Visualising and communicating probabilistic results of in National flood forecasting centres

A global review (F. Pappenberger)

1) Finland (A. Koistinen)

2) Sweden (C. Edlund)

3) The Netherlands (E. Sprokkereef)

4) France (C. de Saint-Aubin)

5) Hungary (G. Balint)

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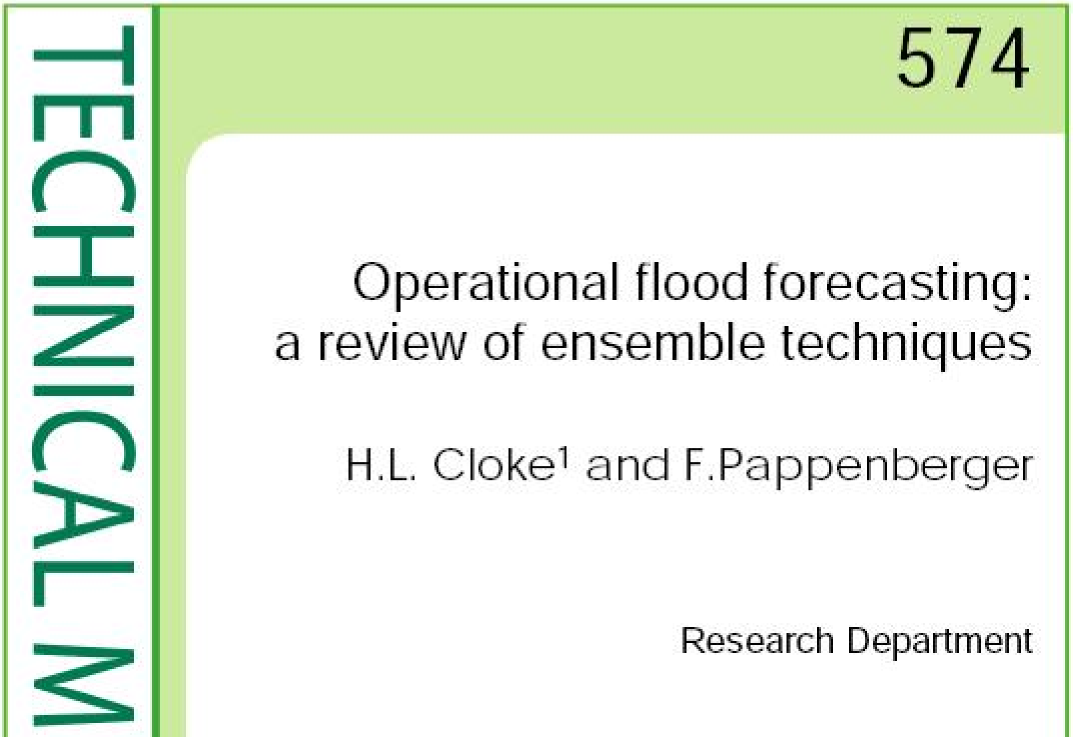
Presentation is based on the ECMWF Technical Memoranda 574, Cloke, H.L. and F. Pappenberger, 2008, “Operational flood forecasting: a review of ensemble techniques” – available as hard copy and from the ECMWF webpage



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- ~14 centres use EPS
- Majority in Europe
- Majority uses ECMWF inputs (or derivates)

Forecast centre	Ensemble NWP input	Further information
European Flood Alert System (EFAS) of the European Commission Joint Research Centre	European Centre for Medium Range Weather Forecasts (ECMWF) and Consortium for Small scale MOdelling – Limited-area Ensemble Prediction System (COSMO-LEPS)	Thielen et al., 2008a
Georgia-Tech/Bangladesh project	ECMWF	Hopson and Webster, 2008
Finnish Hydrological Service	ECMWF	Vehvilainen and Huttunen, 2002
Swedish Hydro-Meteorological Service	ECMWF	Johnell et al., 2007; Olsson and Lindstrom, 2008
Advanced Hydrologic Prediction Services (AHPS) from NOAA	US National Weather Service (NOAA)	http://www.nws.noaa.gov/oh/ahps/; Mcenery and al, 2005
MAP D-PHASE (Alpine region) / Switzerland	COSMO-LEPS	Rotach et al., 2008
Vituki (Hungary)	ECMWF	Balint et al., 2006
Rijkswaterstaat (The Netherlands)	ECMWF, COSMO-LEPS	Kadijk, 2007; Renner and Werner, 2007; Werner, 2005
Royal Meterological Institue of Belgium	ECMWF	Roulin, 2007; Roulin and Vannitsem, 2005
Vlaamse Milieumaatschappij (Belgium)	ECMWF	http://www.overstromingsvoorspeller.be; Cauwenberghs, 2008
Météo France	ECMWF and Arpege EPS	Regimbeau et al., 2007; Rousset-Regimbeau et al., 2008
Land Oberöstereich, Niederöstereich, Salzburg, Tirol (Austria)	Integration of ECMWF into Aladin	Haiden et al., 2007; Komma et al., 2007; Reszler et al., 2006

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- **Over 35 case studies**
- **3 long term studies**
- **2 case studies using multiple Ensemble forecasts**

Case study reference	Catchment / Study Area	Event / Period	Hydrological Model	Meteorological Input
(Balint et al., 2006; Csik et al., 2007)	Main Danube in Hungary	July/August 2002	NHFS modelling system	EPS ECMWF (with 6 day lead time)
(Bartholmes et al., 2007; Bartholmes et al., 2008)	European Flood events	January 2005 until February 2007	Lisflood-FF (as input to the EFAS)	ECMWF (EPS and deterministic), DWD (global and local)
(Bartholmes and Todini, 2005)	Po river	October/November 1994	TOPKAPI	ECMWF EPS, HIRLAM EPS
(Bonta, 2006)	Upper Tisza & central Hungary	March 2001 & August 2005	NHFS modelling system	ECMWF EPS
(Cluckie et al., 2006)	Brue (in Southwest England)	October 1999, December 1999, April 2000	Simplified grid-based distributed rainfall-runoff model (GBDM)	ECMWF EPS & PSU/NCAR mesoscale model (MM5)
(Davolio et al., 2008)	Reno (in north Italy)	7th-9th November 2003, 10-12th April, 2005, 2nd-3rd December 2005	TOPKAPI	Six different forcings (BOLAM, MOLOCH, LM7, LM2.8, WRF7.5, WRF2.5
(Dietrich et al., 2008)	Mulde	August 2002	ArcEGMO (note there is also a short range forecast presented using a large range of different models)	Cosmo-Leps & COMSO-DE
(Gabellani et al., 2005)	Reno (in north Italy)	8-10th November 2003	DriFit	Cosmo-Leps
(Gouweleeuw et al., 2005)	Meuse, Odra	January 1995 and July 1997	Lisflood-FF (as input to the EFAS)	ECMWF (EPS and deterministic), DWD (global and local)
(Hlavcova et al., 2006)	Upper Hron (tributary to Danube)	August 1997 July 2002	Conceptual semi-distributed rainfall runoff model	ECMWF (EPS and deterministic), HIRLAM, DWD (global and local) and ALADIN
(Hopson and Webster, submitted)	Ganges and Brahamaputra	Summer 2003, 2004 and 2006	Catchment lumped model (CLM) & Semi distributed model (SDM)	ECMWF EPS
(Jasper et al., 2002)	Ticino-Verzasca-Magiia (including smaller	September 1993 October 1993 October 1994	WaSiM-ETH	Poor man ensemble consisting of Swiss Model, MESO-NH,

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- **Most case studies indicate that there is added value in using EPS in comparison to deterministic forecasts**
- **A few are convinced of the potential, but are cautious about the added value – mostly quoting the inaccuracy of precipitation predictions as reasons**
- **Most case studies have severe weaknesses in the analysis:**
  - **No report of false alarm**
  - **Qualitative statements only (sometimes only loosely linked to the displayed figures)**
  - **Comparison only done against proxy observations**
  - **decision support or communication of these forecasts to end-users is not adequately considered**

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TM574 postulates 6 key challenges

- **Key challenge 1: improve current NWPs**
- **Key challenge 2: Understand the total uncertainties in the system**
- **Key challenge 3: Analyse more case studies**
- **Key challenge 4: Install more enough computer power**
- **Key challenge 5: Learning how to use it in an operational setting**
- **Key challenge 6: Communicating uncertainty and probabilistic forecasts**

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→ **is on what we focus today in this session**