danhelka (Cz) expressed concern about EFAS distributing flashflood warnings accessible to all partners. J. Thielen made clear that IMPRINTS is a research project and completely independent of the pre-operational EFAS. Any results during the project will only be communicated to the test-bed partners. Only if the results are positive, the development of a flashflood/debris flow early warning system could be envisaged of which the EFAS-FF contribution would only be a small part.

Results from Group II (discussion leader A. de Roo):

(contributions listed by country)

IT

- G. Monacelli reported that IT wants to launch an INTERREG proposal to help assist countries in using EFAS results; The mission of EFAS needs to be stressed.

CZ

- J. Danhelka pointed out that every country has its own system how to alert CP and how to behave, which is in many cases determined by legislation;
- dissemination should go to national/regional responsible services, just as ECMWF makes weather forecasts and makes it available to MS
- at European level, info to the MIC should not trigger action; The national CP person should not take further action, as a maximum should call the NHS;

BG:

- alert is legally defined and should come from authorized institution; who makes the forecasts is secondary, so can be EFAS.
- EFAS should only be information source for 'alert' authorities.

NL:

- Contradicting forecasts should be avoided

FI:

- Alert given is basically informal

Overall it was concluded that

- In any case EFAS is only one of the forecasting sources in addition to the national ones: warning/alerts are NHS responsibility
- MIC info for aid operations preparations is ok, but there are still fears that through MIC national civil protection leaks down and acts.
- Training for CP staff how to use and not to use was seen as very important(note ADR: takes place 17/18 Feb 2009 in Brussels).
- NHS want to be informed when EFAS gives info to MIC on early flood warning.

Results from Group III & IV (discussion leader F. Pappenberger):

The discussions concerning the topic of Group III centered mainly on the availability, quality, and access to meteorological data of specific interest for hydrological problems. In particular the following request to the meteorological centers were made:

- More information on skill of precipitation, temperature, wind speed, soil temperature, soil moisture, snow accumulation (single & ensemble) would be very useful. R. Buizza pointed out that most of this information is already available at the ECMWF but that dissemination and information on how to access these products could be improved.
- Better snow forecasts, in particular water-equivalent/snow depth/packing as modeling snow-related hydrological events is usually difficult and additional information would thus be very valuable.
- Additional information about wind and maximum wind speed
- More information about the availability of & access to meteorological data for hydrological services.

The discussions concerning the topic of Group IV focused mainly around the necessity to include not only meteorological forecast uncertainty but also hydrologic model uncertainty. Furthermore, a stronger emphasis on training of understanding and communicating probabilistic forecasts and a comparison of EFAS thresholds to national threshold levels was requested. In particular the following points on what an operational EFAS should deliver in the future were identified:

- EFAS in its current set-up focuses on the routing of meteorological errors; more focus on should be put on other error sources (hydrological model error, initial condition uncertainty, routing etc.). P. Salamon replied that there is currently research being conducted at the JRC concerning the quantification of the different hydrologic error sources using data assimilation.
- Provide flood forecasts on Multi-model approaches. R. Buizza pointed out that multi-model approaches not necessarily improve predictive capabilities significantly and that the cost of an implementation of a multi-model approach can be very high.
- Foster and/or provide data-access particularly cross border (discharge and meta data) similarly as is already done in the meteorological community.
- Provide teaching/training/research on communication, decision making and understanding of probabilistic forecasting (including practical examples)
- Provide a comparison between EFAS thresholds and national warning levels. This includes more documentation on how EFAS thresholds relate to return periods and more information of false alarm rates. Furthermore, a model climatology would also be helpful.

Presentations, lectures and supporting material

In addition to the EFAS related presentations, lectures were given on the status of EPS developments at EMCWF (R. Buizza) and on the visualization and communication of probabilistic forecasts (J. Thielen and R. Hagedorn).

Further, the Finnish Environment Institute (FI), the Swedish Meteorological and Hydrological Institute (SMHI), Rijkswaterstaat - Center for Water Management (NL), Vituki (HU) and Schapi (FR) reported on their experience with (pre)operational probabilistic flood forecasting, how they developed their systems and how they

communicate and uncertain and probabilistic results. F. Pappenberger gave a global overview on operational flood forecasting systems based on EPS. A summary of the different systems is listed in Annex 4. The presenters agreed to a publication where the different systems are described.

All presentations and lectures can be found at the ECMWF website:

<http://www.ecmwf.int/newsevents/meetings/workshops/2009/EFAS/presentations/index.html>

Additional lecture material by R. Hagedorn can be downloaded from:

http://www.ecmwf.int/newsevents/training/meteorological_presentations/MET_PR.html

Further material on EPS in flood forecasting can be found on:

<http://hydis8.eng.uci.edu/hepex> : **Hepex webpage, check in wiki for literature review**

Workshop: Case study exercise

The last part of the 4th annual EFAS meeting consisted in a workshop where the EFAS partners could get hands on experience in using the EFAS-IS interface and the newly developed products for the case of the heavy flooding during July/August 2008 in Romania, Slovakia, Moldavia, and the Ukraine. First, a general introduction on how to use the EFAS-IS system was given. Participants could browse the interface, look at the different available maps/ points, get especially familiar with the newly developed products and ask the EFAS team specific questions. After that, the participants were guided through the process of using EFAS-IS for emitting an early flood warning to the corresponding authorities, and the participants were asked to give feedback on the usability of EFAS-IS. Overall, the principal feedback from the participants was that this exercise improved their understanding on the different products of EFAS-IS and that more training especially dedicated to the personal in the national operational flood forecasting centers would be appreciated. More specific comments and recommendations on EFAS-IS included the following:

- Please add the number of days considered in the information about the precipitation probability maps.
- A clearly visible warning on the “Query” pop-up page for the catchment areas which are too small to be confident with the results would be appreciated.
- Please change color for the DWD and EUD deterministic curves (brown and black) as they are difficult to differentiate.
- Please add the units to the diagrams concerning rainfall.

Conclusions:

During the two day EFAS workshop an overview on floods and EFAS developments during 2008 was provided. Several presentations on probabilistic weather and flood forecasting were given, as well as on communication of uncertainty and probabilistic results. Several exercises were prepared for the participants as well as a training session on new products included in EFAS-IS. Discussion groups on future EFAS products and an operational EFAS took place. Overall, the workshop was rated positive by all participants (Annex 5).

Annex 1: List of participants (see also on www.ecmwf.int)

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Annex 2: Feedback from EFAS partners on floods during 2008

BG (S. Balabanova)

none, no severe floods

RO (E. Anghel)

only end July 2008 floods were severe: northern border area Ukraine and Hungary, between 22-27 July high precipitation 150-250 mm, in two periods, successive floods 2-3 days later (Siret and Prut river, higher than floods in 1969, probabilities around 1 in 100 year, some 1 in 50 years, one 1 in 200 year);

Siret/Lespezi: 1561-1855 m³/s;

Siret/Dragestci: around 2200 m³/s;

Prut: serious flood coming from Ukraine: highest recorded ever

EFAS forecasts received in an early stage, and used

Comment: reservoir influence makes a difference and EFAS does not currently include them

HU (G. Balint)

EFAS warning received in time in March, as well in July and August, more or less at the same time seen by VITUKI

EFAS forecasts were useful on tributaries of the Tisza (Hornad, with upstream in SK)

ECMWF-deterministic forecasts were ok for upper Tisza

SK (G. Babiakova)

Floods in 24-27 July 2008: eastern part of SK: tributaries to the Tisza

Danube was very low all year

SE (C. Edlund)

Informal alerts received, and 1 formal alert; EFAS was right for predicting the start of the floods; flood event went on for 2 months;

flood in Kalixaven (peak on 12 May, return period 25 years) was probably missed by EFAS (?)

Snow distribution was very uneven: some extreme (200-300% than normal,

some other 20-30% from normal); not very clear situation

EFAS sent on 24 April; real flood peaked on 1 May (Ljusnan river) (normal spring flood, return period around 5 years); (ADR: seems to have been quite right?)

For Osterdalaven (??)

Swedish EPS hydro-forecasts provided to CP an early message and CP was then prepared; worked well

IT (G. Monacelli)

Po informal alerts received; floods were not severe; in May water levels were critical in western Po area, but no damages; in autumn river levels were high, but not critical;

Italy would like EFAS to include small rivers and flash floods events as well

FR (C. de Saint-Aubin)

Important floods in Nov, Upstream Loire basin; EFAS alerts received 5 Days before; EFAS alert was good in pointing to upstream part of the basin (floods did happen!); however not enough to convince local staff, because meteo forecasts were thought to be unstable; communication to local staff should be improved to convince them of the usefulness of the information.

Annex 3: List of publications

Peer-reviewed Publications

Thielen J., Bartholmes J., Ramos M.-H, de Roo A. (2009) The European Flood Alert System - Part 1: Concept and development, *Hydro. Earth Syst. Sci.*, 13, 125-140 (revised version from *HESS Discussions* 5 (1), pp. 257-287)

J. C. Bartholmes, J. Thielen, M. H. Ramos, and S. Gentilini (2009) The European Flood Alert System EFAS – Part 2: Statistical skill assessment of probabilistic and deterministic operational forecasts, *Hydrol. Earth Syst. Sci.*, 13, 141–153 (revised version from *HESS Discussions* 5 (1), pp. 289-322)

Bartholmes, J., Thielen J. , and Kalas M. (2008) "Forecasting medium-range flood hazard on European scale", *Georisk* Vol.2, No.4, December 2008, 0-00

Pappenberger F, Bartholmes J, Thielen J, Cloke H.L, Buizza R, de Roo A (2008) New dimensions in early flood warning across the globe using grand-ensemble weather predictions. *Geophysical Research Letters*. 35, L10404, doi:10.1029/2008GL033837

Younis J., M.-H. Ramos and J. Thielen (2008) EFAS forecasts for the March–April 2006 flood in the Czech part of the Elbe River Basin – a case study, *Atmos. Sci. Let.* 9:88-94

Kalas, M., Ramos, M.-H., Thielen, J., Babiakova, G. (2008) Evaluation of the medium-range European flood forecasts for the March-April 2006 flood in the Morava River, *J. Hydrol. Hydromech J. Hydrol. Hydromech*, 56, 2008, 2, 116-132

Bogner K. and Kalas M (2008) Error-correction methods and evaluation of an ensemble based hydrological forecasting system for the Upper Danube catchment, *Atmos. Sci. Let.* 9, 95–102

Reports and bulletins

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Thielen J.1, Bogner K.1, Pappenberger F.2, Kalas M., del Medico M. 1, de Roo A.1 (2008), Monthly-, medium-, short-range flood warning: testing the boundaries of predictability (a case study), Meteorological Applications (accepted)

Pappenberger, F., Ghelli, A., Buizza, R., & Bodis, K., 2009: The skill of probabilistic precipitation prediction under observational uncertainties. Journal of Hydrometeorology, in press.

Annex 4 : Information on development of operational flood forecasting system presented during the EFAS workshop

A4.1: Finland

Name of organisation: Finnish Environment Institute (SYKE)	
When did your organisation first start thinking about exploring EPS in flood forecasting?	10-day EPS about 2000, exact date not in files. Use of the monthly forecast was considered first time approximately at 2005.
What was the reason for your organisation to start thinking about EPS (i.e. feedback from meteorological services, information at a conference, decision from top management, publications, participation in a research project on EPS)	Meteorologists recommended to use EPS, especially for the latter part of ten days EPS period, instead of / in addition to deterministic forecast. An important reason to try monthly and seasonal forecasts was late warm winters and the climate change: the historic climatology was not anymore applicable input into the hydrological forecasting. (The operational forecasts are still done using the climatology, and they are compared to the forecasts using monthly and seasonal EPS forecasts.)
If the reason was a research project, can you list the name?	Usage of monthly and seasonal forecasts was implemented in co-operation with Finnish Meteorological Institute in OST-K –project, funded by Ministry of Agriculture and Forestry.
When did your organisation start implementing a coordinated research group on EPS in flood forecasting?	No specific research group, the implementation and test use was done by watershed models group in SYKE. Our main interest is operational use. Decision to use the EPS was based on research done in FMI and ECMWF.
How much resources were put on this initial research group? (i.e. 3 scientists, xyz Euros, ...)	1-3 scientists in watershed models group has been working with 10-day /monthly/seasonal EPS forecasts. The total amount of work is hard to say, but maybe approximately 10 person months since 2000.
Was the research done in house or outsourced?	In house.
Since when does your organisation use EPS in full operational mode?	10 days EPS since year 2000. (Monthly forecast has been in test use since October 2007 and seasonal forecast since March 2008.)
Which EPS do you use and at what resolution?	10-days, 30-days and 100-days. Resolution from 1,0 to 1,5 degrees (higher resolution in 10-days EPS).
Was there any IT investment or other necessary to do	No.

this? If yes, which one.	
What were the measures to ensure that your forecasters understand the nature of EPS (seminars, training, publications, ...)	Yearly training, meetings and presentations. Answering the questions if needed.
Have your forecasters adopted EPS as the main source of information or do they use it to backup the deterministic forecasts?	EPS is the main source, but in first days it has been corrected so that the median of the EPS is the same as official FMI forecast.
Do you perform downscaling?	No, but we have standard height correction for temperature and precipitation.
Do you run all members or do you perform any selection of members?	Yes, we're running all members.
Do you perform any calibration/correction of the meteorological input data	See above. In the start of 10-days EPS the official FMI forecast is used for correction.
Do you perform any post-processing of the discharge output data?	Actual post-processed is done only for real time hydrological maps (Gaussian adjustment). The distribution of the discharge forecasts is represented in the forecast pictures, showing separately certain statistical variables, like daily medians and the median of the maximum discharges.

A4.2 Sweden

Name of organisation: Swedish Meteorological and Hydrological Institute	
When did your organisation first start thinking about exploring EPS in flood forecasting?	By 2001-2002
What was the reason for your organisation to start thinking about EPS (i.e. feedback from meteorological services, information at a conference, decision from top management, publications, participation in a research project on EPS)	Research projects and feedback from the meteorological service
If the reason was a research project, can you list the name?	SOUP (Internal research project on probabilities and regional updating)
When did your organisation start implementing a coordinated research group on EPS in flood forecasting?	Around 2002
How much resources were put on this initial research group? (i.e. 3 scientists, xyz Euros, ...)	2 researcher from research department + 2 hydrologist from hydrological forecasting division + 1 programmer + references among meteorologists
Was the research done in house or outsourced?	In house
Since when does your organisation use EPS in full operational mode?	Since 2004
Which EPS do you use and at what resolution?	ECMWF, 51 EPS, ~ 100 km resolution
Was there any IT investment or other necessary to do this? If yes, which one.	Only the programming, otherwise we used the existing hydrological production platform.
What were the measures to ensure that your forecasters understand the nature of EPS (seminars, training, publications, ...)	Seminars, training and discussions
Have your forecasters adopted EPS as the main source of information or do they use it to backup the deterministic forecasts?	The EPS based forecasts are well implemented in the operational forecasting chain
Do you perform downscaling?	Yes, according to sub-basin
Do you run all members or do you perform any selection of members?	All members
Do you perform any calibration/correction of the meteorological input data	We use the meteorological input as it's delivered by the meteorological forecasting service.
Do you perform any post-processing of the discharge output data?	In graphs we choose to show only 5 EPS members.

A4.3. The Netherlands

Name of organisation: Rijkswaterstaat – Centre for Water Management	
When did your organisation first start thinking about exploring EPS in flood forecasting?	1998
What was the reason for your organisation to start thinking about EPS (i.e. feedback from meteorological services, information at a conference, decision from top management, publications, participation in a research project on EPS)	Participation in research project
If the reason was a research project, can you list the name?	EFFS
When did your organisation start implementing a coordinated research group on EPS in flood forecasting?	2000
How much resources were put on this initial research group? (i.e. 3 scientists, xyz Euros, ...)	
Was the research done in house or outsourced?	Joint research with Delft Hydraulics, BfG, FOEN
Since when does your organisation use EPS in full operational mode?	Not yet, anticipated by summer 2009
Which EPS do you use and at what resolution?	ECMWF-EPS, 51 members, 80 km resolution Cosmo LEPS, 16 members, 10 km resolution
Was there any IT investment or other necessary to do this? If yes, which one.	Development of a new forecasting system and new hardware are necessary
What were the measures to ensure that your forecasters understand the nature of EPS (seminars, training, publications, ...)	Training and seminars with forecasters provided by the meteorological service
Have your forecasters adopted EPS as the main source of information or do they use it to backup the deterministic forecasts?	At the moment not yet operationally implemented and used only by a small group of forecaster in research/test mode. EPS are used for visual interpretation of the uncertainty and for pre warning (level over thresholds).
Do you perform downscaling?	no
Do you run all members or do you perform any selection of members?	all 51 members and all 16 members
Do you perform any calibration/correction of the meteorological input data	Not yet
Do you perform any post-processing of the discharge output data?	Not yet

A4.3 France

Name of organisation: SCHAPI	
When did your organisation first start thinking about exploring EPS in flood forecasting?	2006 for EFAS (signature of the MOU) - SIM EPS 2008
What was the reason for your organisation to start thinking about EPS (i.e. feedback from meteorological services, information at a conference, decision from top management, publications, participation in a research project on EPS)	EFAS Proposal from JRC to participate into the evaluation of EFAS SIM EPS : Mise en dispo du système par MF
If the reason was a research project, can you list the name?	
When did your organisation start implementing a coordinated research group on EPS in flood forecasting?	SIM EPS : 2008
How much resources were put on this initial research group? (i.e. 3 scientists, xyz Euros, ...)	1 MMonth on both systems (SIM and EFAS) – 3 months study
Was the research done in house or outsourced?	In house and Meteo France
Since when does your organisation use EPS in full operational mode?	We are still in experimental phase.
Which EPS do you use and at what resolution?	SIM EPS and EFAS (resolution ?)
Was there any IT investment or other necessary to do this? If yes, which one.	Nothing for the moment.
What were the measures to ensure that your forecasters understand the nature of EPS (seminars, training, publications, ...)	Comparison between EFAS and SIM EPS systems (3 months study) Still in work. There's still much work to better explain the EPS data.
Have your forecasters adopted EPS as the main source of information or do they use it to backup the deterministic forecasts?	No. Not yet.
Do you perform downscaling?	No
Do you run all members or do you perform any selection of members?	Meteo France is in charge of the run. We only use the output (51 runs of SIM EPS).
Do you perform any calibration/correction of the meteorological input data	Not at SCHAPI but Meteo France does.
Do you perform any post-processing of the discharge output data?	We would like to be able to do it for both systems EFAS and SIM EPS (presentation of the output – testing of several other thresholds).

A4.4 Hungary

Name of organisation: VITUKI Environmental Protection and Water Management	
When did your organisation first start thinking about exploring EPS in flood forecasting?	2000
What was the reason for your organisation to start thinking about EPS (i.e. feedback from meteorological services, information at a conference, decision from top management, publications, participation in a research project on EPS)	<ol style="list-style-type: none"> 1. Request from forecast users / flood managers to characterize uncertainty of forecast 2. Participation in research projects
If the reason was a research project, can you list the name?	EFFS, Preview
When did your organisation start implementing a coordinated research group on EPS in flood forecasting?	2005
How much resources were put on this initial research group? (i.e. 3 scientists, xyz Euros, ...)	3 scientists, 1 IT (part time)
Was the research done in house or outsourced?	In-house
Since when does your organisation use EPS in full operational mode?	Operated only in emergency situations and on request of flood managers, and/or triggered by EFAS forecast or observed or predicted critical value for upstream sections of transboundary rivers.
Which EPS do you use and at what resolution?	ECWMF-EPS, -VarEPS, NWS-NCEP-EP
Was there any IT investment or other necessary to do this? If yes, which one.	Only moderate upgrade
What were the measures to ensure that your forecasters understand the nature of EPS (seminars, training, publications, ...)	Internal training of district flood forecasters, participation in research seminars, training and user groups
Have your forecasters adopted EPS as the main source of information or do they use it to backup the deterministic forecasts?	No, it remains only a supplementary tool.
Do you perform downscaling?	Yes – global krieging utilizing regional elevation dependents of meteorological elements
Do you run all members or do you perform any selection of members?	All EPS, usually only for 6 days, occasionally 12 days
Do you perform any calibration/correction of the meteorological input data	Correction of meteorological input is included into the downscaling procedure.
Do you perform any post-processing of the discharge output data?	Statistical correction based on error series of the deterministic forecasts (uniform for all EP elements), visualization: graphs of hydrological ensemble elements and outliers, exceedance tables.

Annex 5: Outcome of survey on EFAS workshop

Following the EFAS workshop an online survey was conducted on the satisfaction of the participants on the workshop. In total 16 participants responded to the workshop.

1) Were you satisfied with the 4th annual EFAS workshop (Choose one of the following)






	Percentage	Responses
very dissatisfied	0.0	0
dissatisfied	0.0	0
satisfied	86.7	13
very satisfied	13.3	2
Total responses:		15

2) What do you think of having the workshop at other places than the JRC (choose all that apply)



	Percentage	Responses
The workshops should always be at the JRC	4.5	1
The workshops should always be at an EFAS partners institution	4.5	1

The workshops should occasionally be at an EFAS partner institution		54.5	12
The place of meeting is not important		22.7	5
Other		13.6	3

Comparison response:

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[Click to view all OTHER text responses](#)

3) What do you think of the length of the workshop? (choose one of the following)



Chart Wizard

		Percentage	Responses
1 day would have been enough		0.0	0
2 days was adequate		68.8	11
The workshop could even be longer		18.8	3
Other		12.5	2
		Total responses:	16

Comparison response:

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[Click to view all OTHER text responses](#)

4) Please tell us which parts of the workshop you found useful (choose all that apply)



		Percentage	Responses
Lectures		19.4	14
Presentations by partners (SHMI, RIZA, Vituki, Finland, Schapi)		18.1	13
Excercises		11.1	8
Tour through ECMWF premises		13.9	10
Training on new EFAS products with interface		15.3	11
Discussion groups		16.7	12
Other		5.6	4

Comparison response:

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[Click to view all OTHER text responses](#)

5) Was enough time allocated for discussions after the lectures?




		Percentage	Responses
Yes		86.7%	13
No		13.3%	2


Total responses: 15

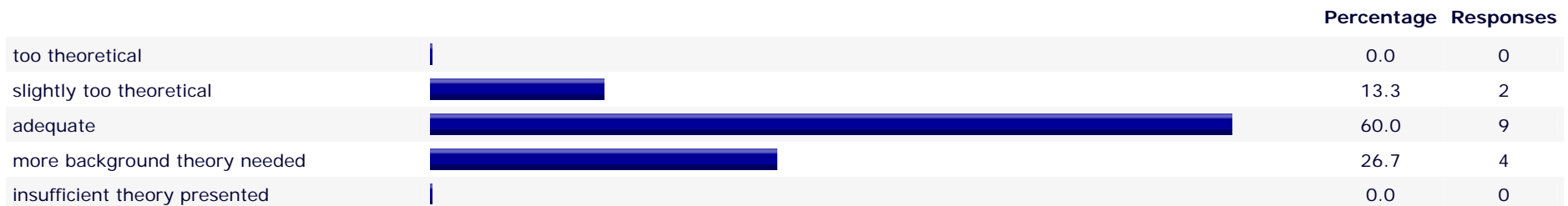
6) Was enough time allocated for plenary discussions?  [Chart Wizard](#)



7) Was enough time allocated for the working group discussions?  [Chart Wizard](#)



8) How would you rate the lectures on meteorological ensembles? (choose one answer)  [Chart Wizard](#)



no opinion



0.0

0

Total responses:

15

9) In the lectures on meteorological EPS I would have liked to see (tick all that apply)



Chart Wizard

		Percentage	Responses
more background information on how ensembles are generated		11.4	4
examples of variables relevant for hydrological applications		25.7	9
more information on skill scores - their calculation, interpretation and limitations		25.7	9
more information on the different EPS existing globally and regionally		31.4	11
nothing more than what was presented.		5.7	2
Other		0.0	0

Comparison response:

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[Click to view all OTHER text responses](#)

10) What do you think of the information provided by the EFAS team? (choose all that apply)



Chart Wizard

Percentage Responses

The information provided by the EFAS team was adequate		25.0	9
There was too much information provided for the given time		0.0	0
I would have liked more in-depth information on the ongoing research		11.1	4
I would have liked to see more on data collection		2.8	1
I would have liked to see more on the performance of EFAS		19.4	7
I would have liked to see more on the future of EFAS		19.4	7
I would like to see more on the technical implementation of EFAS		16.7	6
Other		5.6	2

Comparison response:



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[Click to view all OTHER text responses](#)

11) The training exercises ... (choose all that apply)



Chart Wizard

		Percentage	Responses
... were adequate		26.1	6
... were too long for the given time		8.7	2

should have had more emphasis on the interface		13.0	3
should have had more emphasis on the novel products		8.7	2
should have allowed more feedback possibilities		13.0	3
not necessary		4.3	1
Other		26.1	6

Comparison response:

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[Click to view all OTHER text responses](#)

The training excercises ...

should be 1 or 2 hours longer

- **should be hour or two longer**

- **I was using the EFAS system first time in my life, so little more basics of the system and the interface should have been introduced. But I understand that training cannot be planned for one or two people. Next time I'll manage it better...**

- **The training - I prefer the type which you organise 2 or 3 years ago - 1 all day. After this exercise for many people were very clear how use the product EFAS effectively.**

- **No opinion on training as I did not participate**

- **The time devoted to the training session was a bit short.**

We would have needed more time for the discussion about how to use the Efas results.

What do you think of the information provided by the EFAS team? (choose all that apply)

Complete list of all responses given to this question

- **I would like to receive more information before the meeting**
- **We would have like knowing more about how the EFAS forecasters (JRC) use the EFAS system (how many forecasters/day, what signal do they look for, etc.).**

Please tell us which parts of the workshop you found useful (choose all that apply)

Complete list of all responses given to this question

- **I didn't attend the ECMWF tour**
- **EFAS-forecast for smaller riverbassins !!!**
- **I didn't attend the training on EFAS products.**
- **No opinion on training as I did not participate**

What do you think of the length of the workshop? (choose one of the following)

Complete list of all responses given to this question

- **More than 2 days is important the best 3 complet (including excercise)**
- **would be nice to arrange the program to demand for one nighth spent in the destination. But this time it was OK as meeting included many extra lessons and topics and had to be a little longer.**

What do you think of having the workshop at other places than the JRC (choose all that apply)

Complete list of all responses given to this question

- **because of length/cost of the journey**
- **As long as there's an added value in the location (something to see (ECMWF is a good example), I have no problem with changing locations.**
- **It's interesting to visit some partners institution and learn about their work.**