

?

# Could a perfect model ever satisfy the forecaster ?

## On grid-box mean versus point verification

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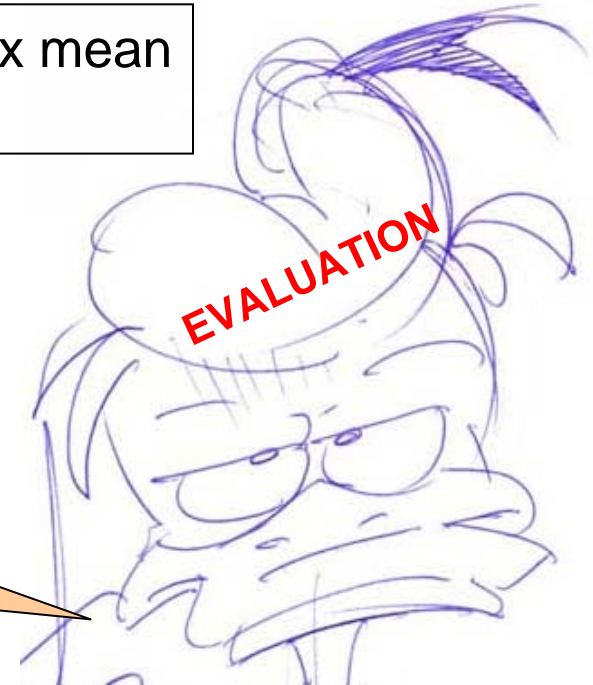
# The problem



„...the model predicts 20 mm,  
therefore there is even some  
risk of 50 mm...“

**Fact:** model value = grid box mean  
**Task:** point forecast

„...the model predicted 20 mm,  
but we observed 50 mm  
in Stratford upon Point,  
thus the **model was wrong**...“



# Framework of a thought experiment

perfect model  
imperfectly verified

**Perfect** model value = grid box mean of **observations**

„**truth**“ = maximum observation in grid box

# Observations

- very high spatial resolution: synop obs + climate + ....
- European rain gauge network of 24-hourly accumulations
- 5 years of data
- results with 80 km, 40 km and 25 km grid box size
- minimum number of observation in grid box required

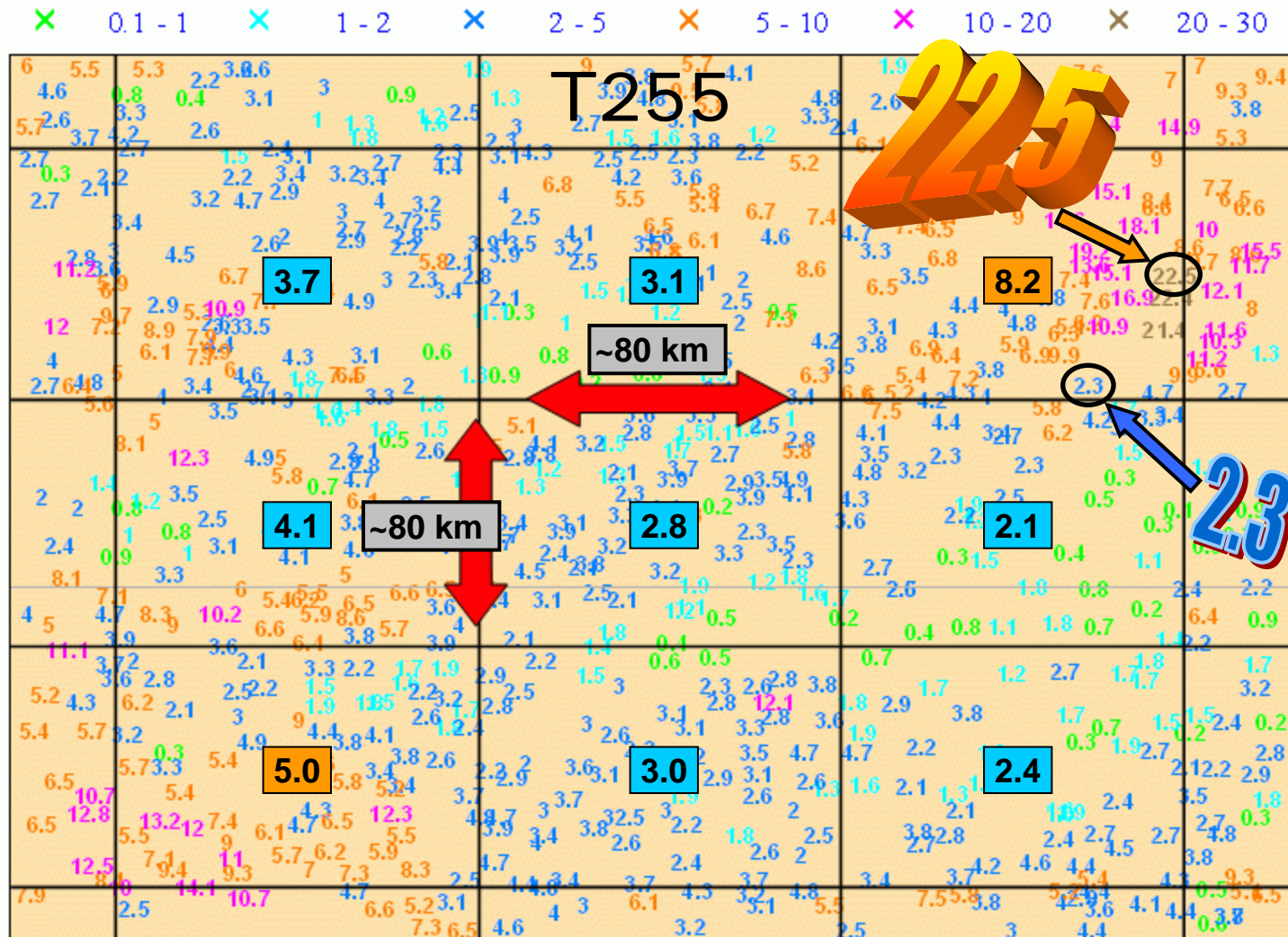
# Distribution of number of observations in grid box



GTS



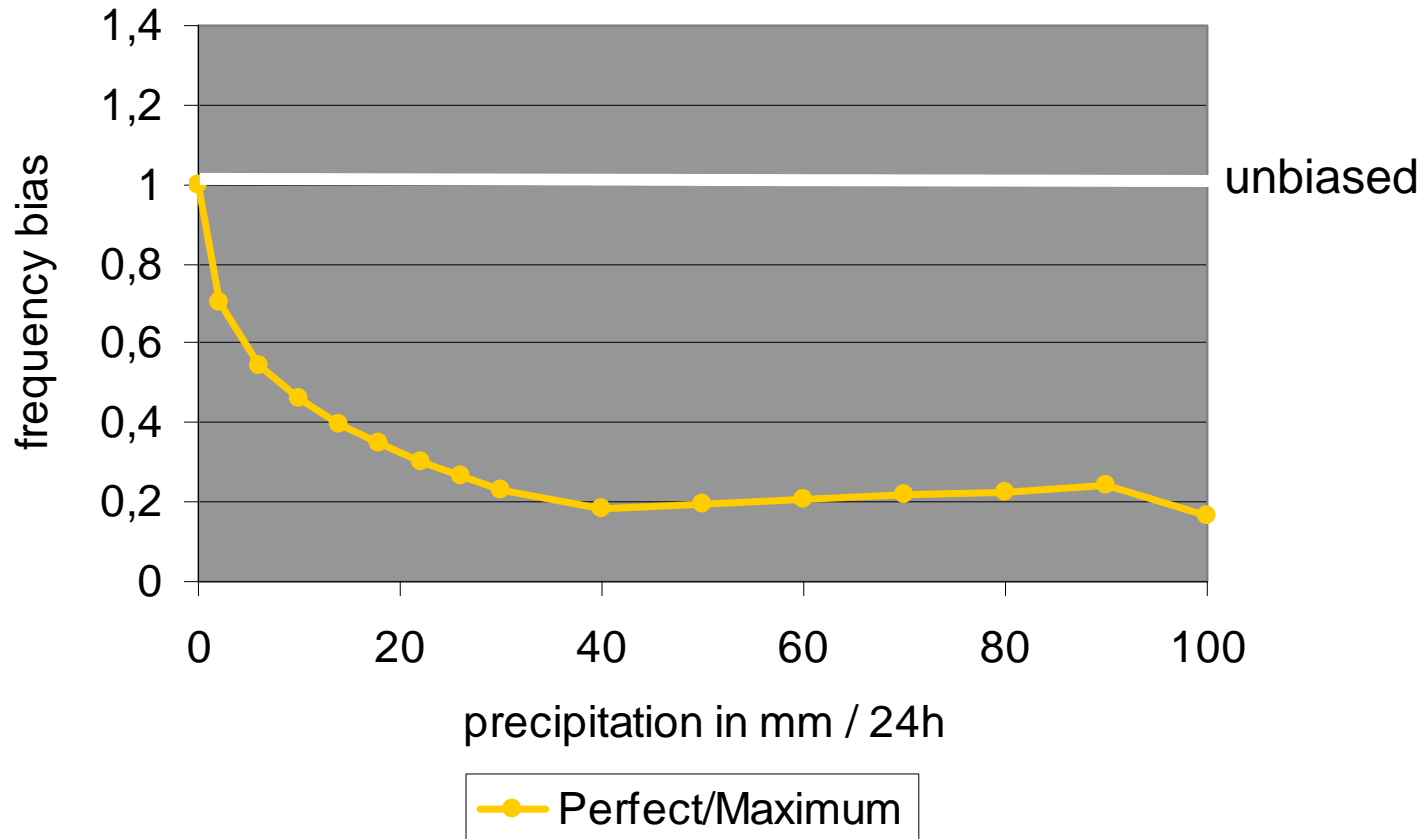
# Example of the sub-grid scale variability



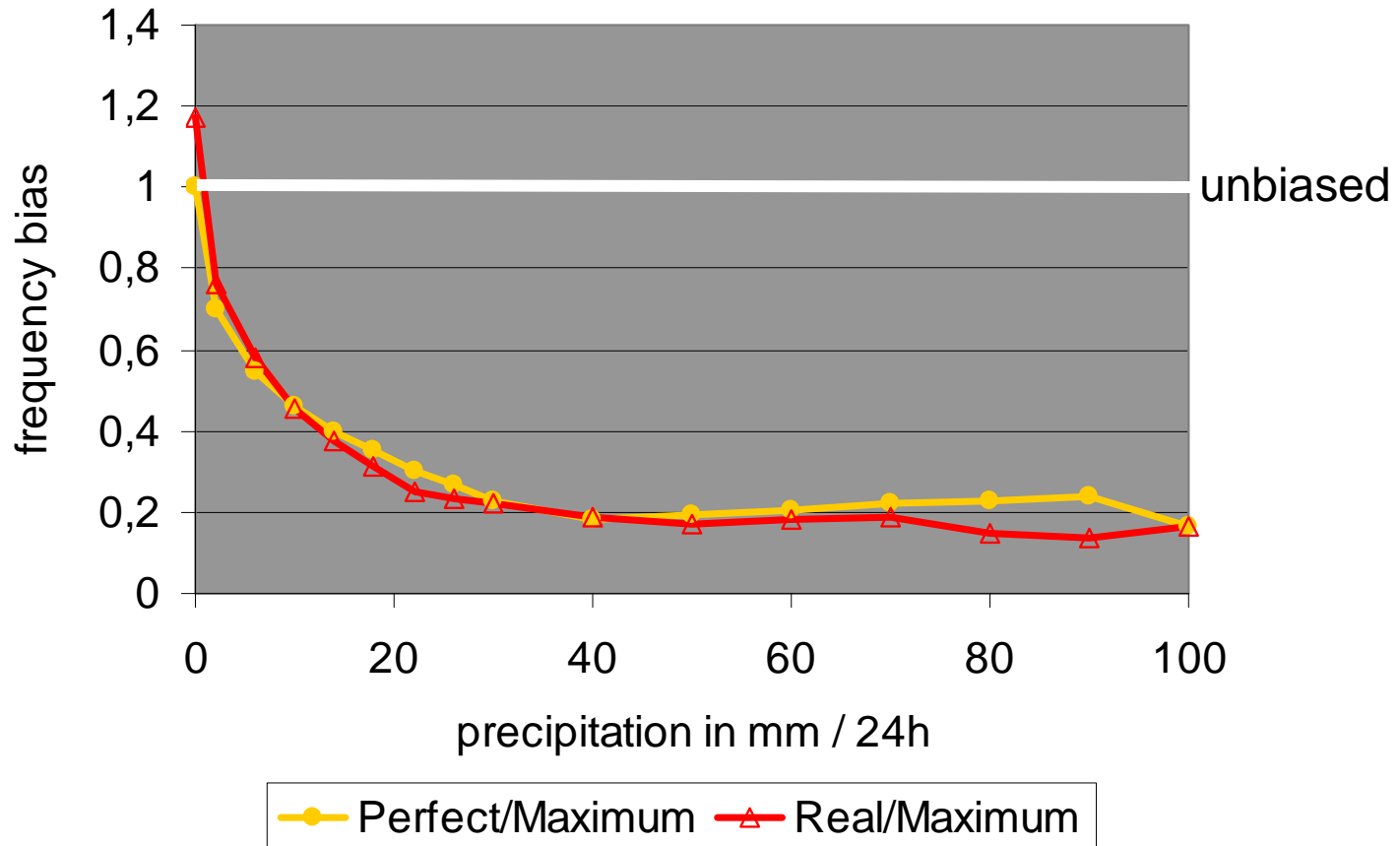
Most of the following results:

Winter, 40 km resolution

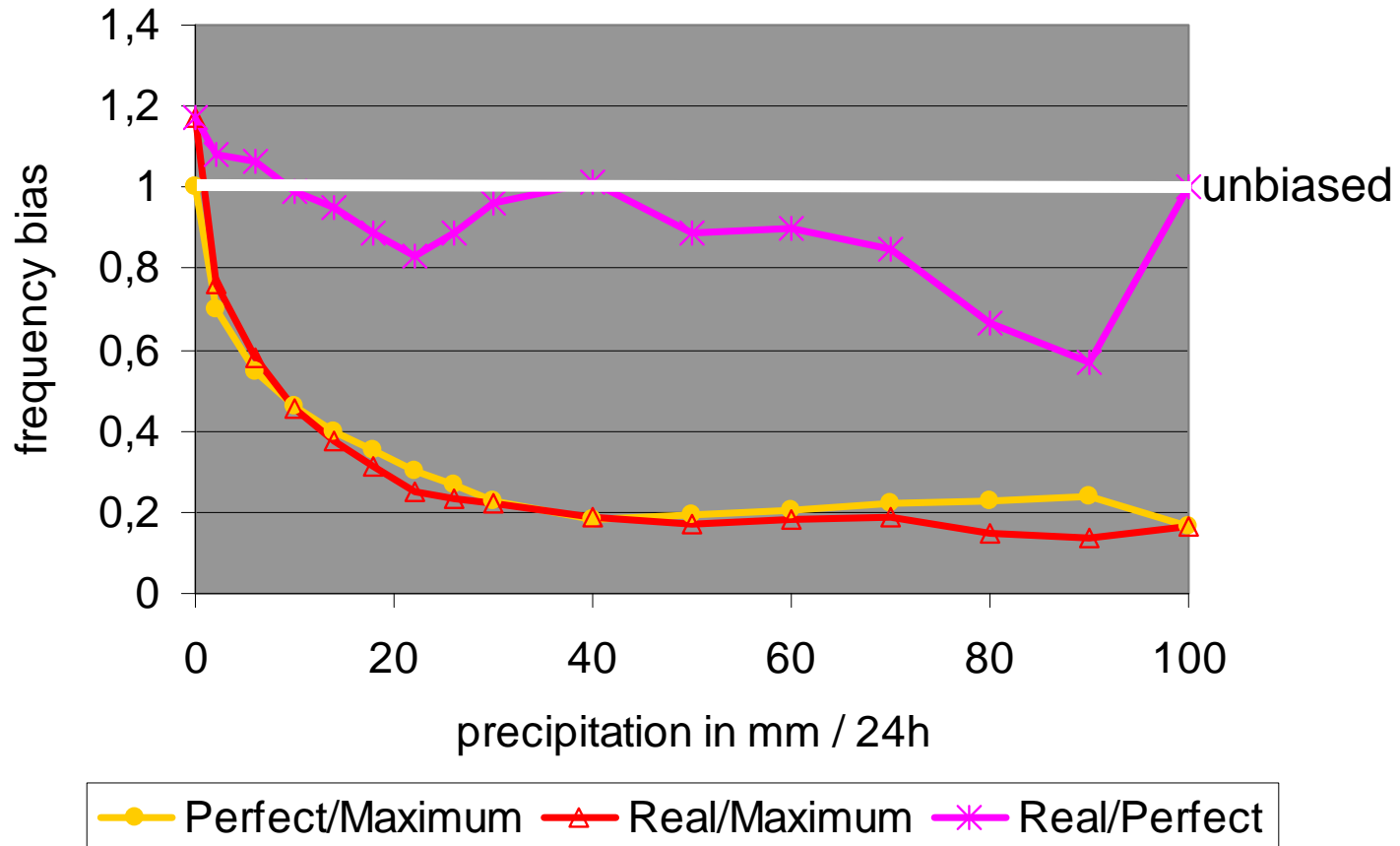
# Frequency bias



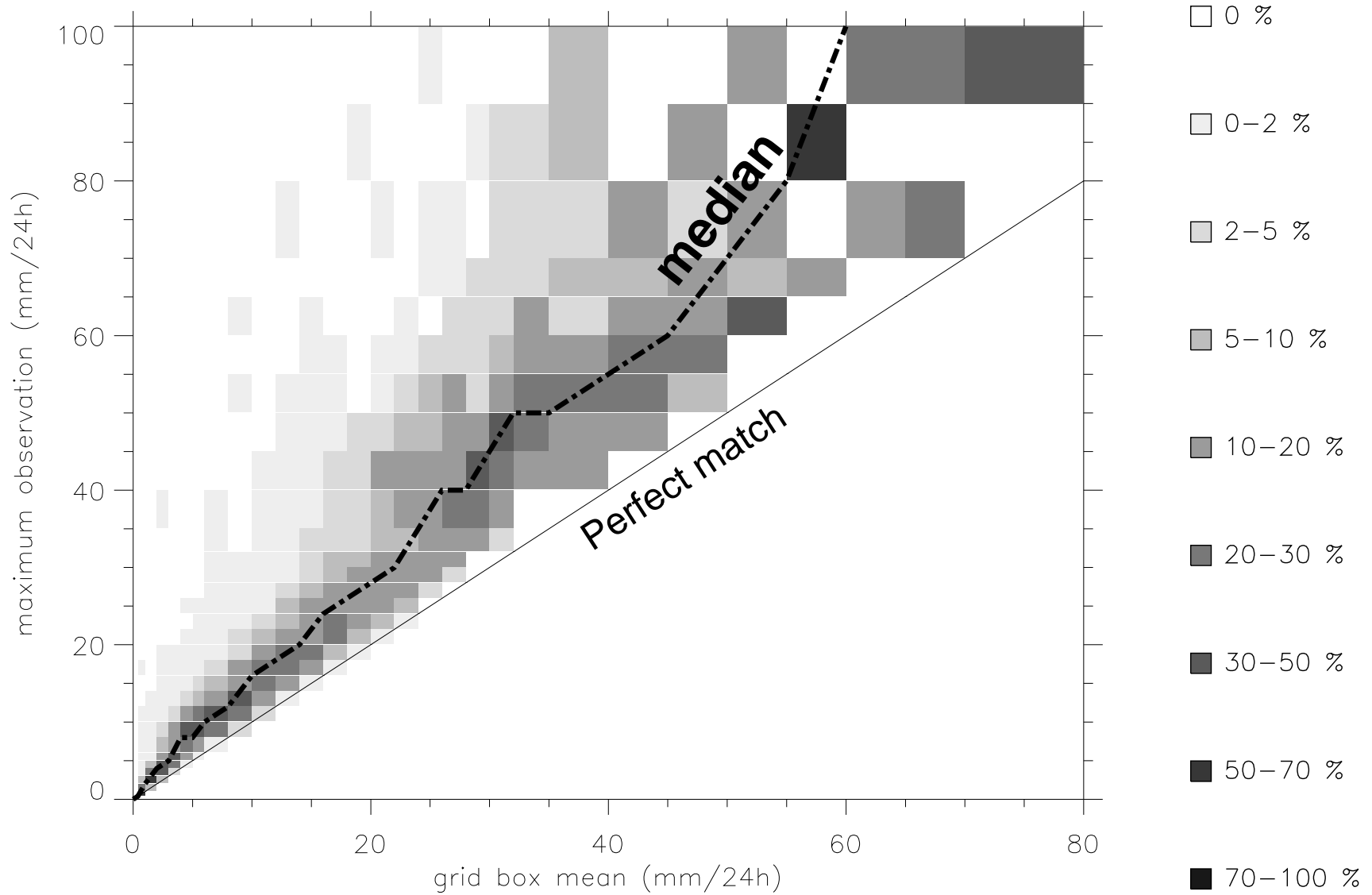
# Frequency bias



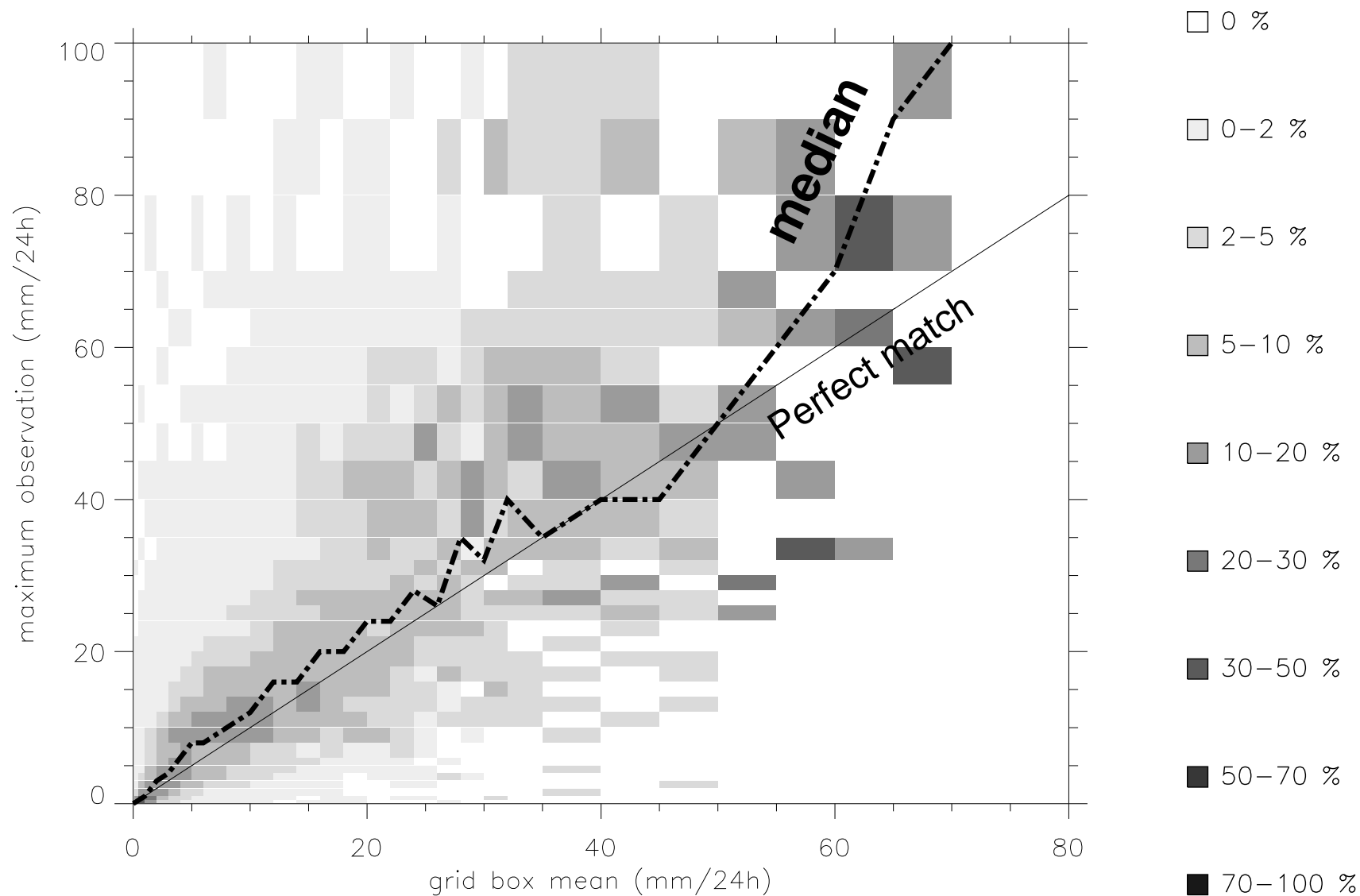
# Frequency bias



# Conditional distribution of maxima given a perfect grid box mean

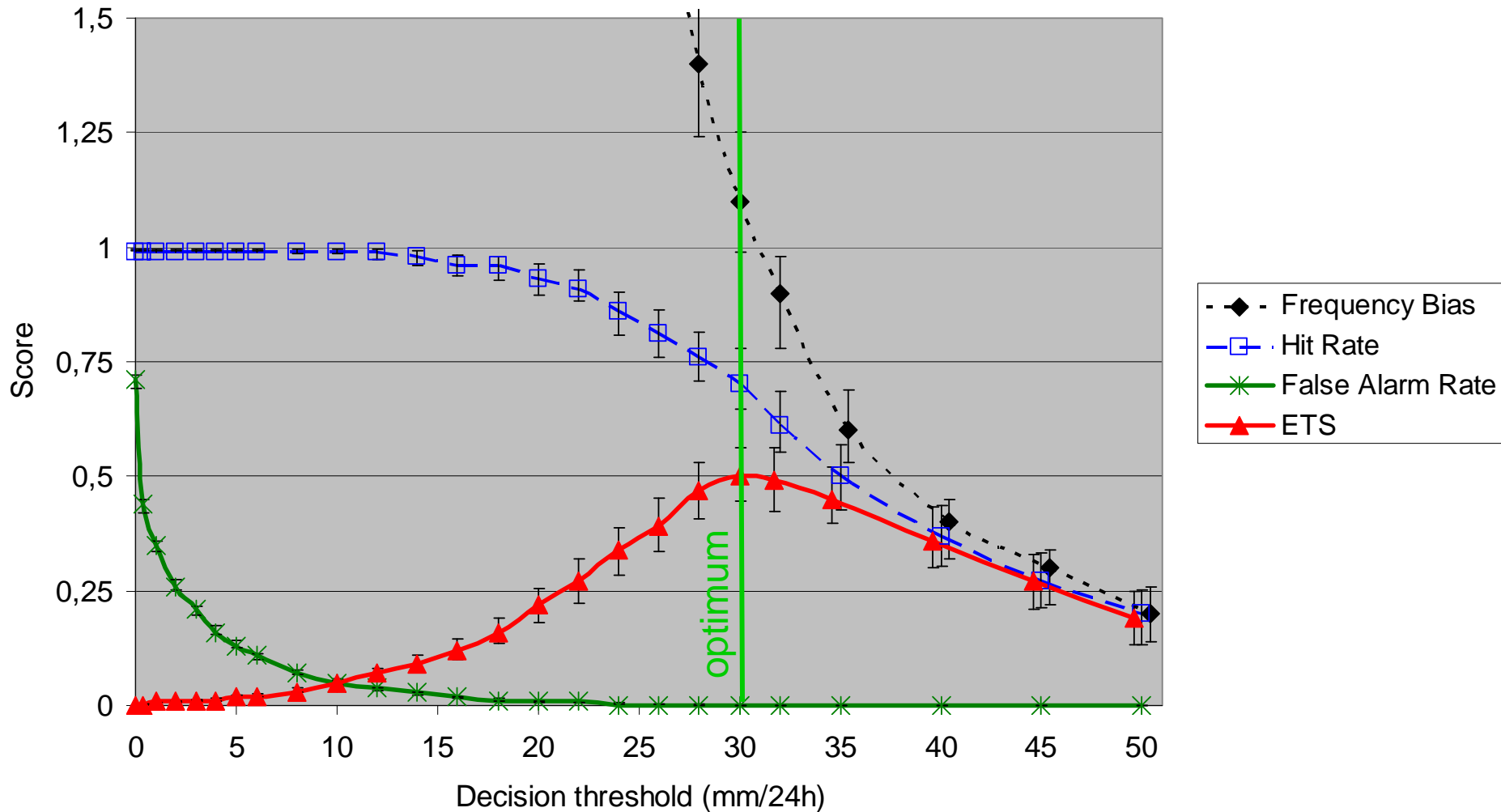


# Conditional distribution of maxima given a forecast grid box mean

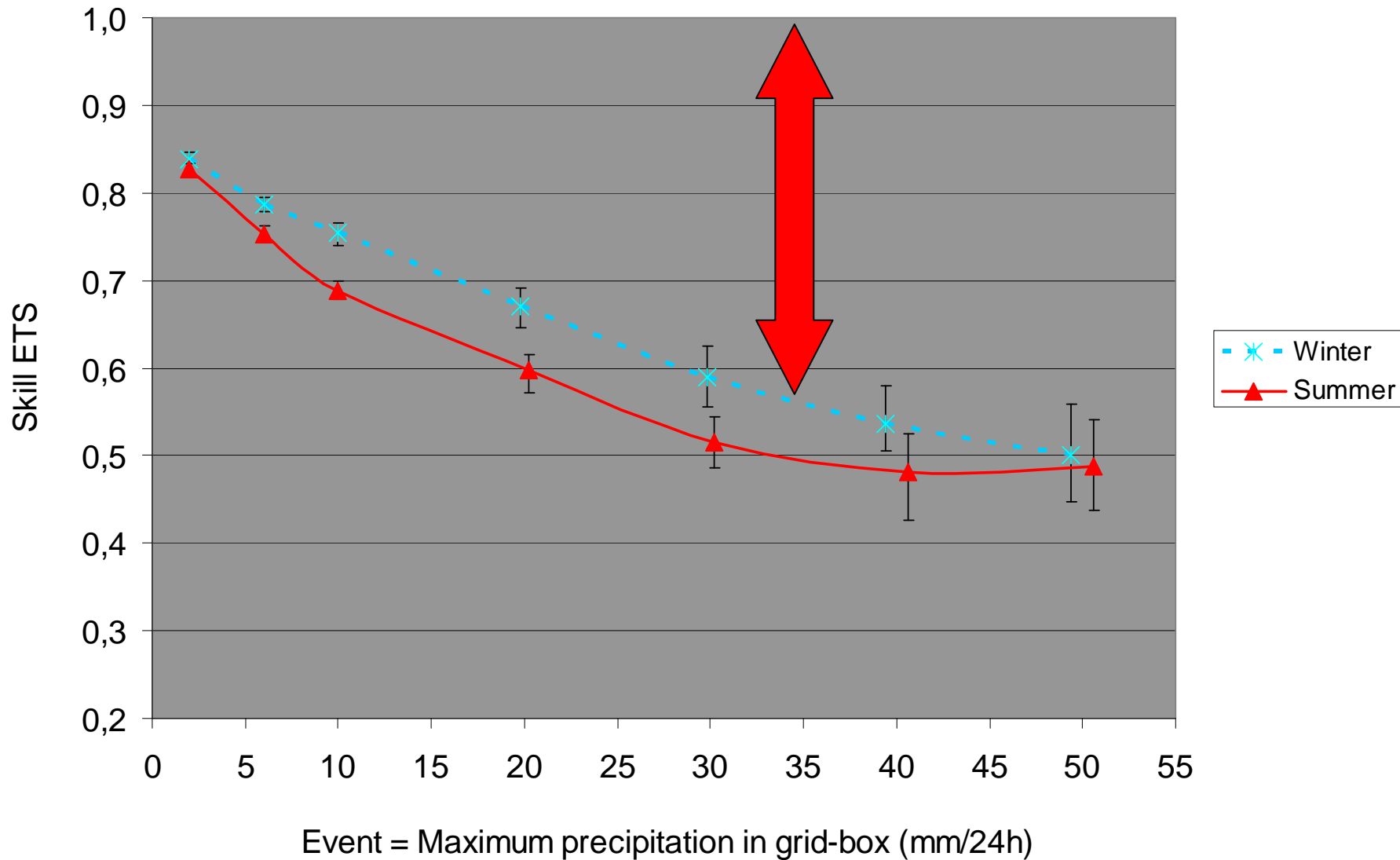


# Signal Detection Statistics

event: 50 mm / 24h

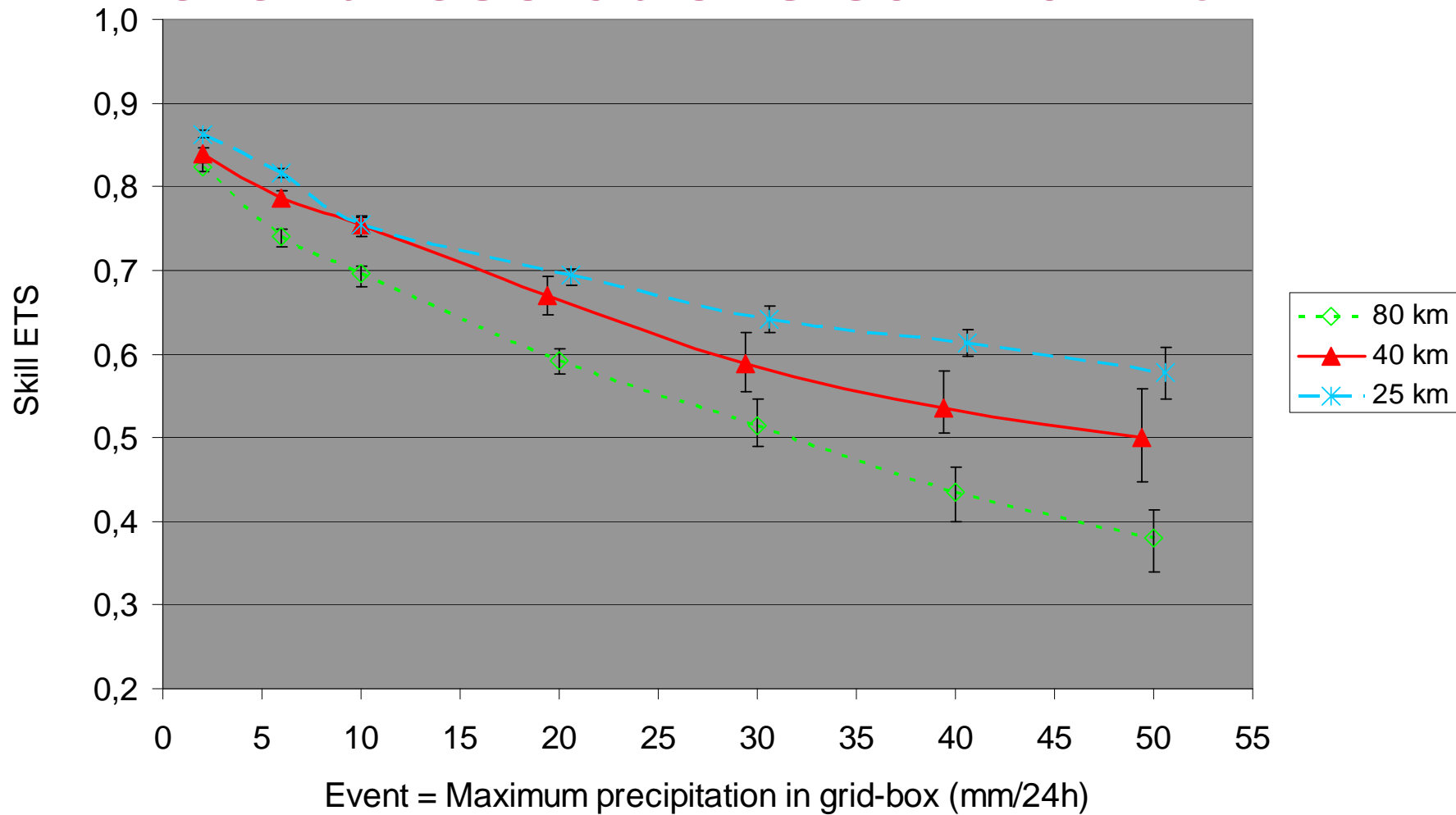


# Maximum attainable ETS

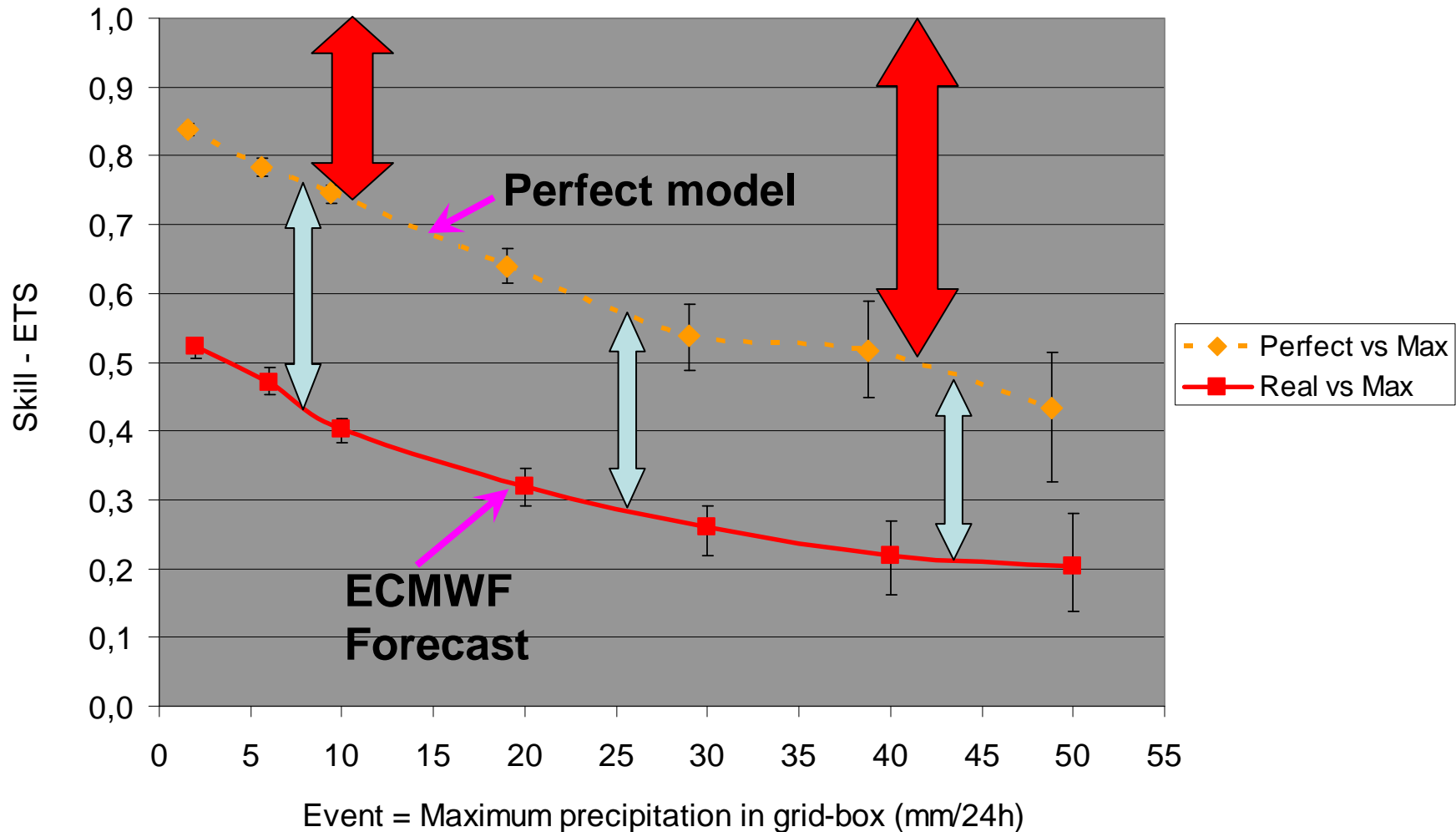


# Perfect model verification

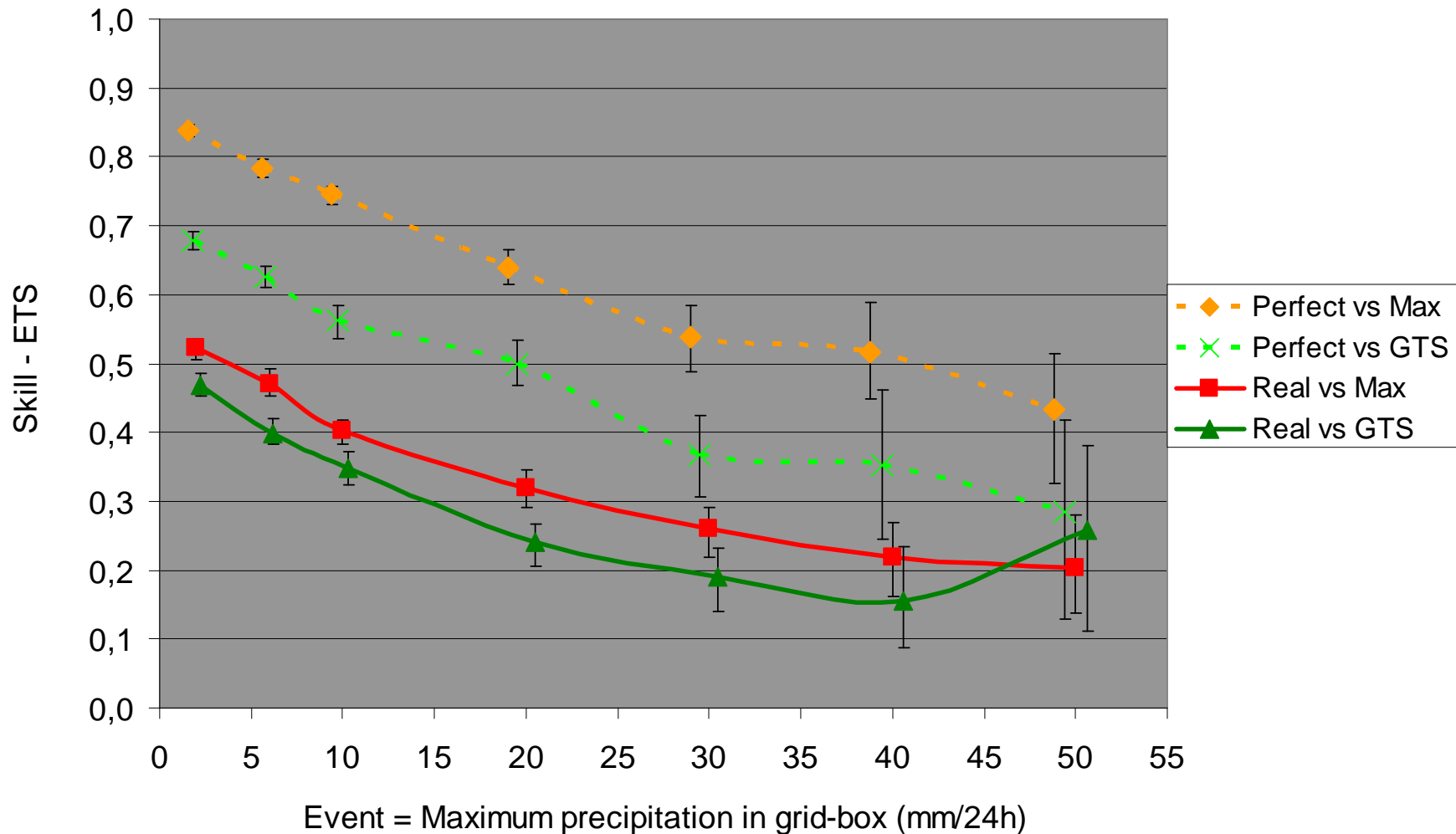
## Different resolutions 80 - 40 - 25 km



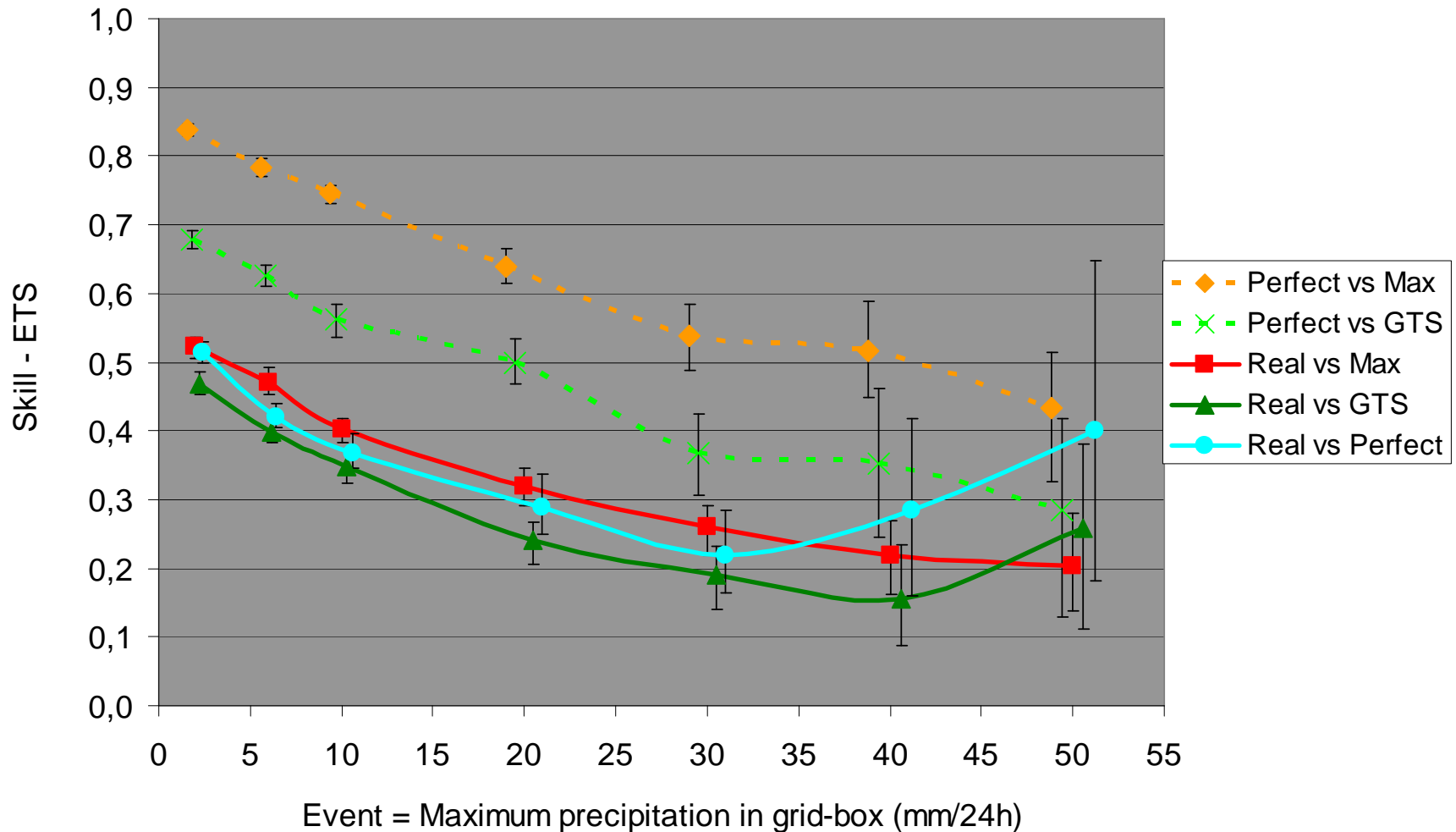
# What about real model forecasts?



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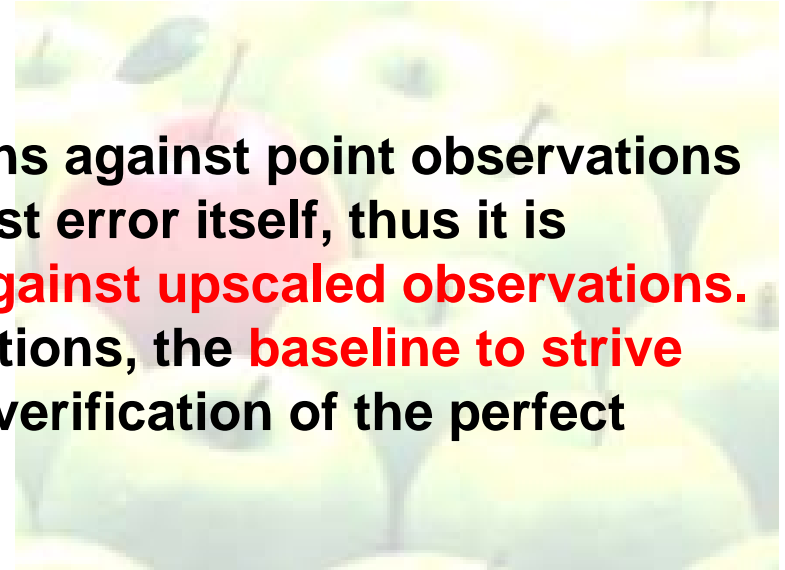
# Conclusions

## For (point) forecasting

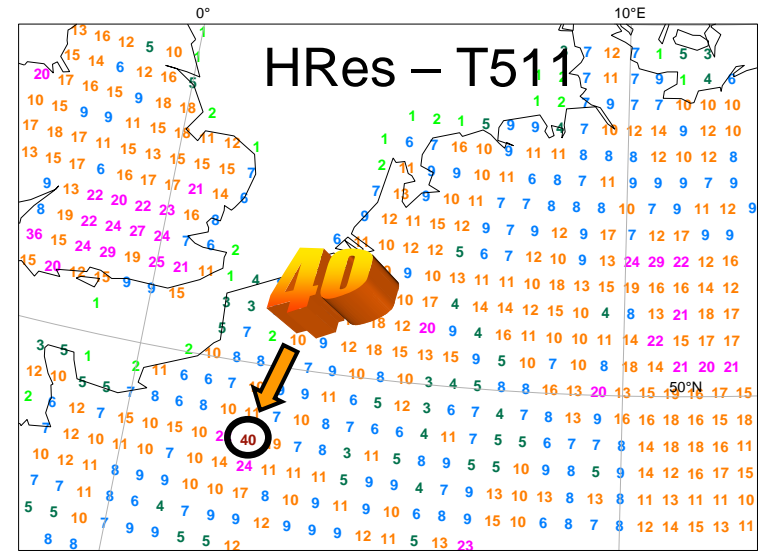
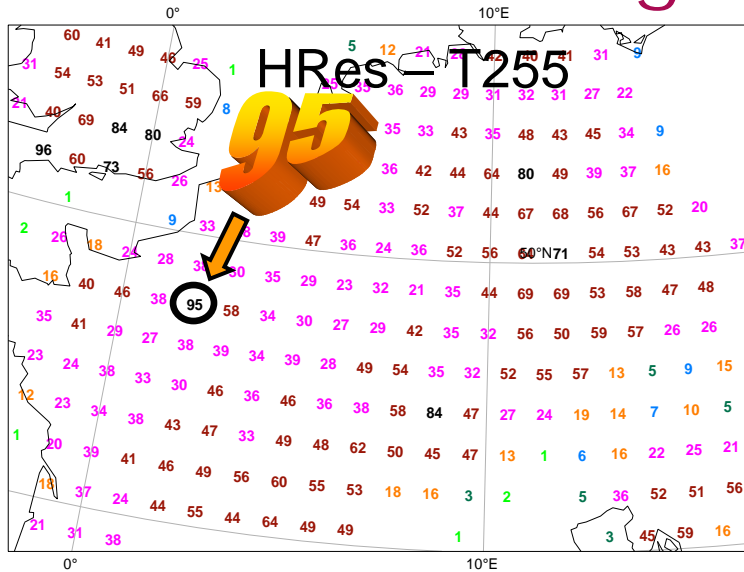
Even a perfect model could not nearly satisfy that forecaster, who just wants to pass on a model value to a customer in need of a point forecast. A good forecaster would still have to apply some statistical, dynamical, or mental **post-processing in order to estimate the subgrid scale variability and thus the probability of exceeding some threshold.** Finally, this probabilistic forecast could be turned into a deterministic forecast by taking the cost-loss ratio of a particular user into account.

## For verification

„Imperfect“ verification of grid box means against point observations causes errors on the order of the forecast error itself, thus it is **imperative to verify numerical models against upscaled observations.** If forced to verify against point observations, the **baseline to strive for is not theoretical perfection**, but the verification of the perfect model.



# Number of gridded observations



Lot more stations in the high resolution database

