



# Development of new products by operational forecasters

## Probability of Thunder -algorithm

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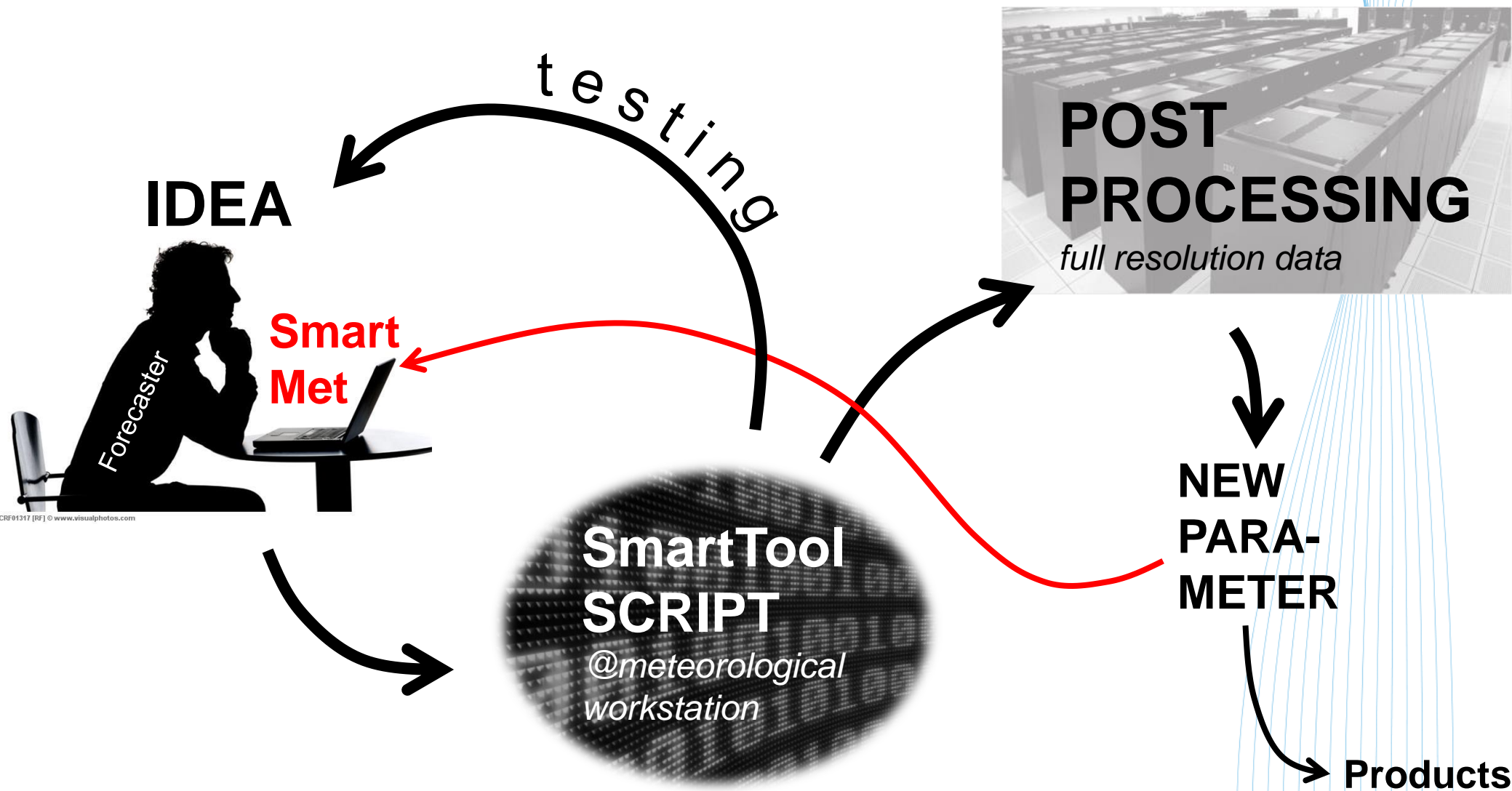


# Content

1. Operational meteorologists and meteorological workstations – a source of innovative development
2. Example: ECMWF based thunderstorm forecasting parameter
3. Example: Severity Index
4. Development ideas/ suggestions for ECMWF



# Principle of low-threshold development process





# Operational forecasters are good developers

## **Knowledge and operational experience about:**

- Forecasting weather impacts
- Distinguishing critical parameters and information
- Compressing information
- Visualizing the information
- Communicating the information



# Advantages of low-threshold development

- Ideas from operational work can evolve into **innovative customer products**
- Forecasters have direct opportunity to advance their own forecasting parameters → **innovative tools** → **Enhanced performance**
- SmartMet enable Forecasters to produce ***on-demand tailored weather situation based products*** for civil protection and media
- Enhanced customer support



# Example: Probability of Thunder (POT)

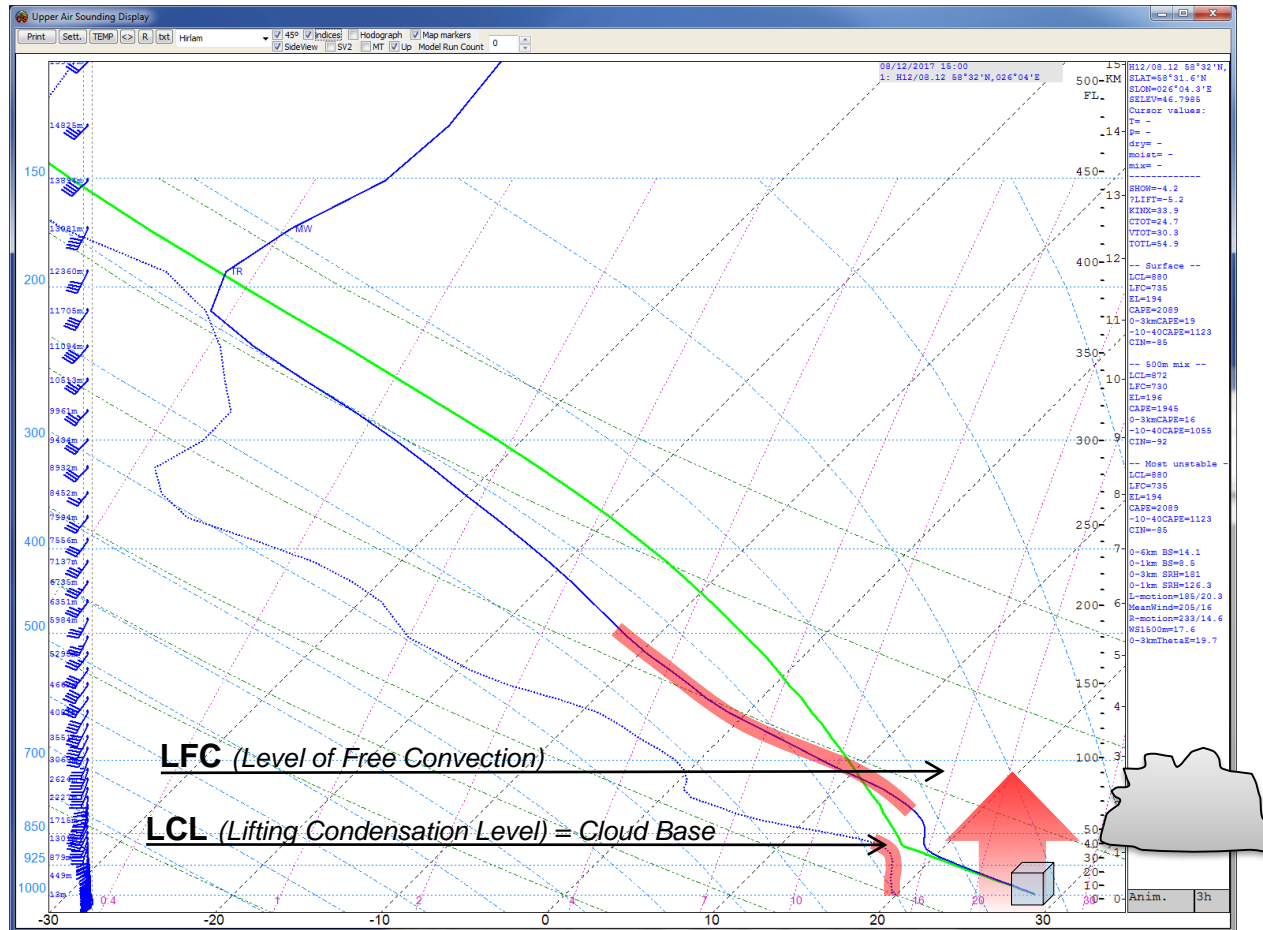
- **Simple tool for assessing thunderstorm potential**
- **Algorithm uses model vertical temperature and moisture profiles and precipitation forecasts**

## **Key parameters derived from model soundings**

- CAPE (integrated between -10...-40 C)
  - EL (Cloud top) temperature
  - LCL (Cloud base) temperature
  - Convective layer depth (LFC ->EL)
- **Uses ingredients based approach** (*physically reasonable*)
    - Moisture
    - Instability
    - Lift



# Ingredients based forecasting



Three necessary ingredients

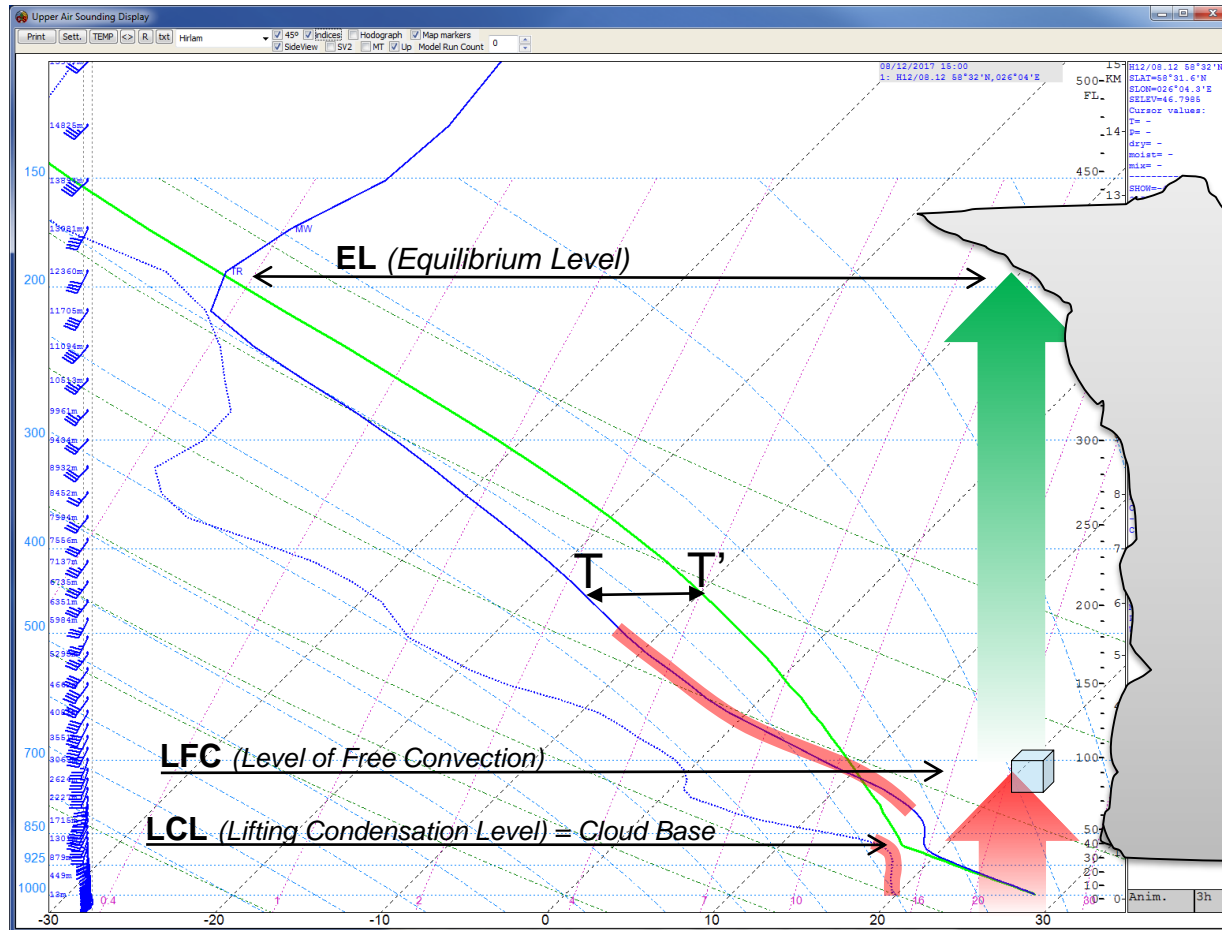
1. Instability

2. Moisture

3. Lift



# Ingredients based forecasting



Three necessary ingredients

1. **Instability**

2. **Moisture**

3. **Lift**









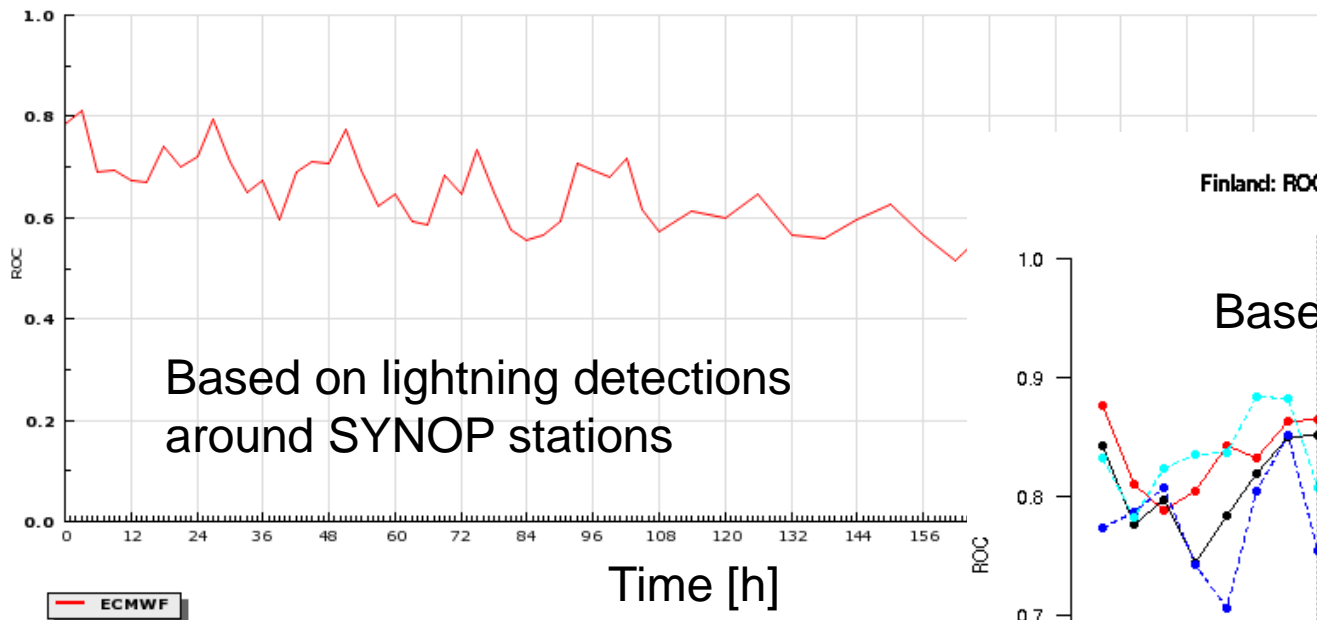
# Known issues

- **POT is dominated by precipitation forecasts**
  - In strongly forced situations precip. forecasts are good
  - In weakly forced situations precip. forecasts are poor
- **POT doesn't have genuine probabilistic characteristics**
  - POT is basically a deterministic product



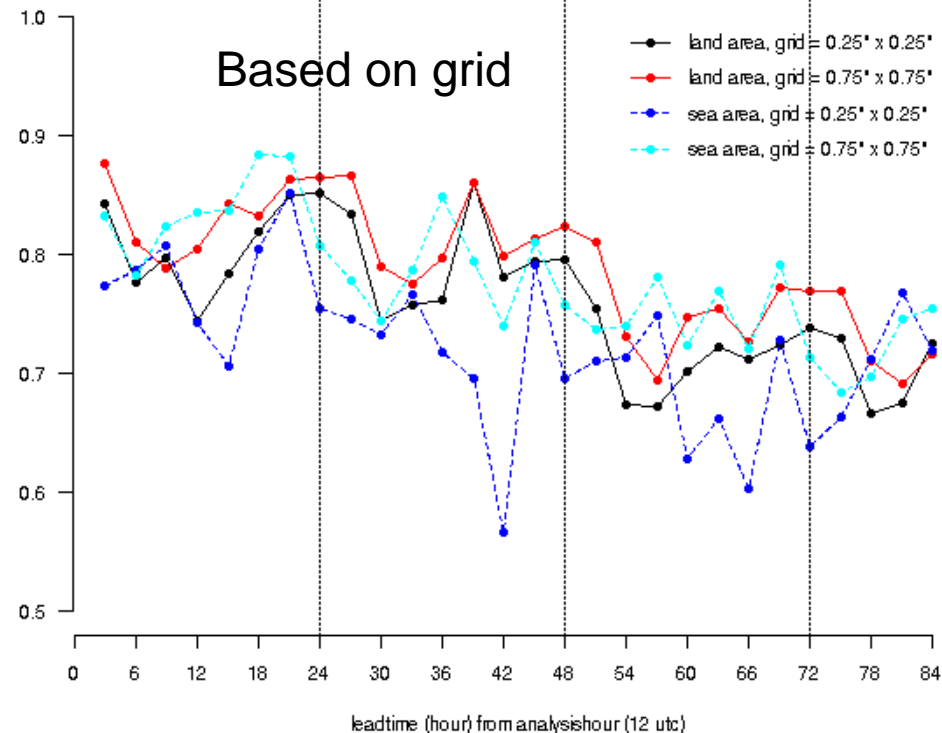
# Verification

## Relative Operating Characteristics @ Central Europe



Finland: ROC for probability of thundem (from ECMWF parameters)

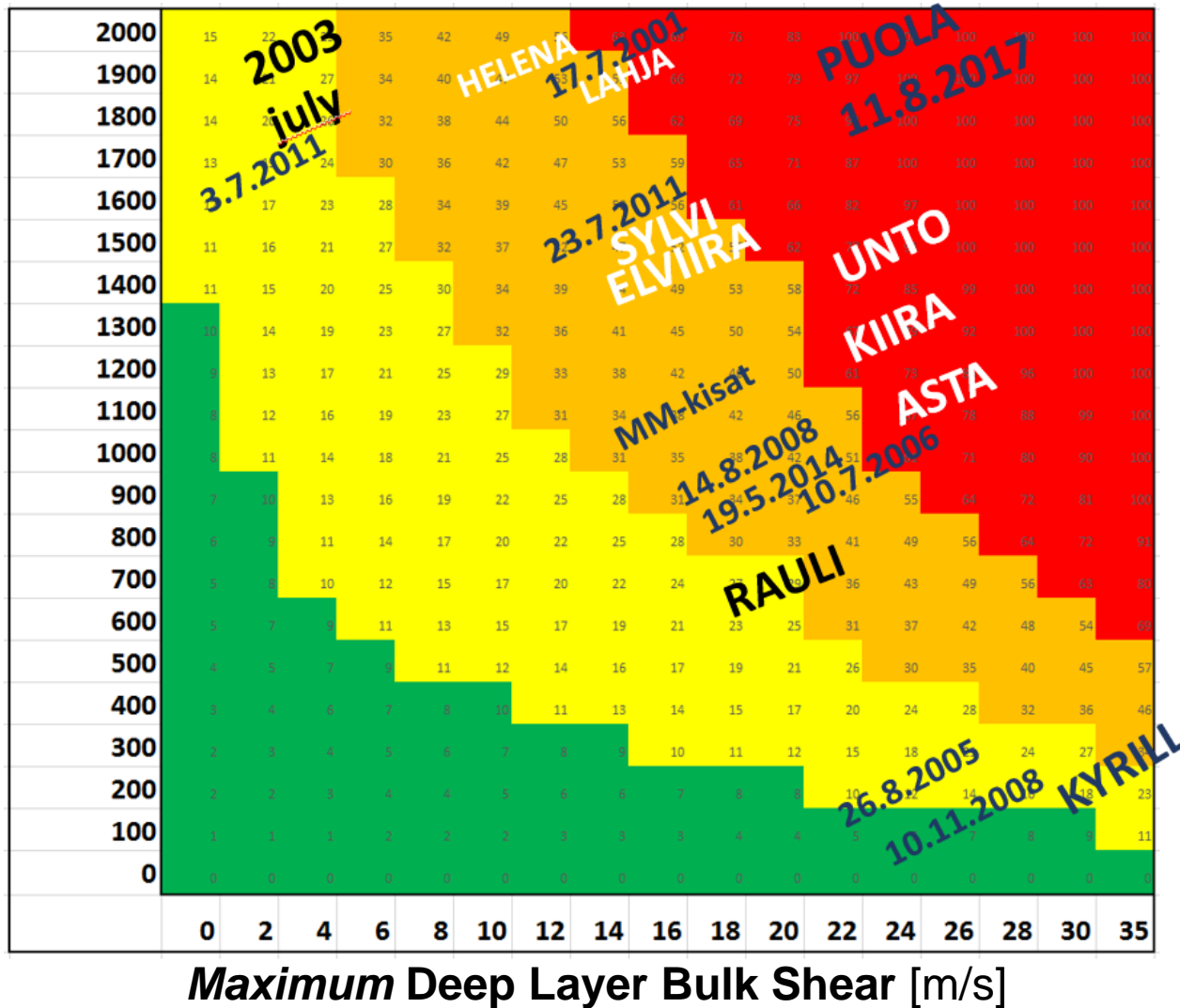
2.6.2017 - 15.9.2017





# Another example: Severity index

Most Unstable CAPE [J/kg]



Index indicates severity of possible thunderstorms

Coloring represents approximated warning level

Warning level approximation is based on past cases over Finland

### Usage:

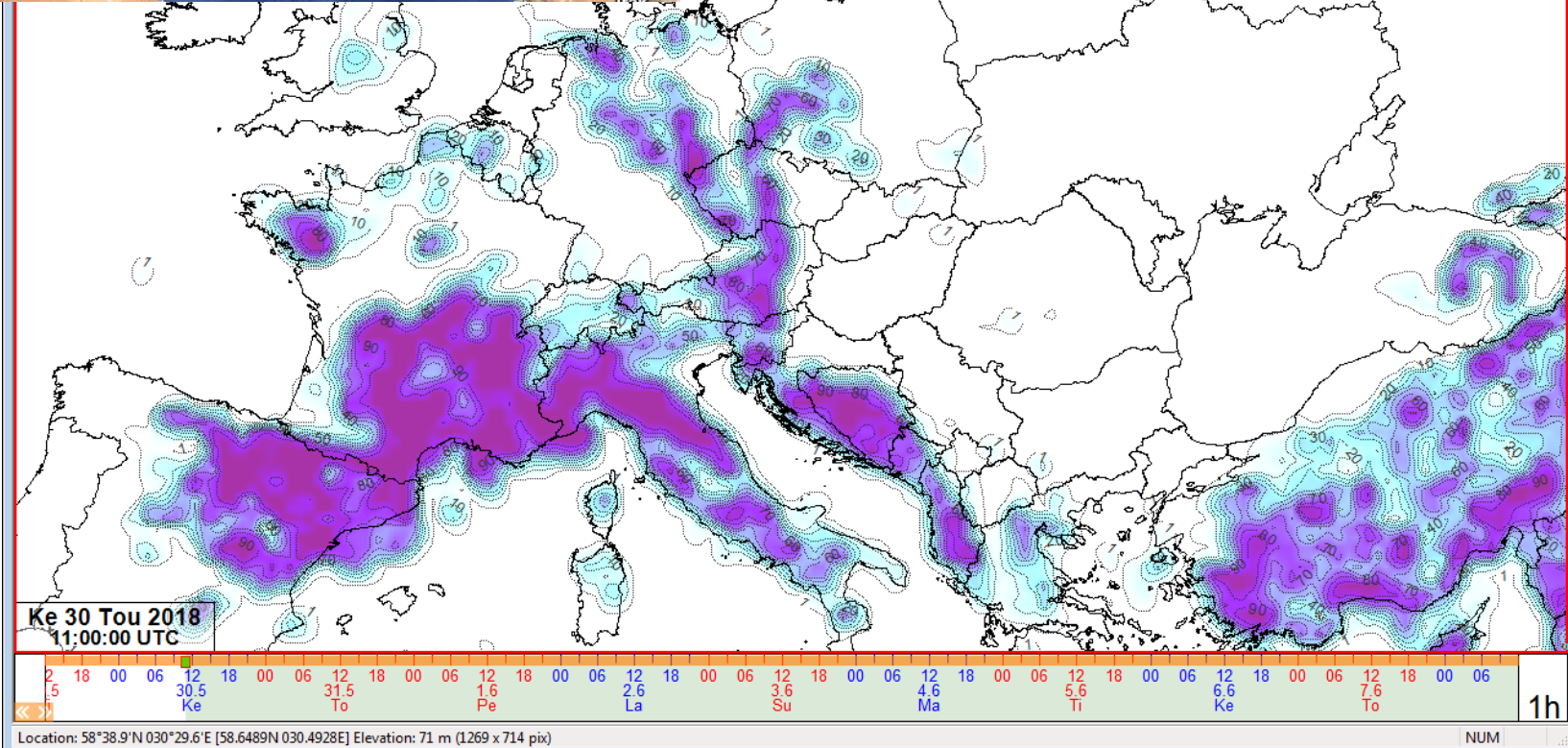
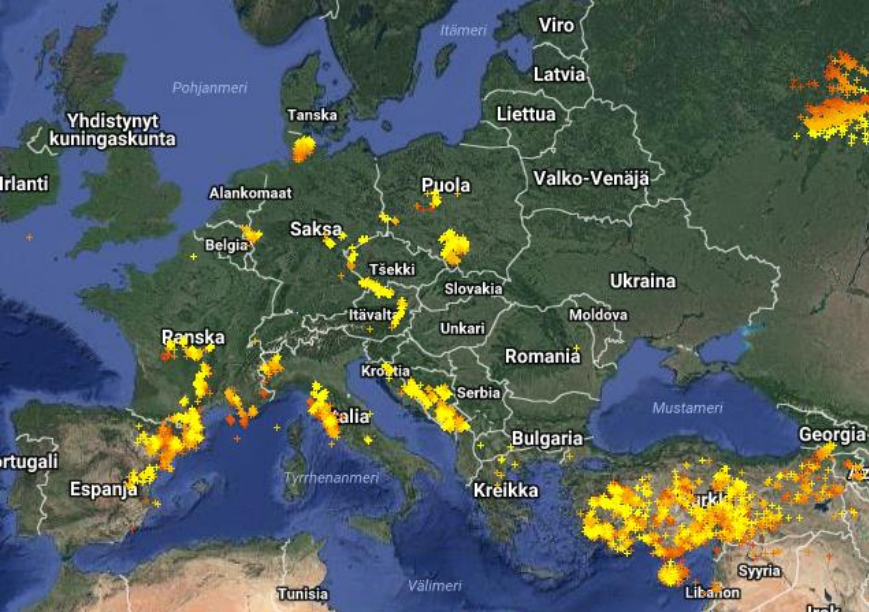
- Indicates **the worst case scenario**
- Doesn't take triggering (thunderstorm development) into account!





# enshots

POT









# Ideas and suggestions

1. Ensemble precipitation forecast based Lift term
  - Tests show promising results for short forecasts
2. POT ensemble
  - Comparison between POT and the new ECMWF lightning product, representing two very different approaches
3. Classic and widely used stability parameters into ECMWF ensemble production
  - Currently only CAPE, which is non-classical?
  - *At least convective key ingredients should be included*
  - Lowest 500m average mixing ratio, Lapse rate 850→500hPa, MU\_CAPE, SFC\_CAPE, ML\_CAPE, Precipitable water, Effective Bulk Shear