



# Using EPS for the European Flood Alert System (EFAS)

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# Outline

1. The European Flood Alert System (EFAS)
2. LISFLOOD hydrological model
3. EFAS set up 2005
4. Using EPS in EFAS : Real-time case-study
5. Conclusions



# European Flood Alert System (EFAS)

- European Commission project
- Research and development phase at the EC Joint Research Centre (2003-2006)
- experience from feasibility study EFFS (2000-2003)
- JRC actions intend to complement Member-States activities towards natural hazards in terms of **prevention**, **preparedness** and **damage assessment**.

## Complementing activities in Flood Forecasting:

- ✓ Medium- to long term flood forecasts on European scale (**3-10** days)
- ✓ applying EPS in flood forecasting
- ✓ enhance information exchange on European scale



## Advantages of a European Flood Alert System

### European Level

- Monitoring and overview of flood situation in Europe
- Comparable results across Europe
- Harmonisation of hydr. data and data exchange in Europe

### National level

- Additional early warning information for NWA & backup
- Catchment based (information from upstream catchment)
- Help in interpretation of uncertainty from weather forecasts (EPS)



# EFAS & EPS

## “Exploratory” research

- Methods to extract useful information from FEPS for hydrologists
- Cascading uncertainty in hydrological modeling
- Verification of FEPS in hydrology
- Identification of value for end-users

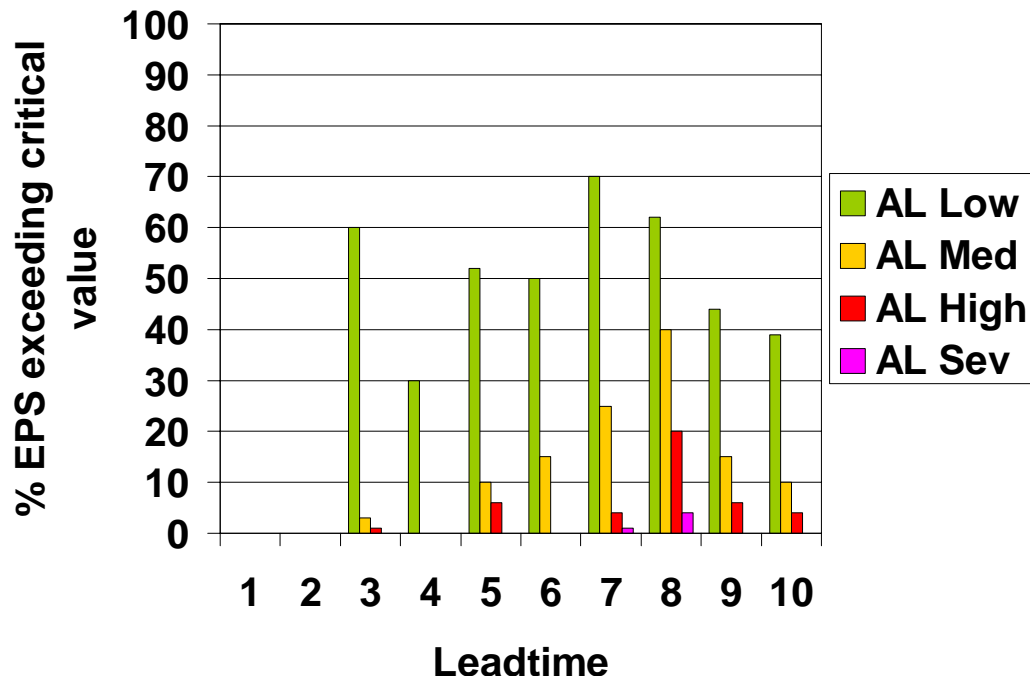
## “Operational” research

- Running FEPS efficiently for the whole of Europe
- How to prepare information for end-users
- Identify needs for end-users

# Flood Ensemble Prediction Systems

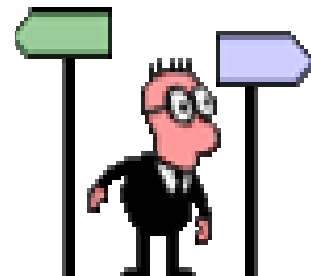
“I only want to know  
*HOW MUCH* rainfall is  
going to fall, and  
*WHEN* and *WHERE!!*”

(citation end-user at 1<sup>st</sup> EFAS  
workshop when discussing  
uncertainty)



Potential of EFAS: Translating the range of different forecasts into concise and useful information for local forecasters for a potential look “ahead”.

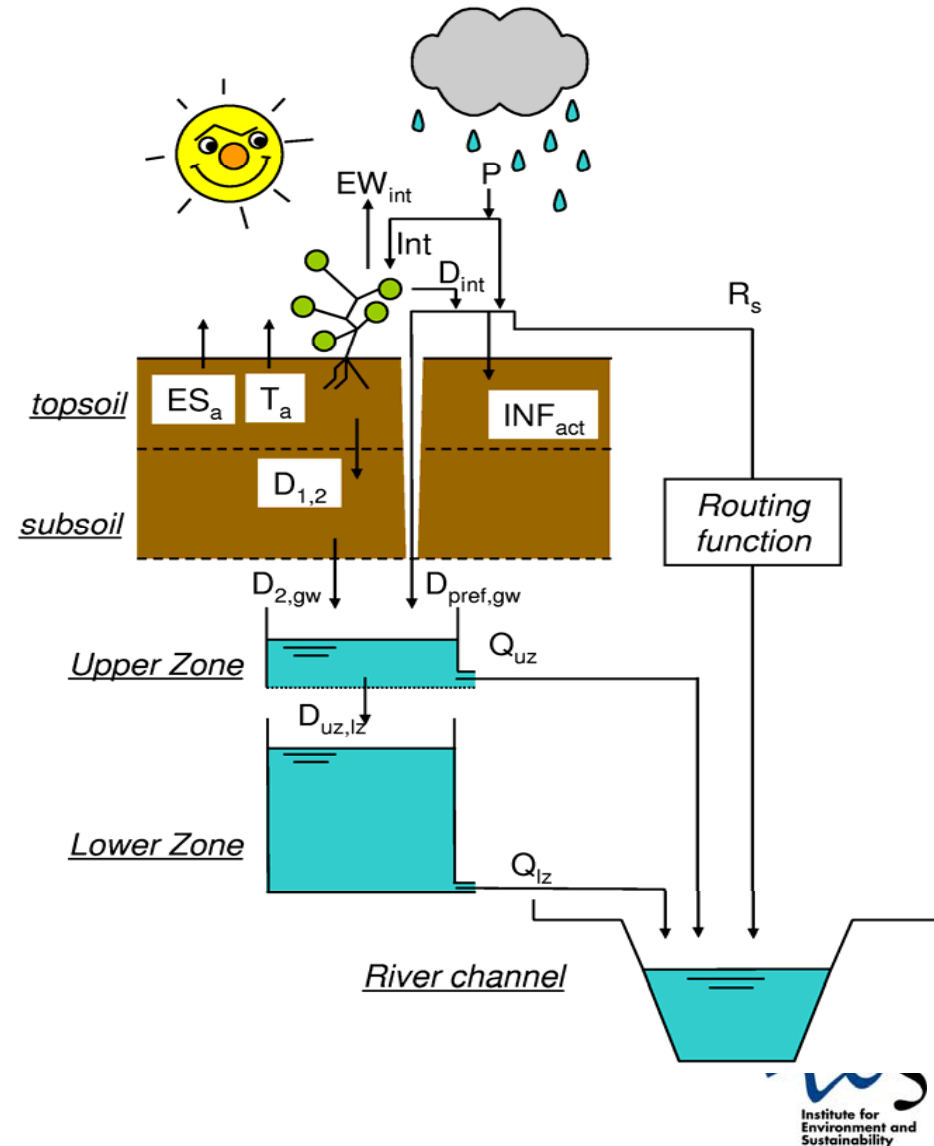
2<sup>nd</sup> HEPEX workshop, Boulder 19-22<sup>nd</sup> July 2005



# LISFLOOD model

## Physically based rainfall-runoff model

- Division Rainfall/Snow
- Interception
- Evapotranspiration
- Leaf drainage
- Snow melt
- Glacier melt
- Soil freezing
- Infiltration
- Vertical soil moisture redistribution
- Groundwater recharge
- Groundwater flow
- River channel flow
- Reservoir operations
- Retention storage / polders
- Lakes
- Dyke breaks (in prep)



# EFAS 2005

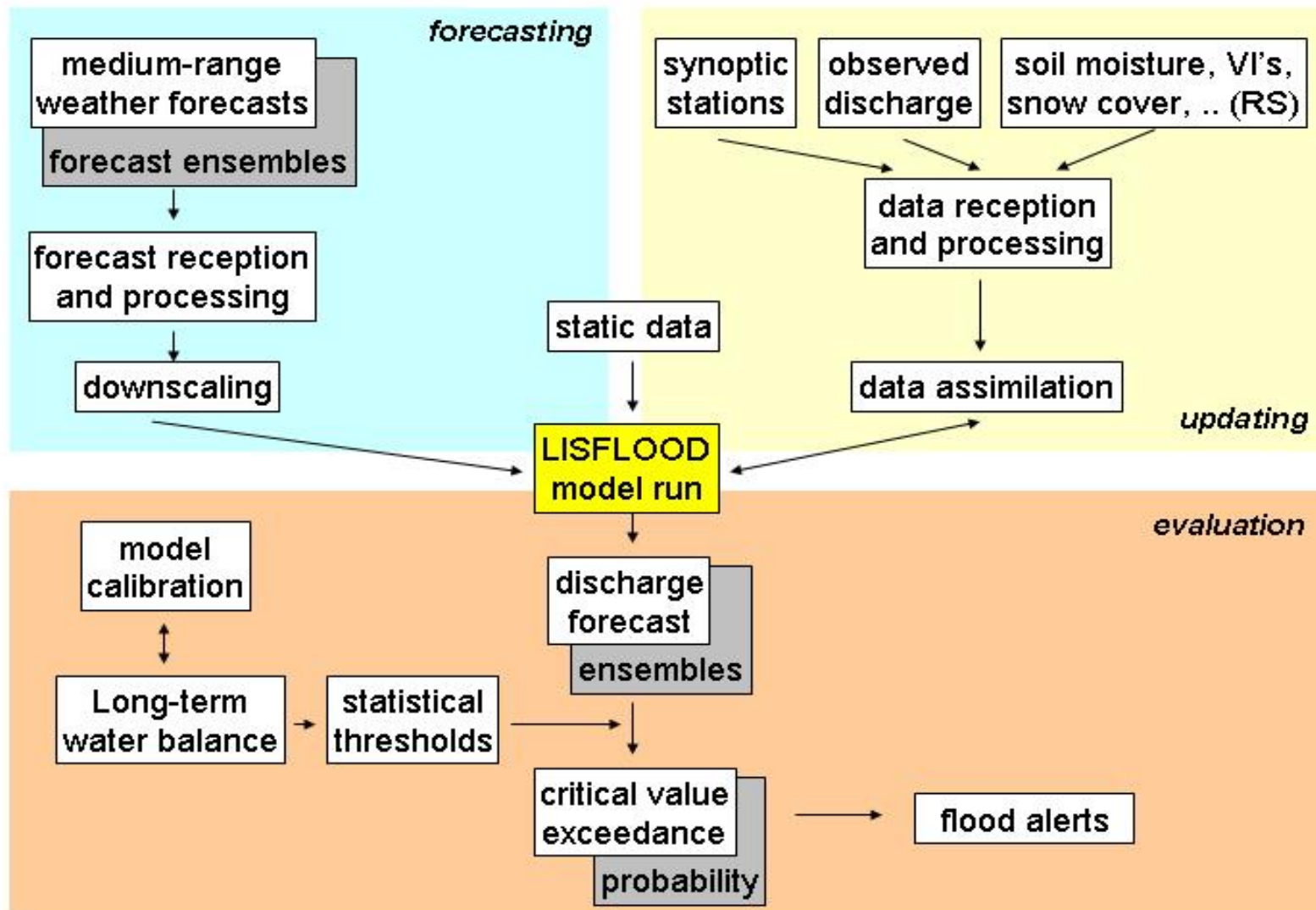
## Setup

- European catchments > 2000 km<sup>2</sup> on a **5 km** grid
- Selected transnational catchments on a **1 km** grid (Danube, Elbe, Meuse, Oder)
- **Hourly, daily** time step
- Forecast run on arrival of 00&12 weather forecasts

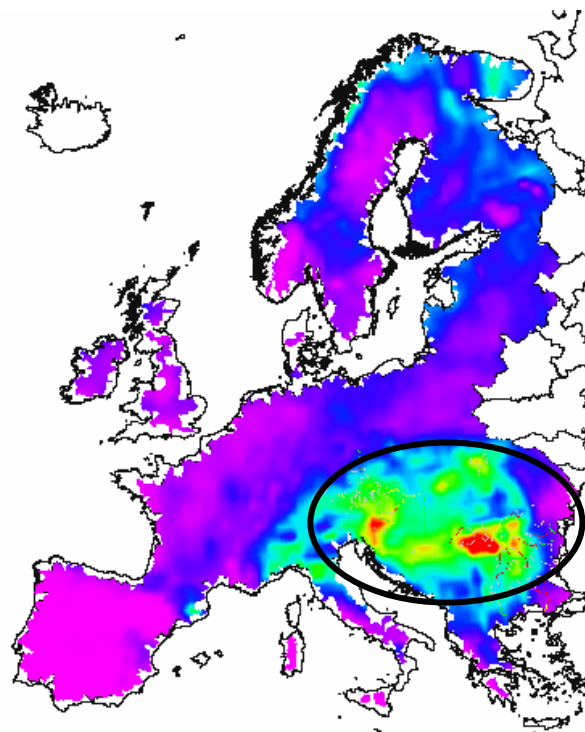
## Input data

- 2xDWD, 7 days
- 2xECMWF – Deterministic, 10 days
- 51x2 ECMWF EPS, 10 days
- observed meteo data






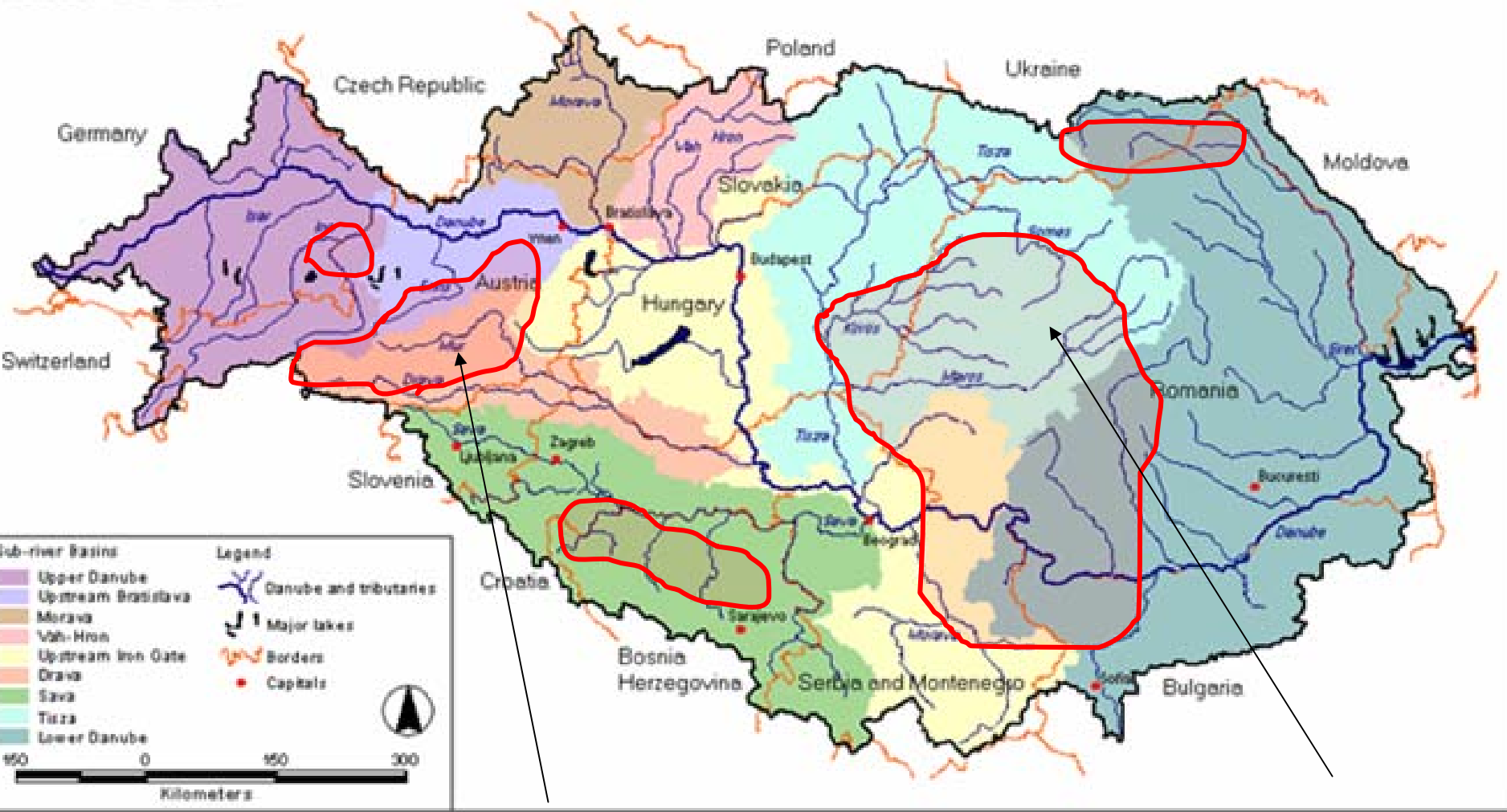
## Case-Study: Danube Catchment - July 2005



- Widespread flooding in Central & Eastern Europe (20050711-20050716) in tributaries to the Danube and Elbe rivers.
- Return periods varying between 1-2 years and 50 years depending on location
- Heavy rainfalls predicted with both deterministic MeteoForecasts (DWD, ECMWF) *but*
  - Spatially not consistent between the different meteorological services
  - Temporally not consistent from one forecast to the other


 Areas with flooding reported from  
 20050707-20050716

**Danube River Basin**



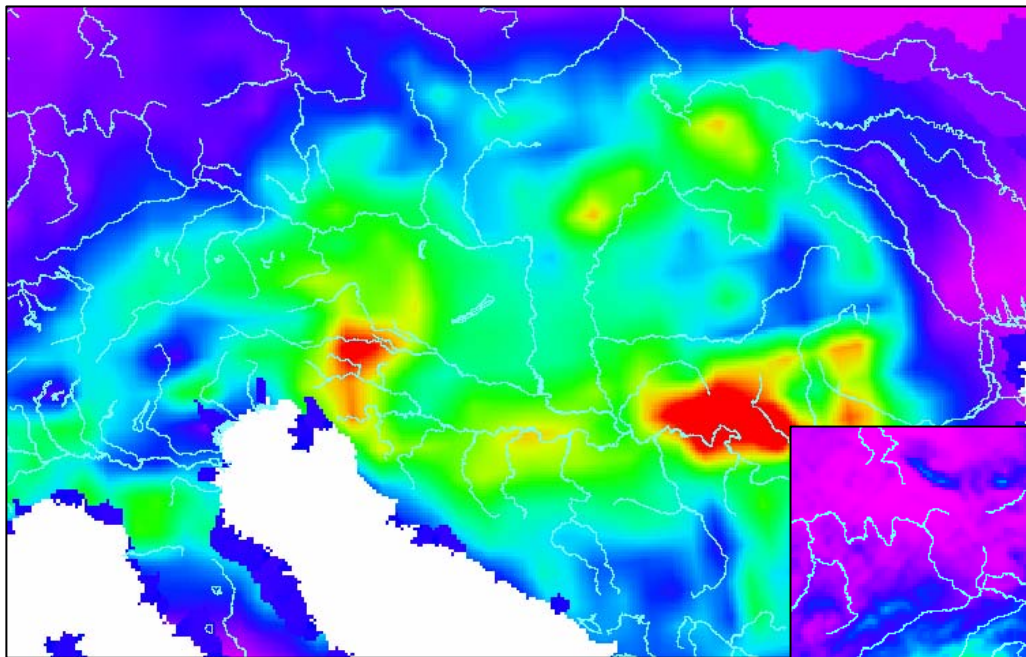
11-12<sup>th</sup> July

15<sup>th</sup> July

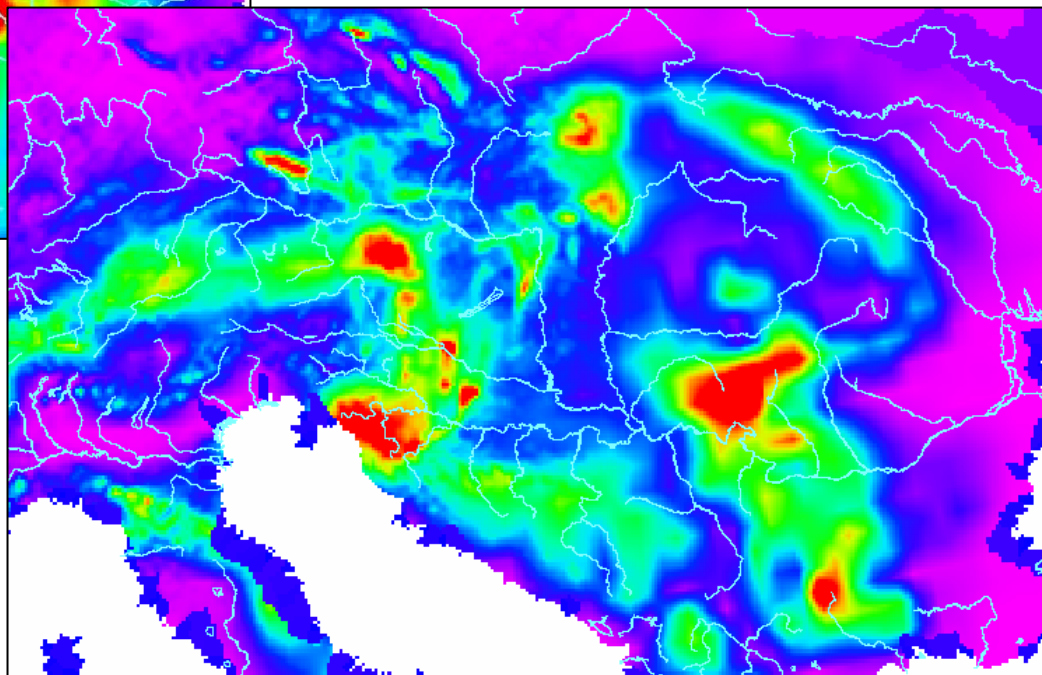
2<sup>nd</sup> HEPEX workshop, Boulder 19-22<sup>nd</sup> July 2005

## Case-Study: Danube Catchment - July 2005

**ECMWF Forecast - 20050708 12:00**



**DWD Forecast - 20050708 12:00**







## Case-Study: Danube Catchment July 2005

ECMWF – EPS forecasts  
20050708 12:00

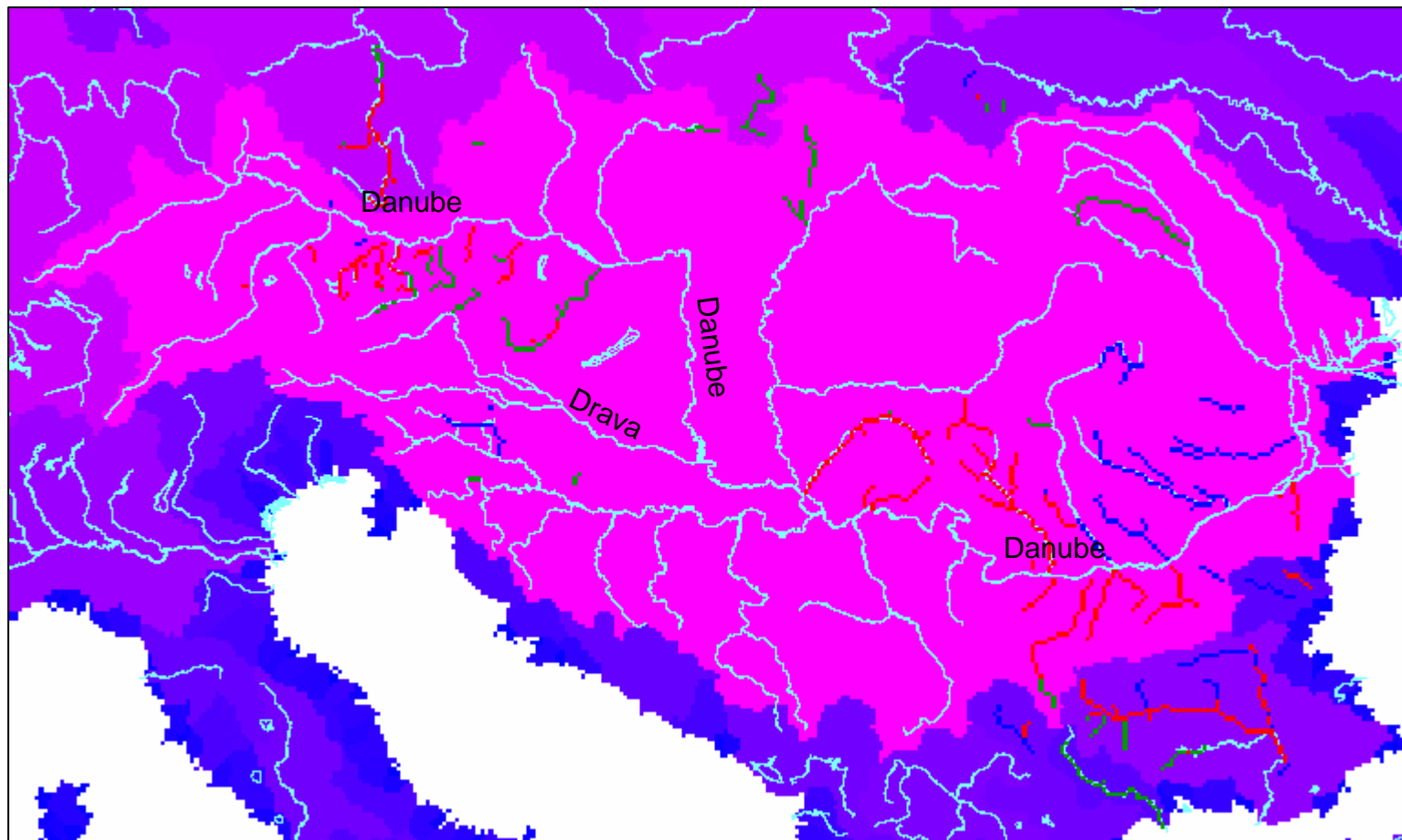




Forecast date: 200507 0812

## Combined 7-10 days EFAS High Alert Map

■ ECMWF & DWD    ■ ECMWF    ■ DWD



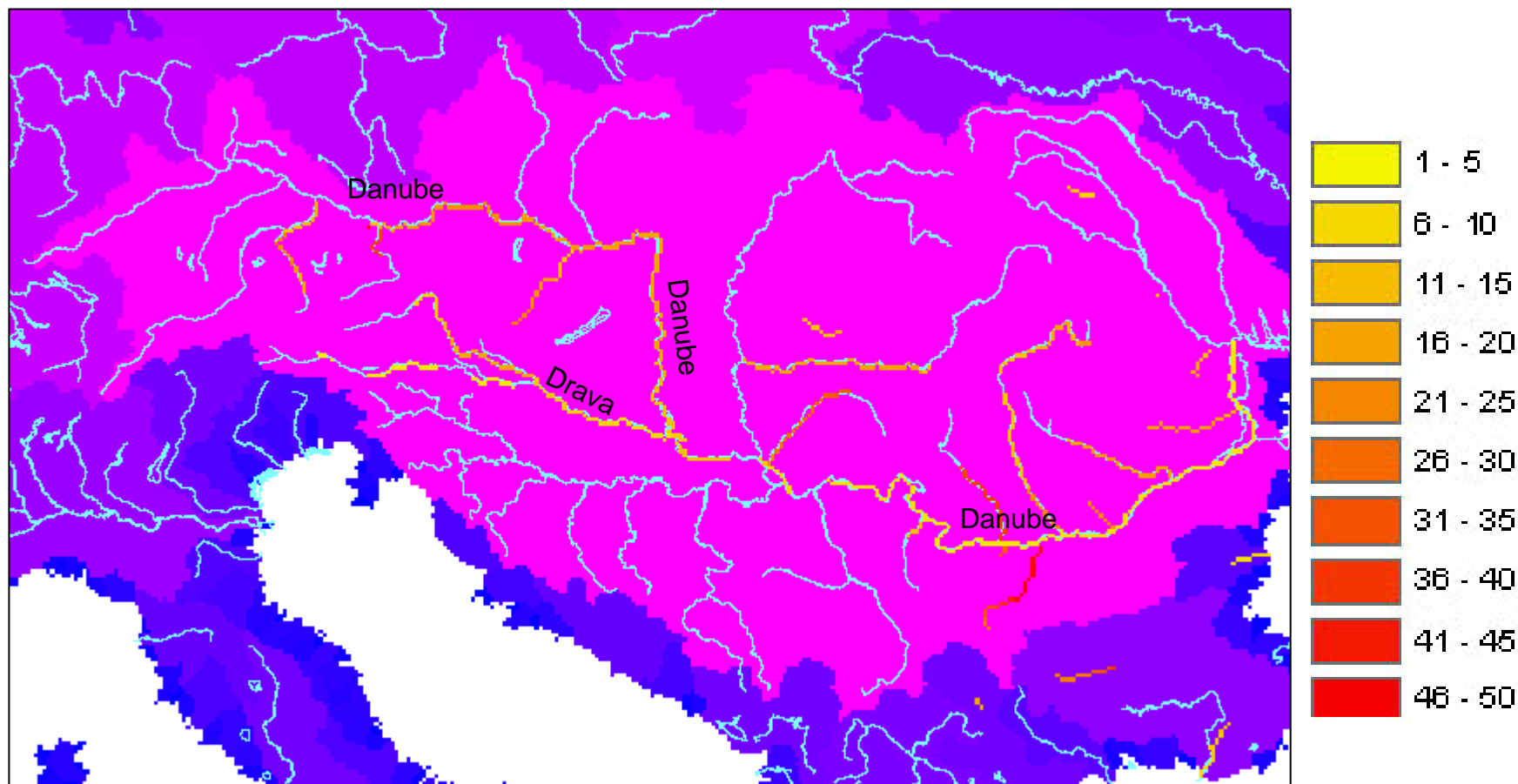
2<sup>nd</sup> HEPEX workshop, Boulder 19-22<sup>nd</sup> July 2005



## Case-Study: Danube Catchment - July 2005

Forecast date: 200507 0812

### ECMWF - EPS High Alert Map

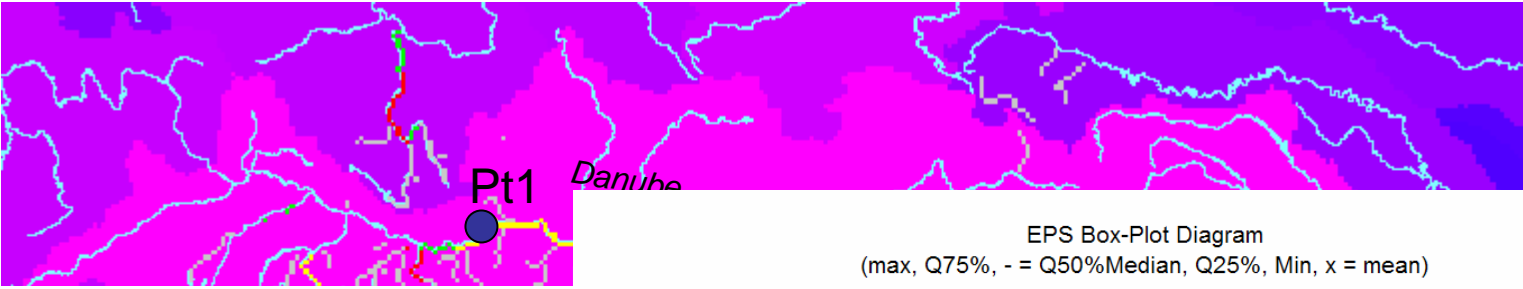


2<sup>nd</sup> HEPEX workshop, Boulder 19-22<sup>nd</sup> July 2005

**Forecast date: 200507 0812**

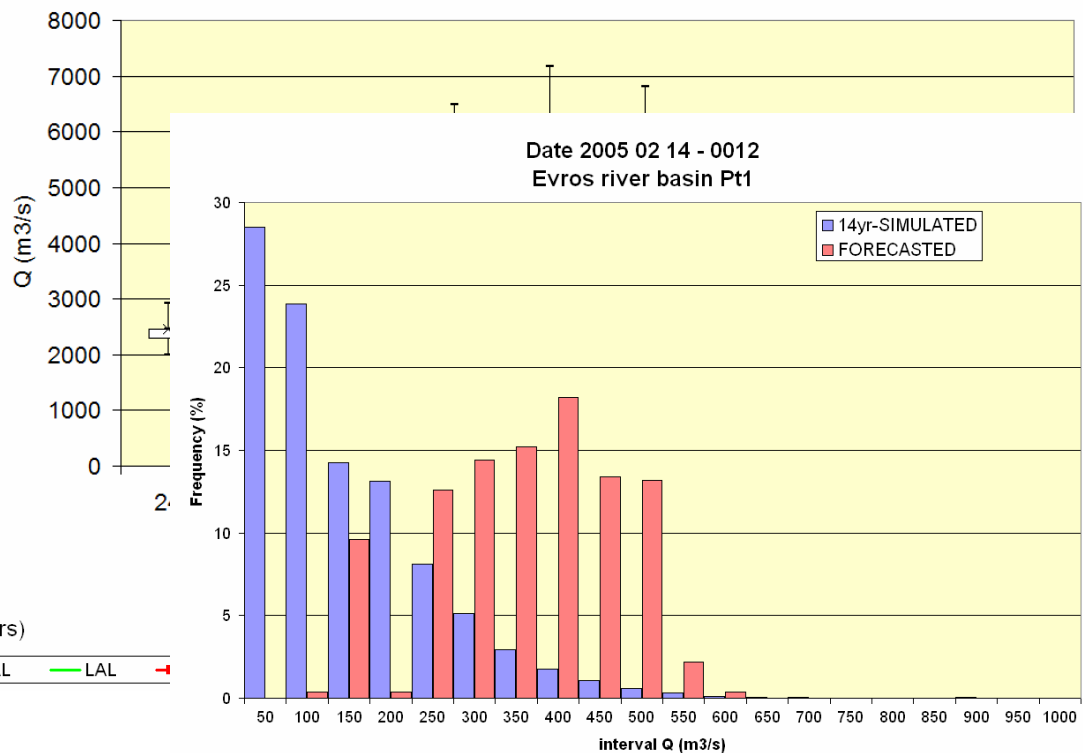
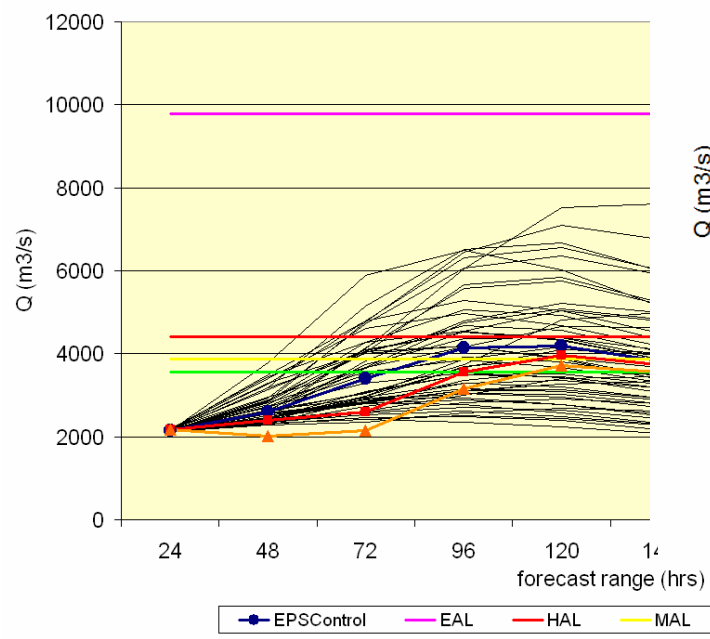
## EFAS Alert Map based on 10 day ECMWF forecasting data

**severe**
 **high**
 **medium**
 **low**

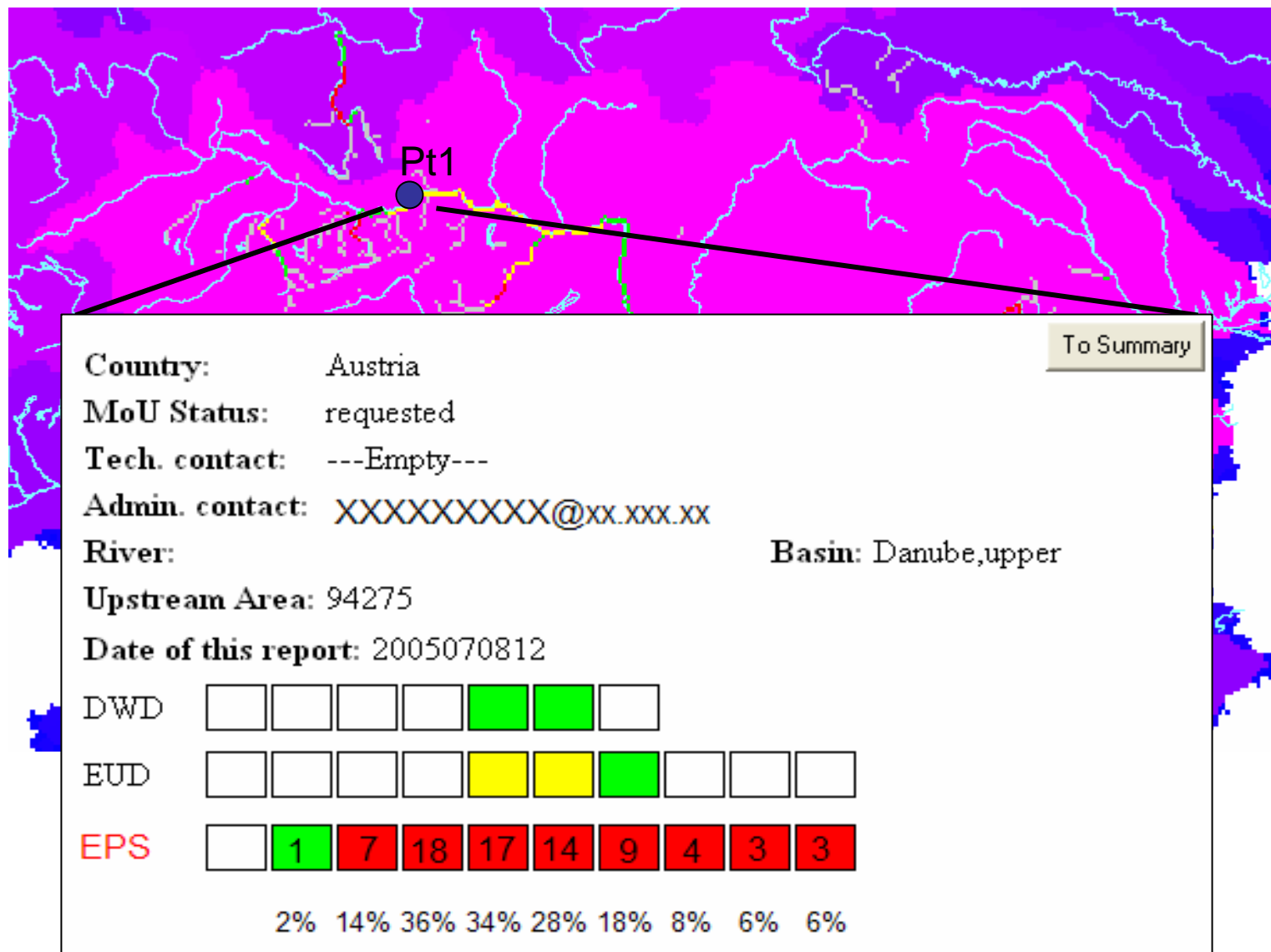


EPS Box-Plot Diagram  
 (max, Q75%, - = Q50%Median, Q25%, Min, x = mean)

EUE2005070812



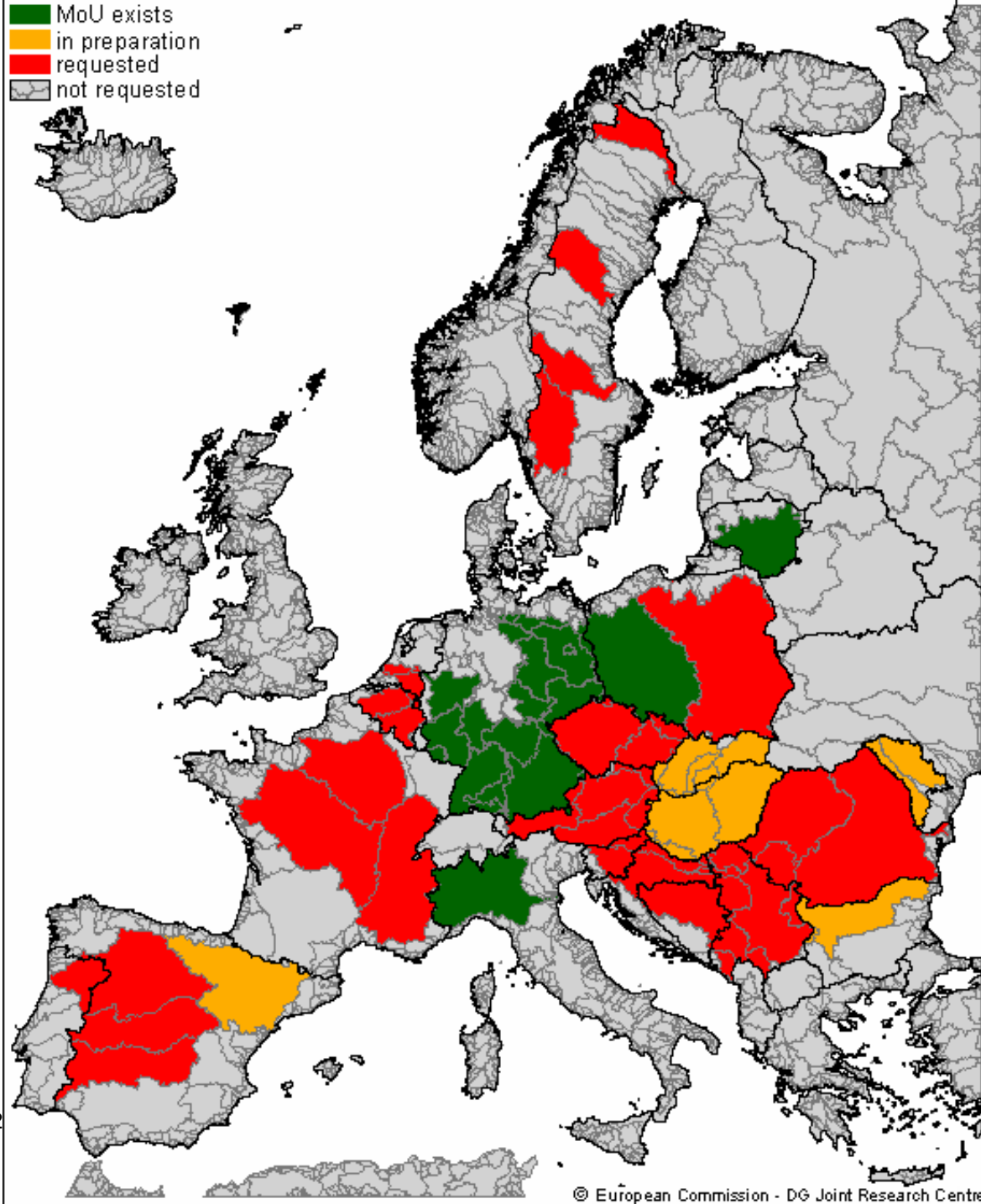




# Status of MoU

on

24.05.2005

2<sup>nd</sup> HEPEX workshop, Boulder 19-2



## Summary

- EFAS at present in pre-operational stage under refinement
- EPS are incorporated pre-operationally in EFAS
- At present constraints arising from limited data availability
- Research on EPS
  - extraction of relevant information
  - verification of probabilistic results – a challenge on EU scale
  - communication of information to end-users