



FINNISH METEOROLOGICAL INSTITUTE



QPF Verification in ~~Small~~ River Catchments with the SAL Measure

Pertti Nurmi

Sigbritt Näsman & Antonios Niros

***Joint MAP D-PHASE
COST 731 Mid-term Workshop
Bologna, 19-22 May 2008***



Requirements



... for *optimal* spatial precipitation forecasts

- ✓ Occurrence vs. non-occurrence should be forecast
- ✓ **Location** (*displacement*) predicted precisely
- ✓ **Amplitude** (*volume*) predicted correctly
- ✓ **Structure** (*size and shape; pattern*) and **spatial variability** predicted properly

❖ **SAL** ⇔

- ✓ Entity-, Object-, Features-, Displacement-based family of verification measures (like CRA, MODE, ...)
- ✓ **SAL Originator** ⇔ **Uni. Mainz / MeteoSwiss / DLR**
- ✓ *Software (Fortran code) available at FMI in mid-2007*



SAL features



- ✓ QPF in pre-specified area ⇔ **River/Lake catchment**
- ✓ Three independent components addressing the quality
 - Structure - S -
 - Amplitude - A -
 - Location - L -
- ✓ For a perfect forecast: $S = A = L = 0$
- ✓ More details of the method in
Wernli, Paulat, Hagen, Frei, 2008 (MWR)



SAL features



S: Structure

-2 ...
objects
too small or
too peaked

0 ...
Perfect

+2
objects
too large or
too flat

A: Amplitude

-2 ...
averaged
QPF under-
estimated

0 ...
Perfect

+2
averaged
QPF over-
estimated

L: Location

0 ...
Perfect

+2
wrong location of
Total Center of Mass
(TCM) and / or of
objects relative
to TCM



What's the "truth" ?

From precip observations to precip analysis

- ✓ Gauge data ?
- ✓ Radar data ?
 - ⇒ Used mostly in this study
- ✓ Merged Gauge-Radar data ?
 - *Would like to use, but...*
 - Which methodology ???

Observed "truth" ? ~ Uncertainty ?

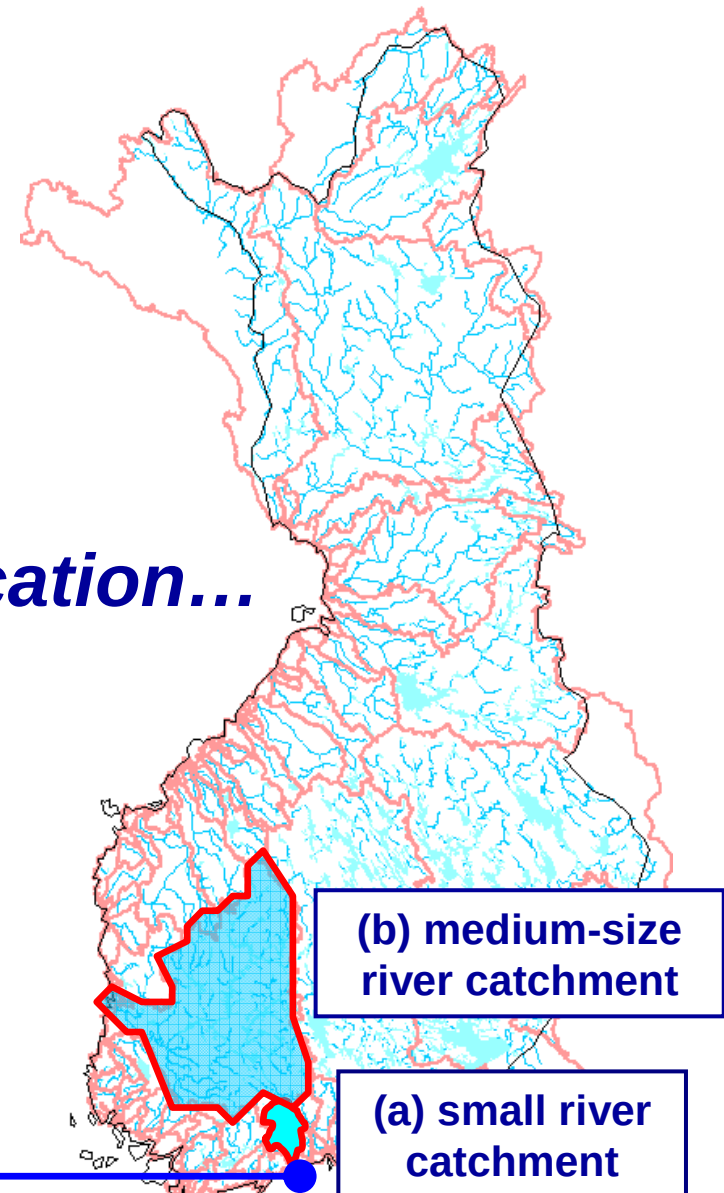
Implications to verification !

Interpretation of the results !?!?



Catchments areas in Finland: Sub-domains for SAL verification...

Helsinki

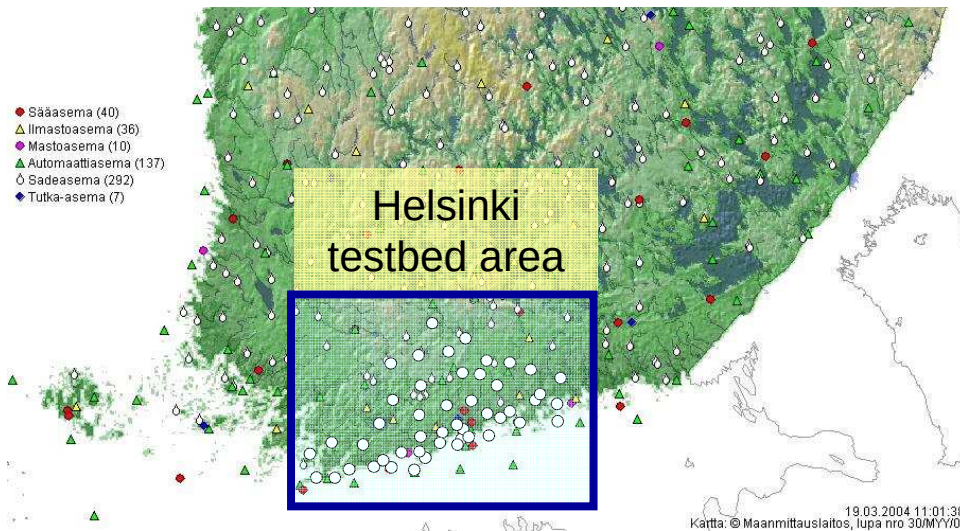


Forecast Data

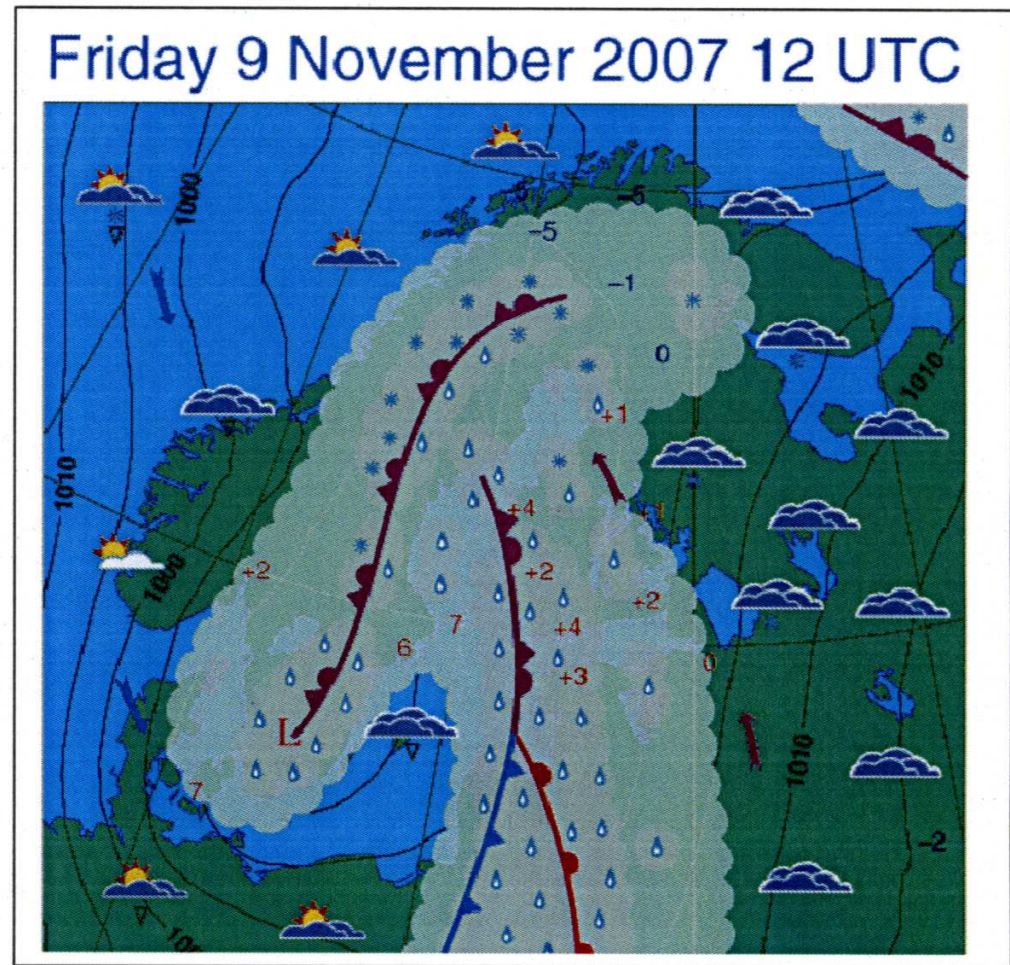
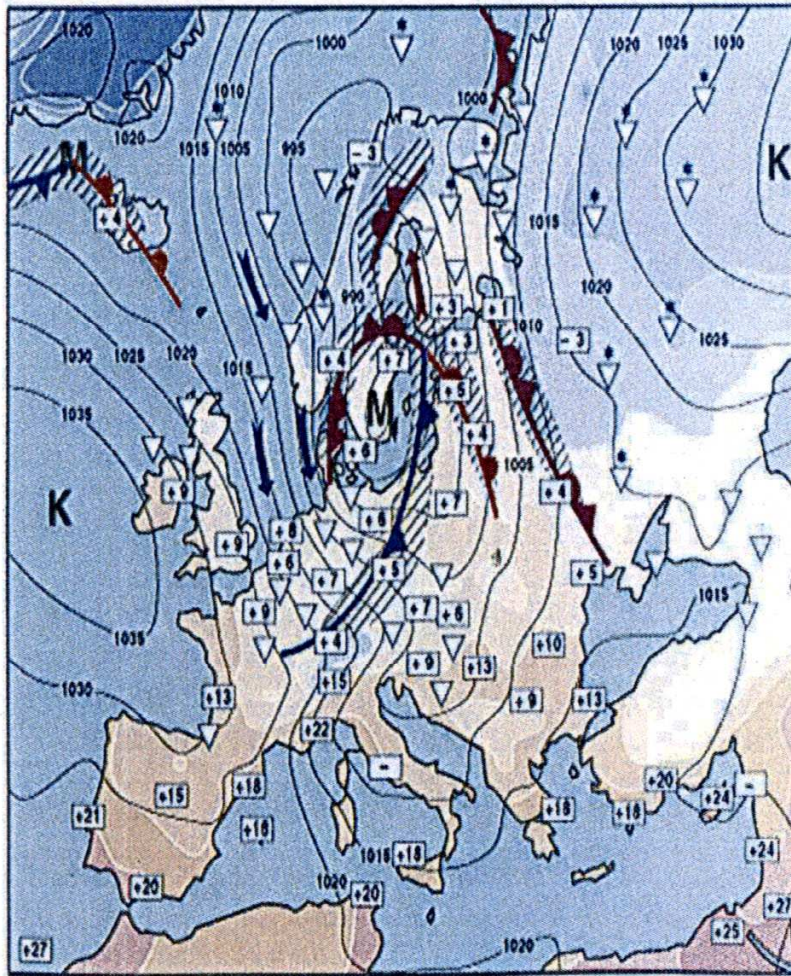
1. ECMWF QPF ~ 25 km
2. HIRLAM RCR (Reference) QPF ~ 16 km
3. HIRLAM MBE (MesoBeta) QPF ~ 7.5 km
4. MetEdit = Forecasters' grid edited QPF ~ 15 km

**24 hr area
accumulations
used in verification**

- o Radar QPE ~ 1 km
 - o Gauge obs ~ ?
- } **"Truth"**



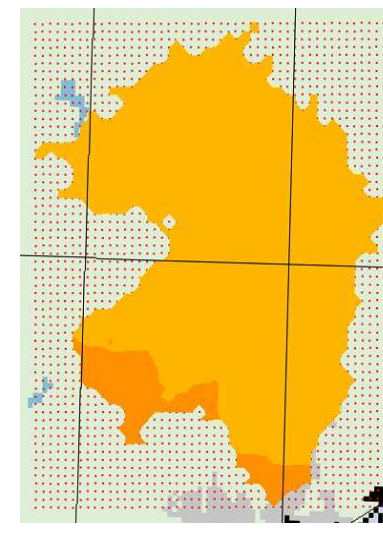
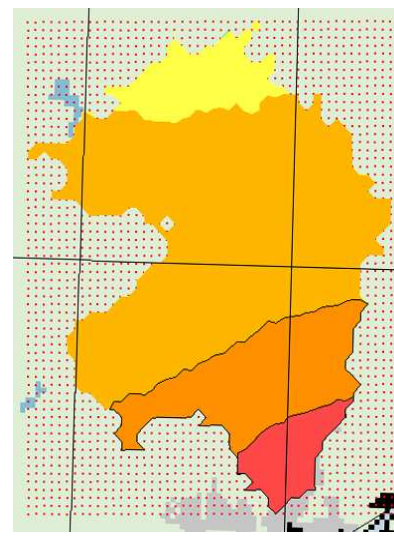
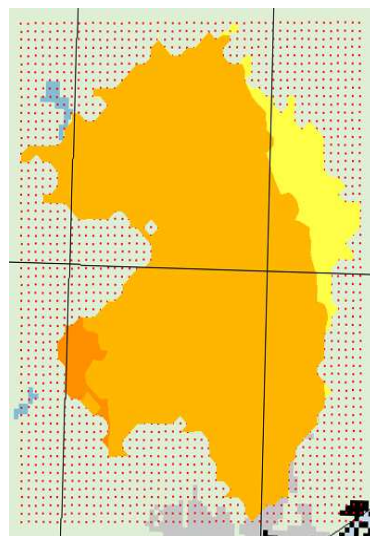
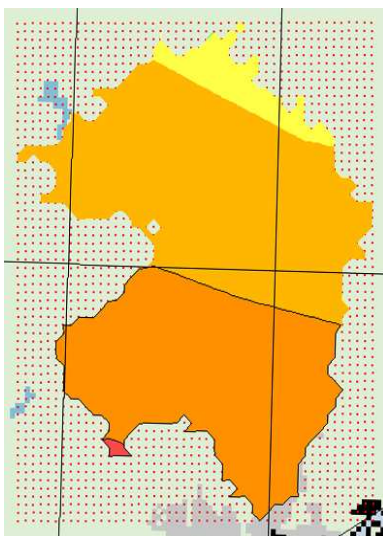
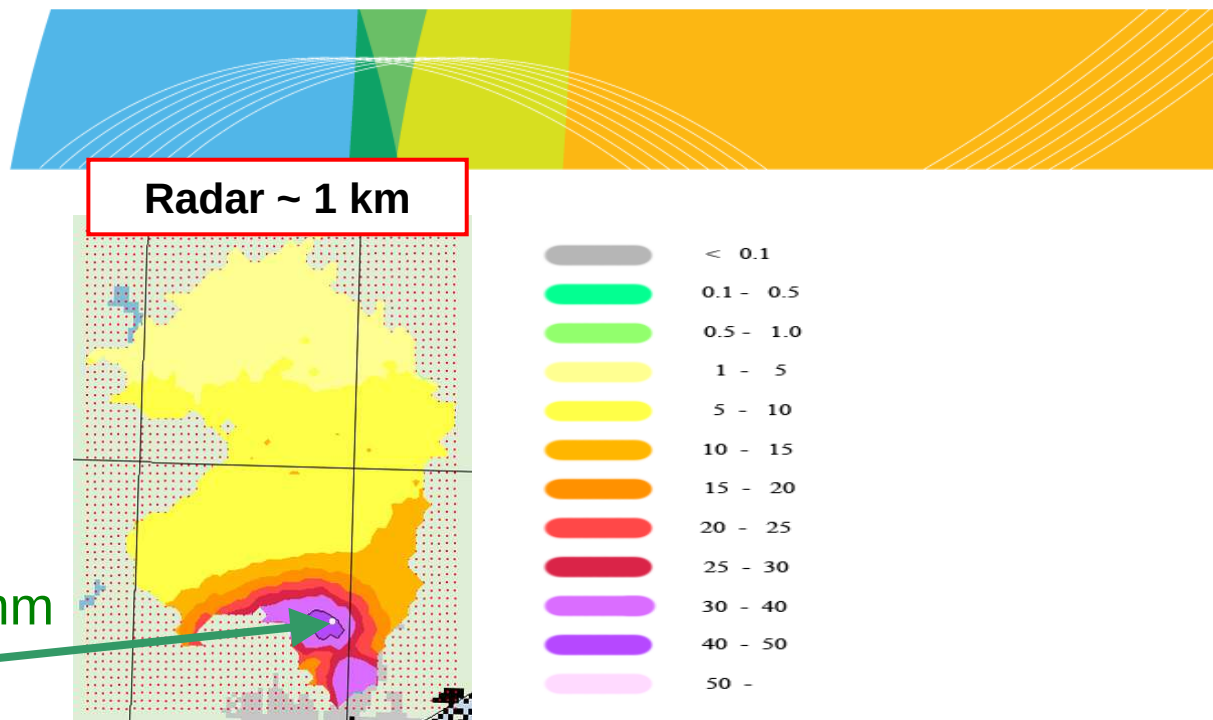
Small catchment case study



Small catchment case study

9 November 2007
24 hour precip

Helsinki Airport: 42 mm
in SYNOP obs



ECMWF ~ 25 km

HIR_RCR ~ 16 km

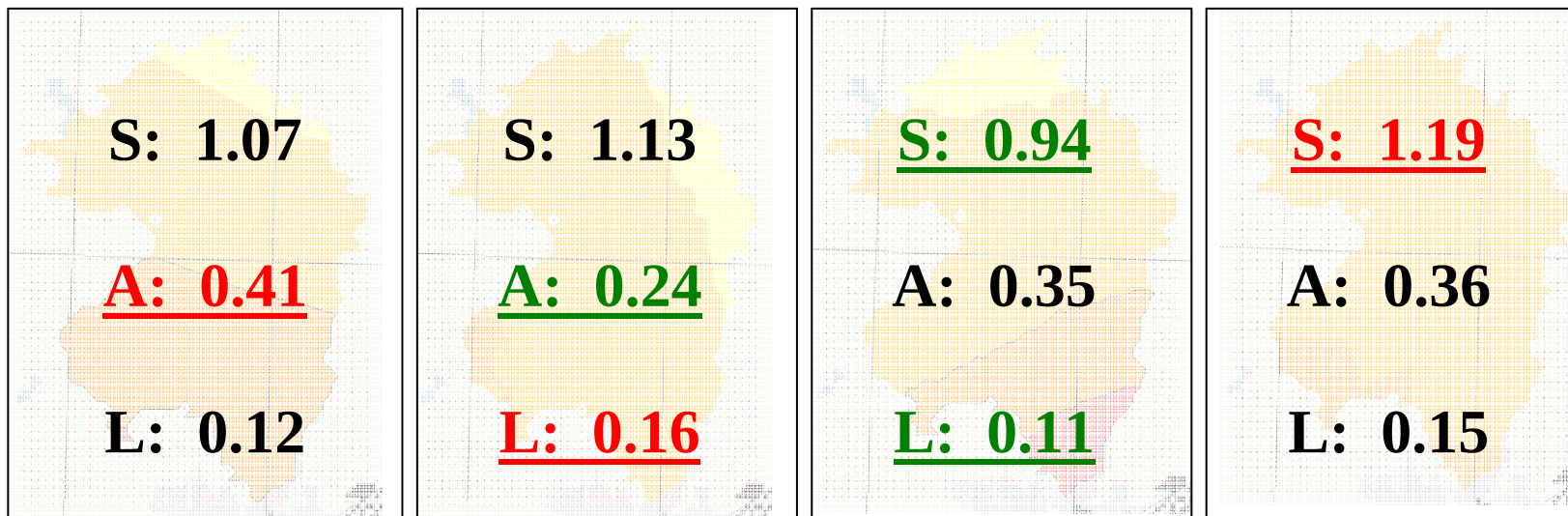
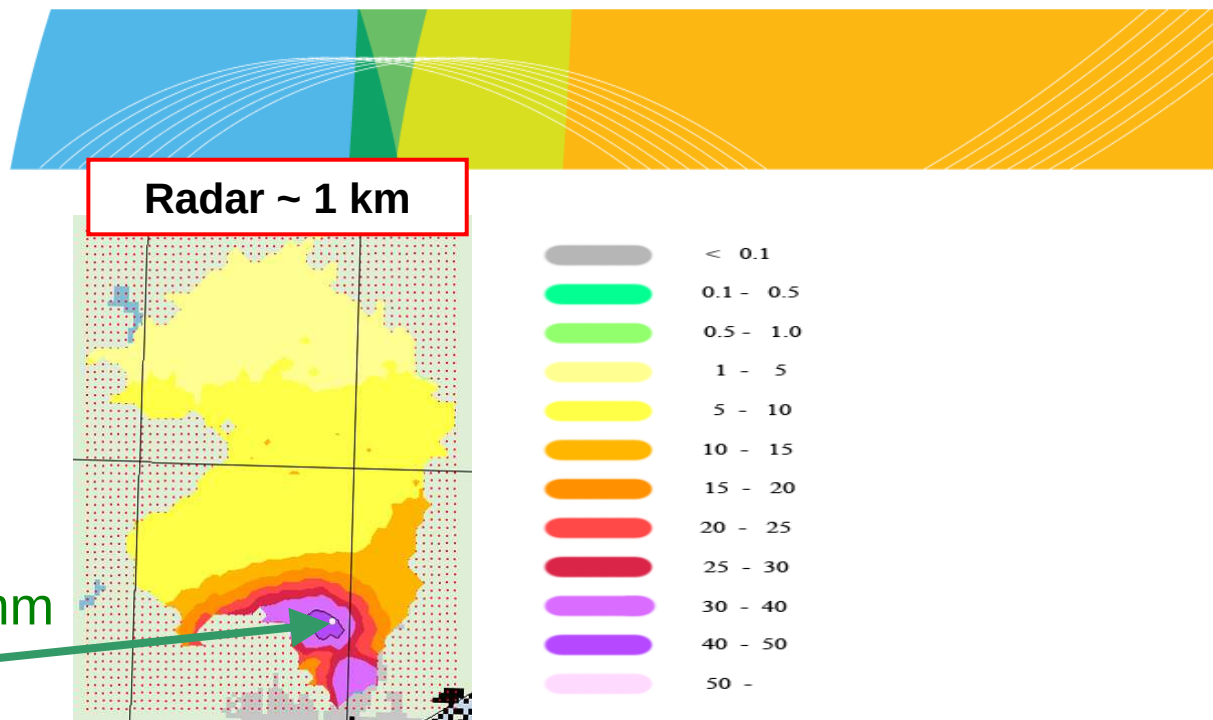
HIR_MBE ~ 7.5 km

MET_Edit ~ 15 km

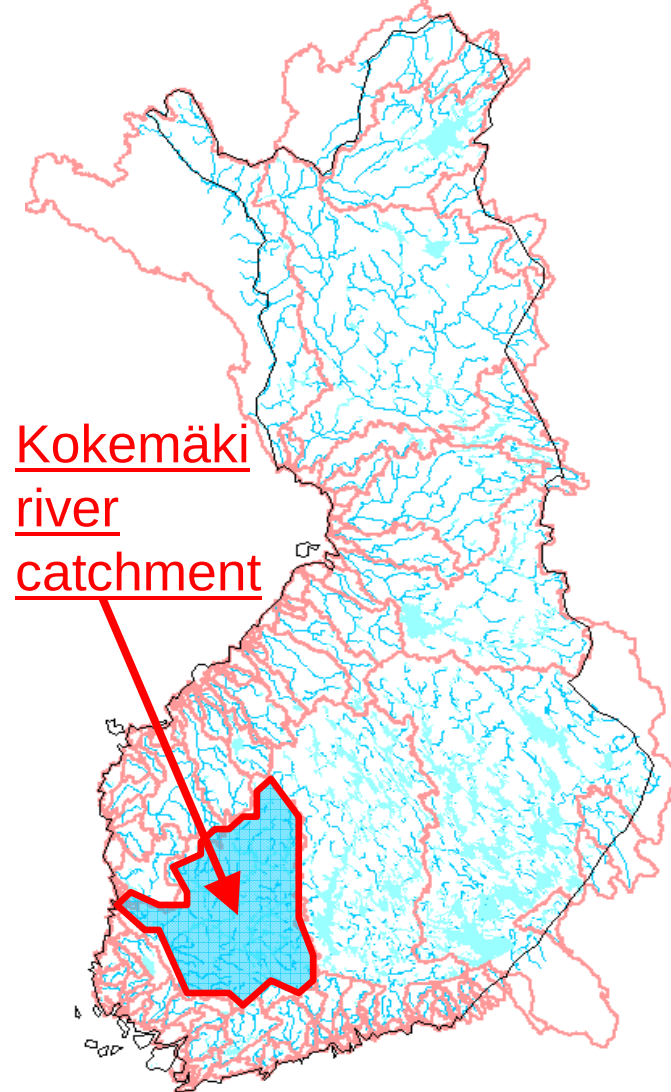
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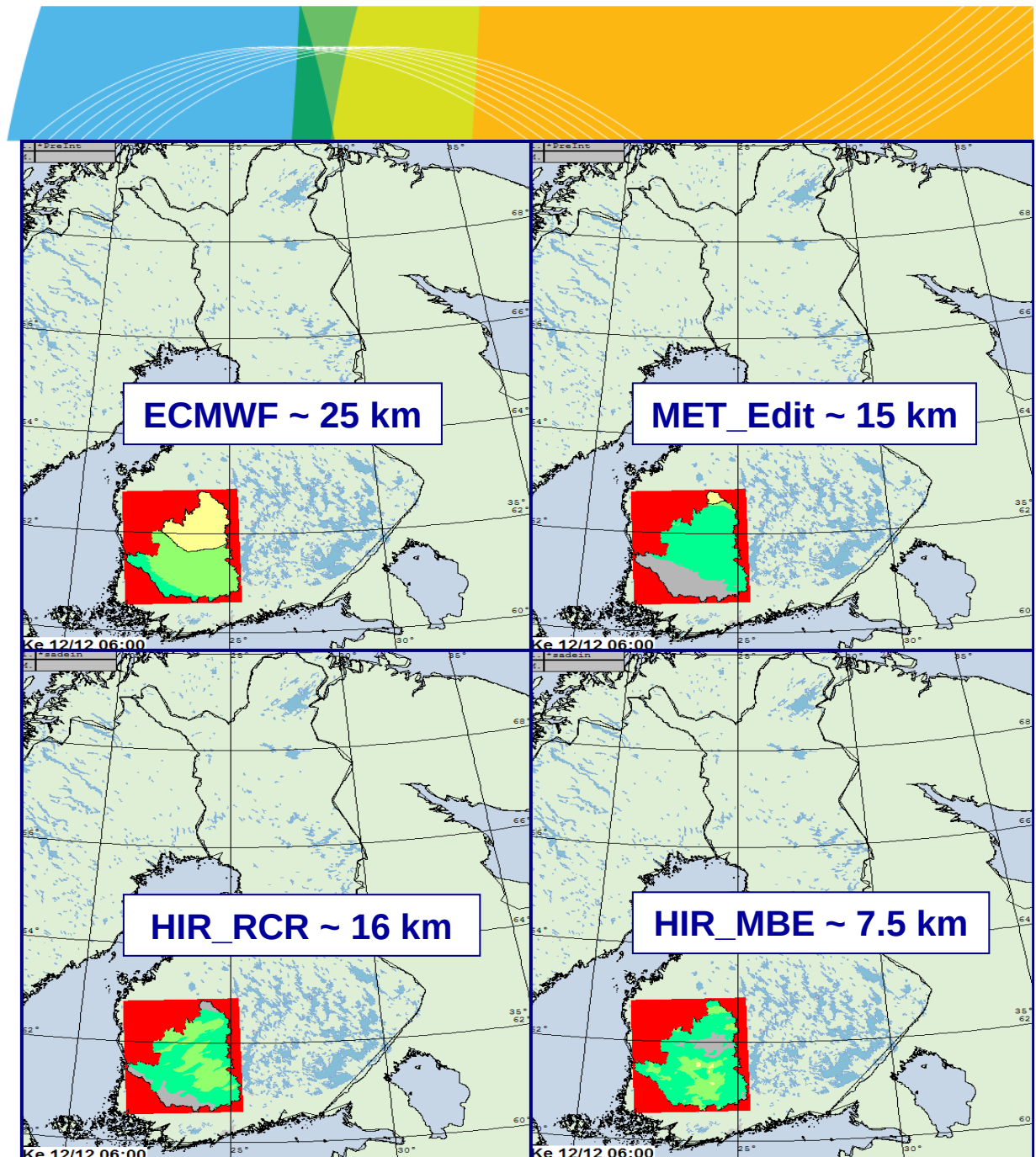
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Medium-size catchment ...

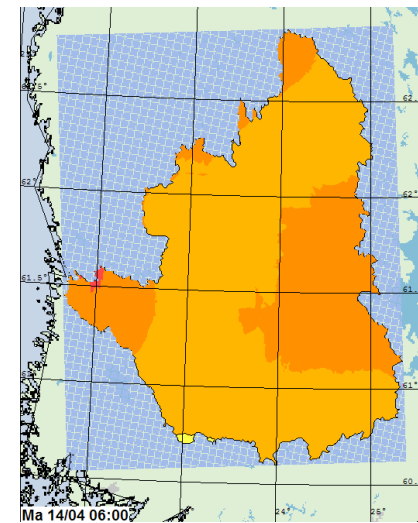
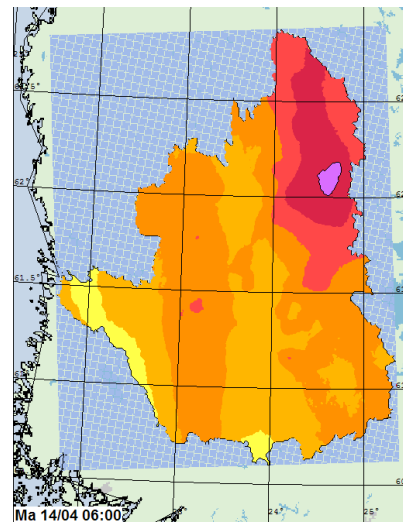
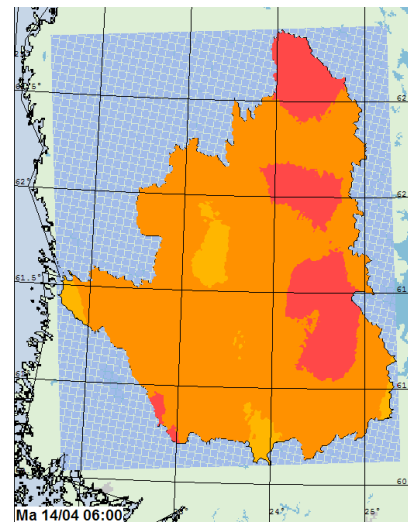
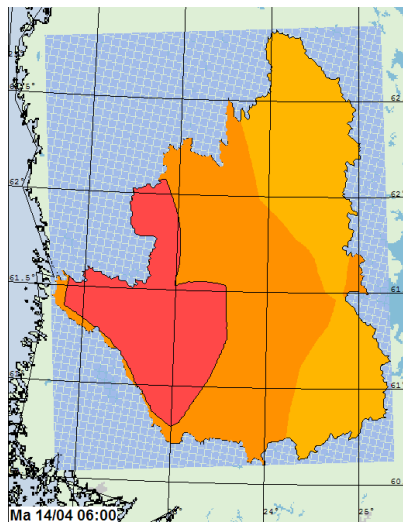
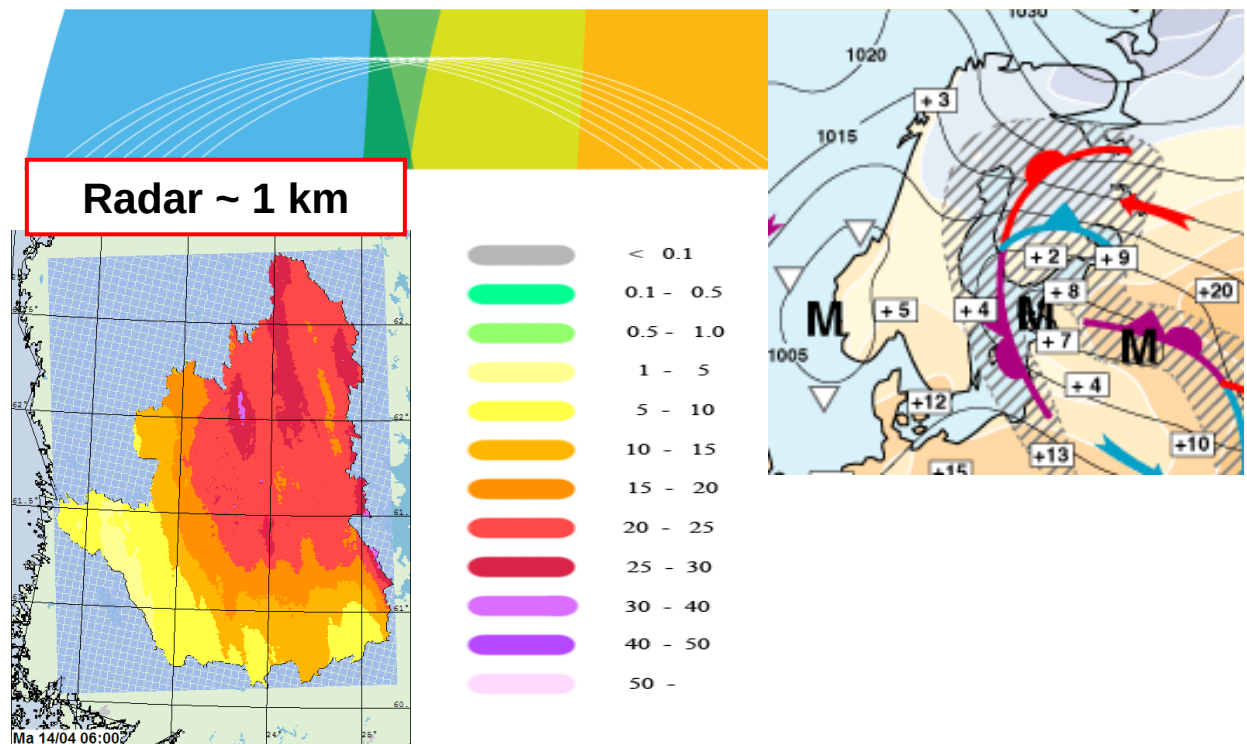


pertti.nurmi@fmi.fi



Medium-size catchment **case** ₁

13 April 2008
24 hour precip



ECMWF ~ 25 km

HIR_RCR ~ 16 km

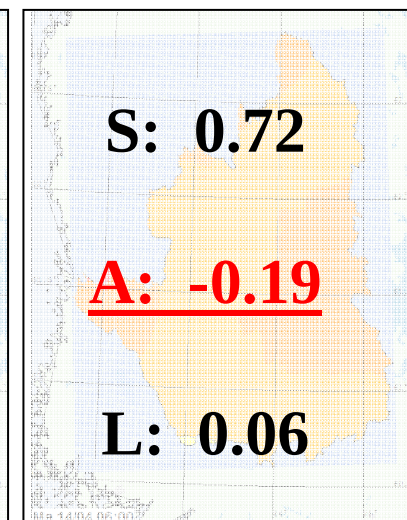
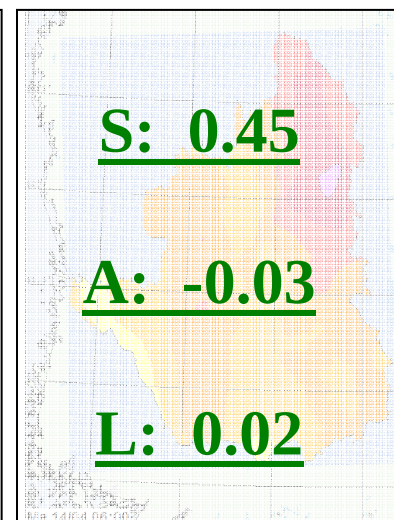
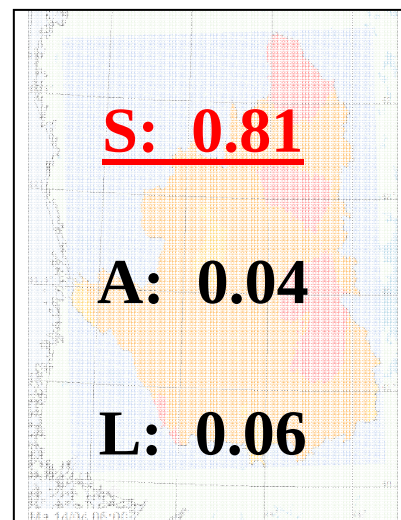
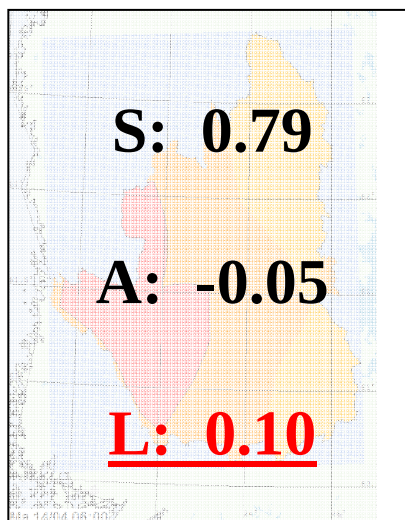
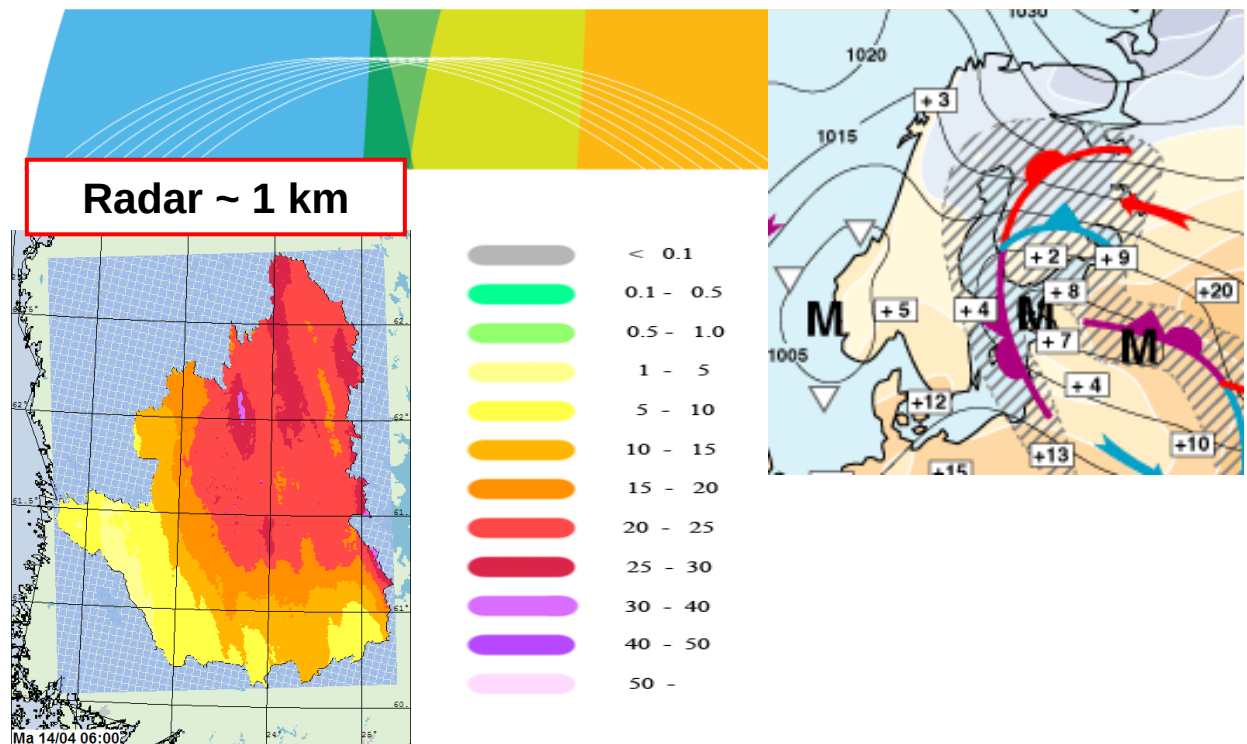
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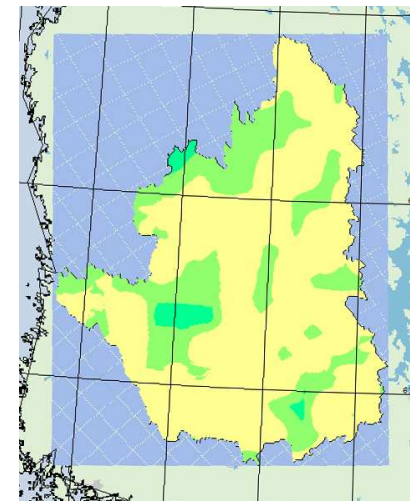
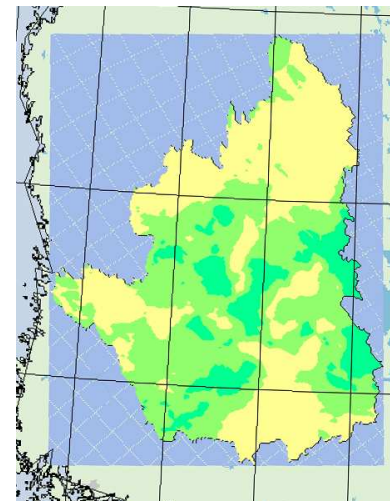
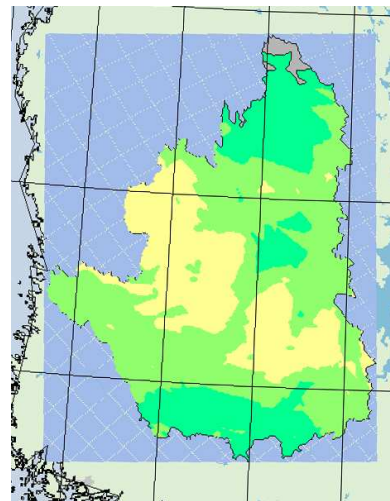
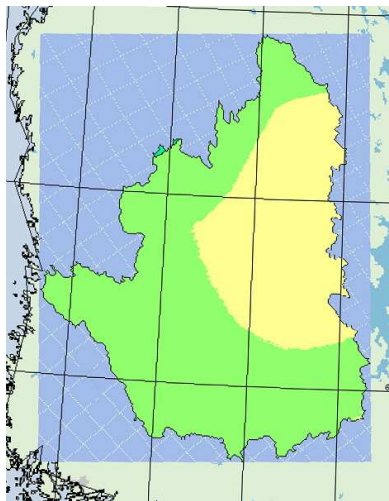
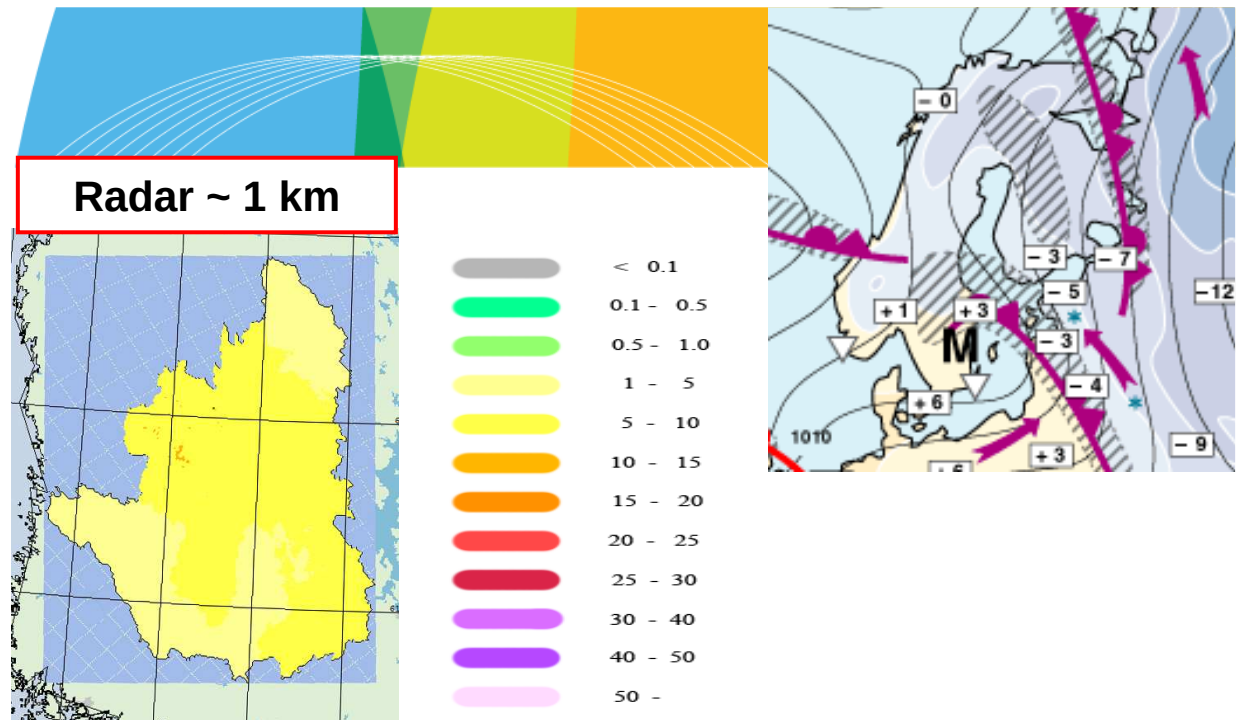
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Medium-size catchment **case** ₂

8 January 2008

24 hour precip

- Snowfall !

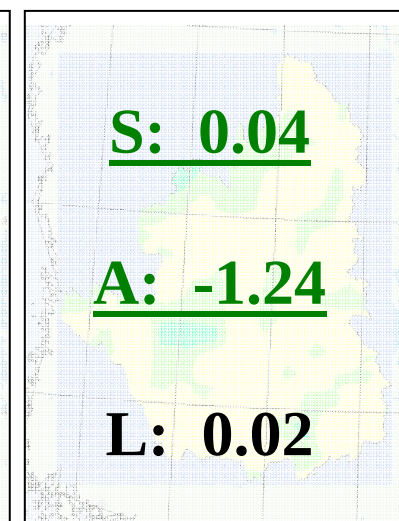
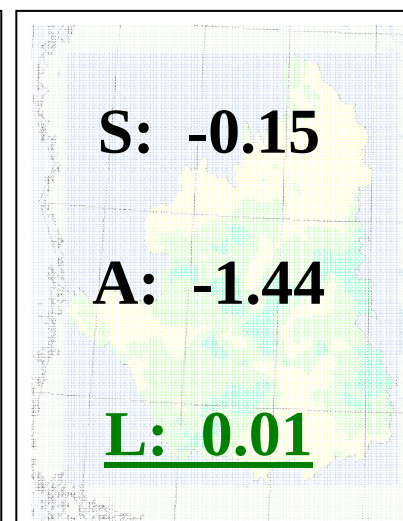
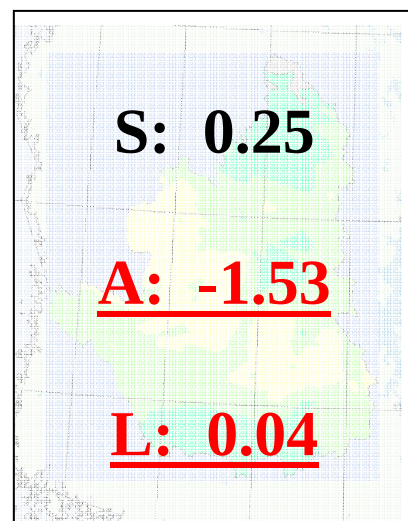
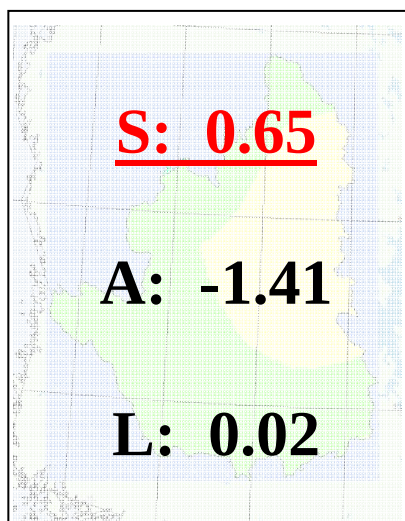
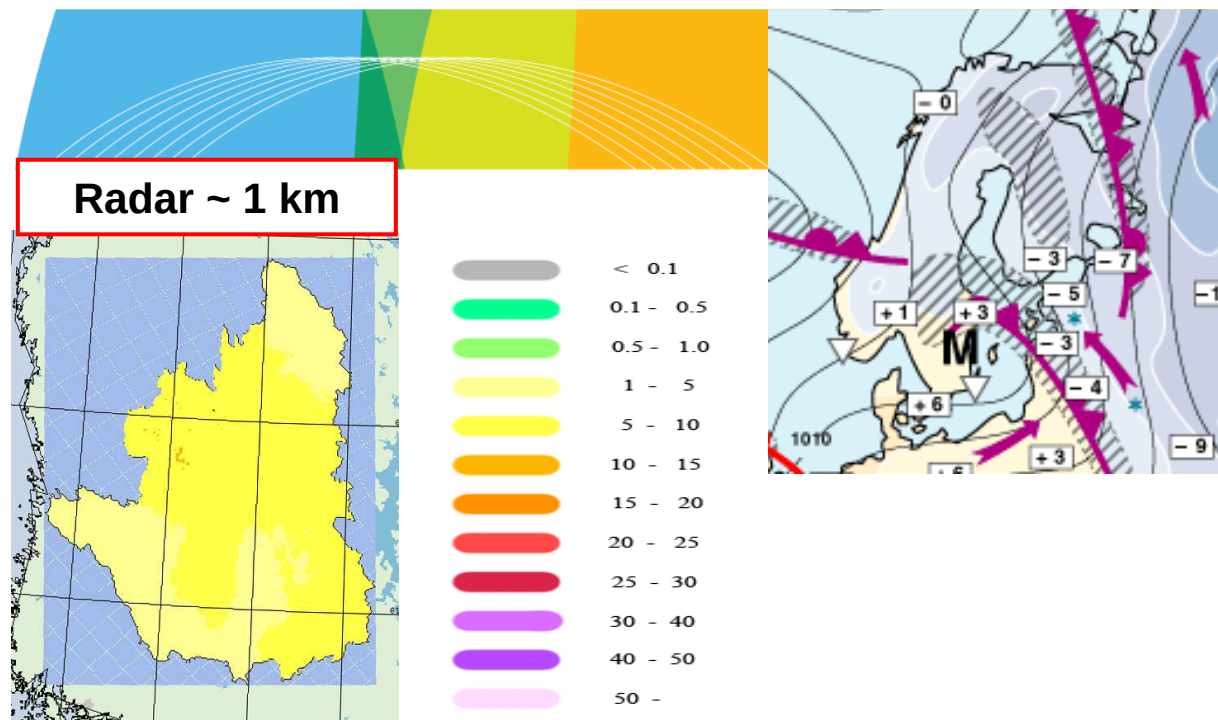


Medium-size catchment **case** ₂

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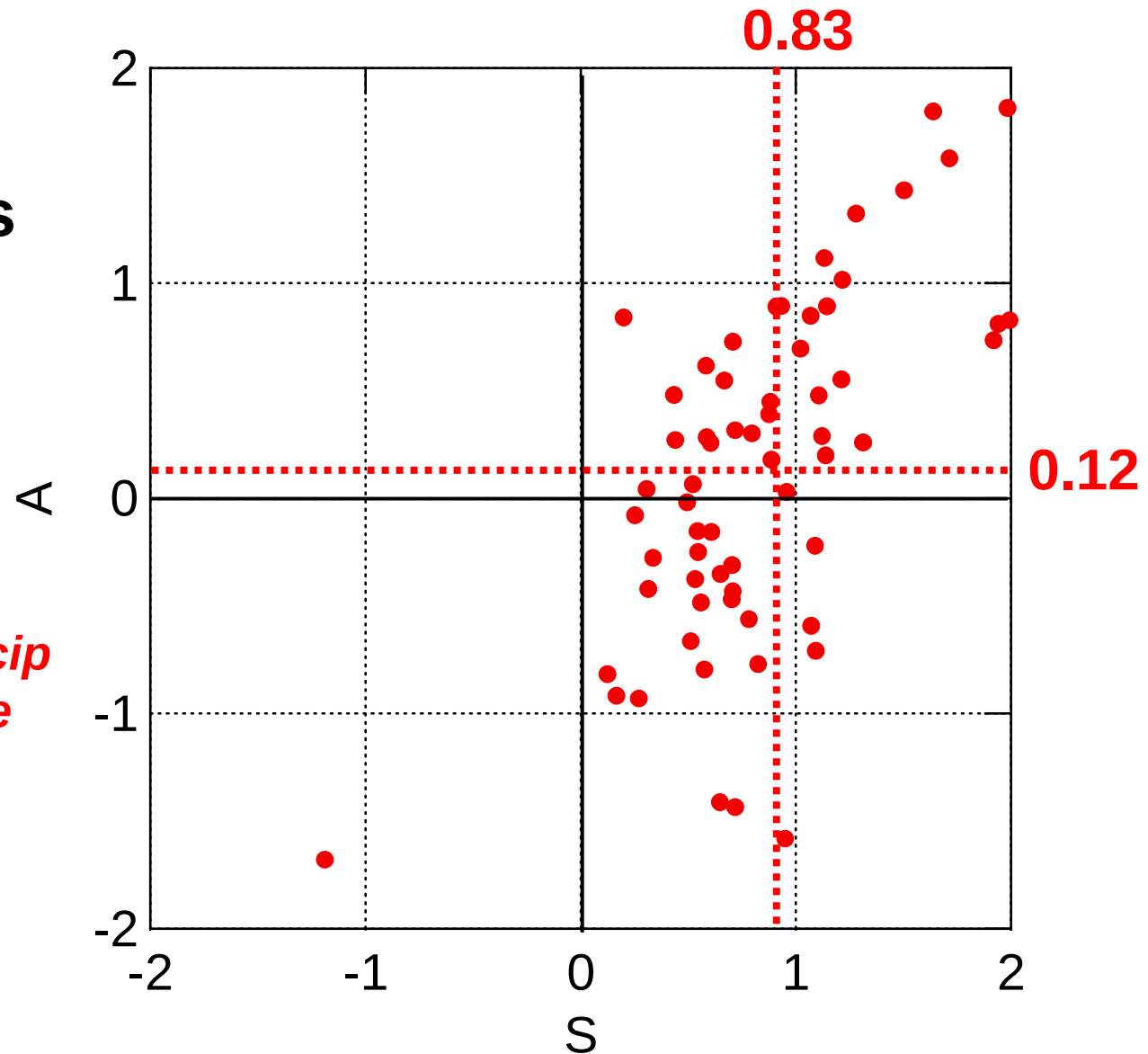
MET_Edit ~ 15 km

Medium-size catchment

Winter 07-08
SAL Statistics
(63 cases)

ECMWF

*- Too large/flat precip
objects, on average*



Medium-size catchment

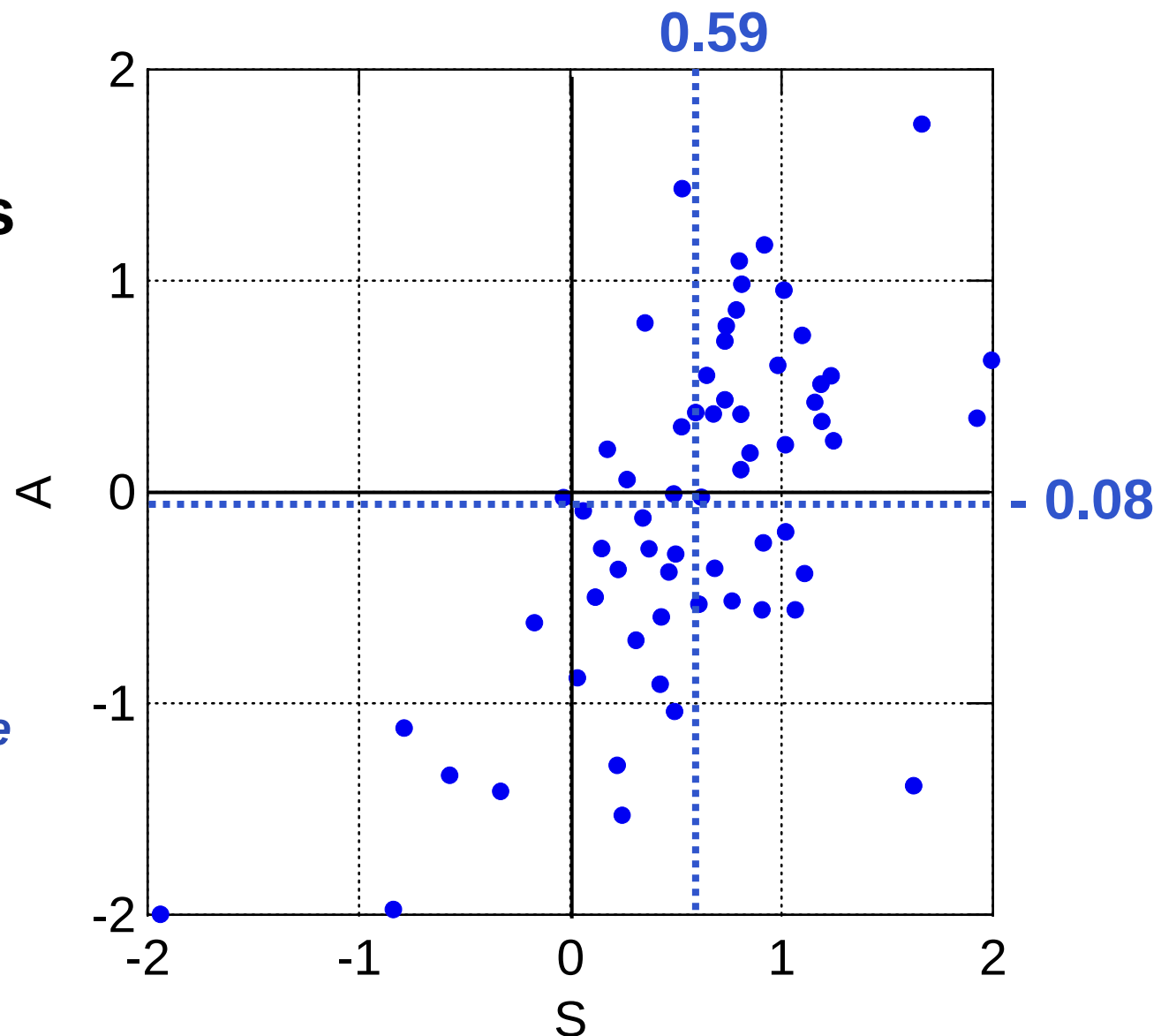
Winter 07-08 **SAL Statistics**

(63 cases)

HIR RCR

(Reference)

- *Somewhat too
large/flat precip
objects, on average*

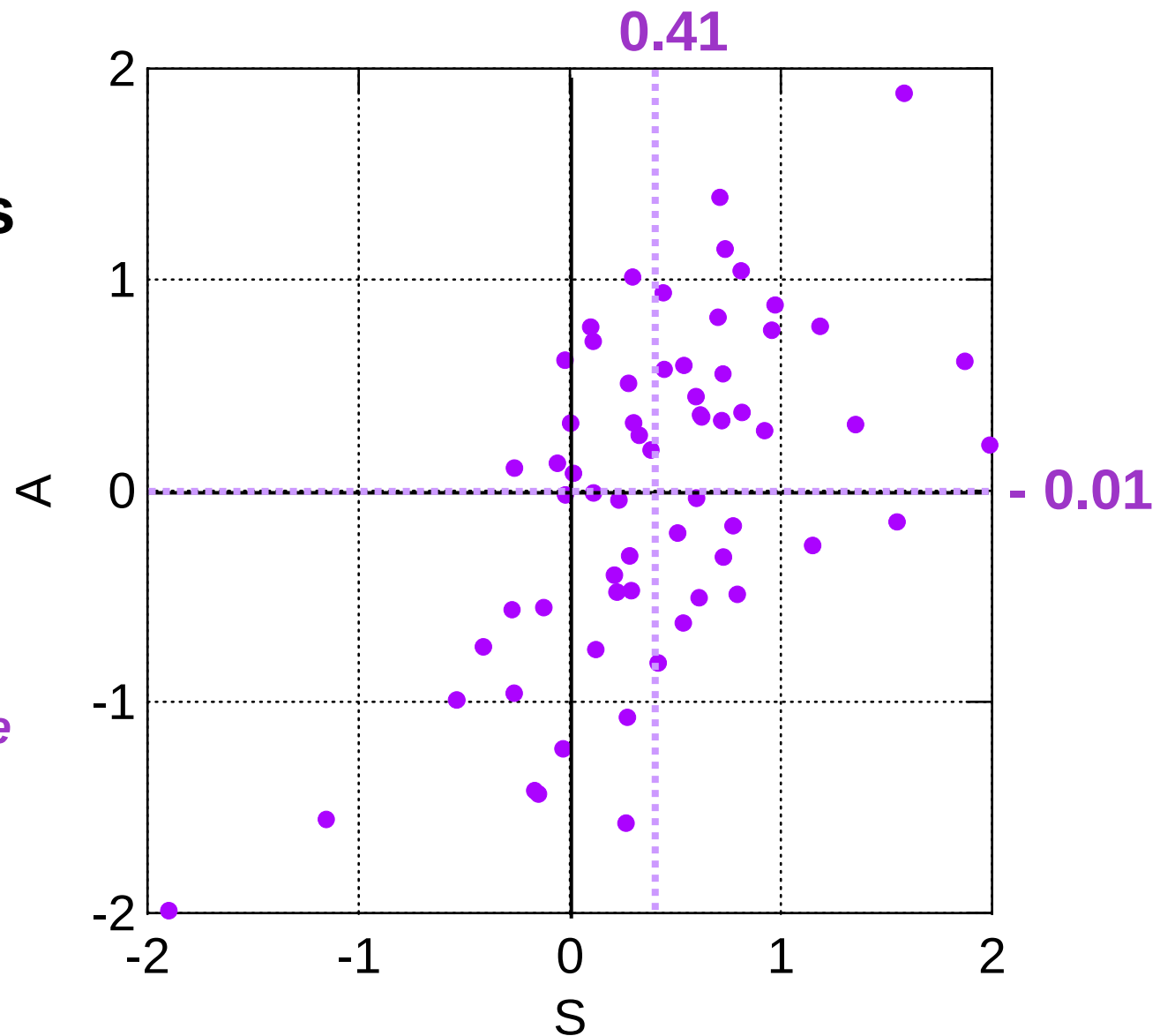


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Winter 07-08
SAL Statistics
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HIR MBE
(MesoBeta)

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Medium-size catchment

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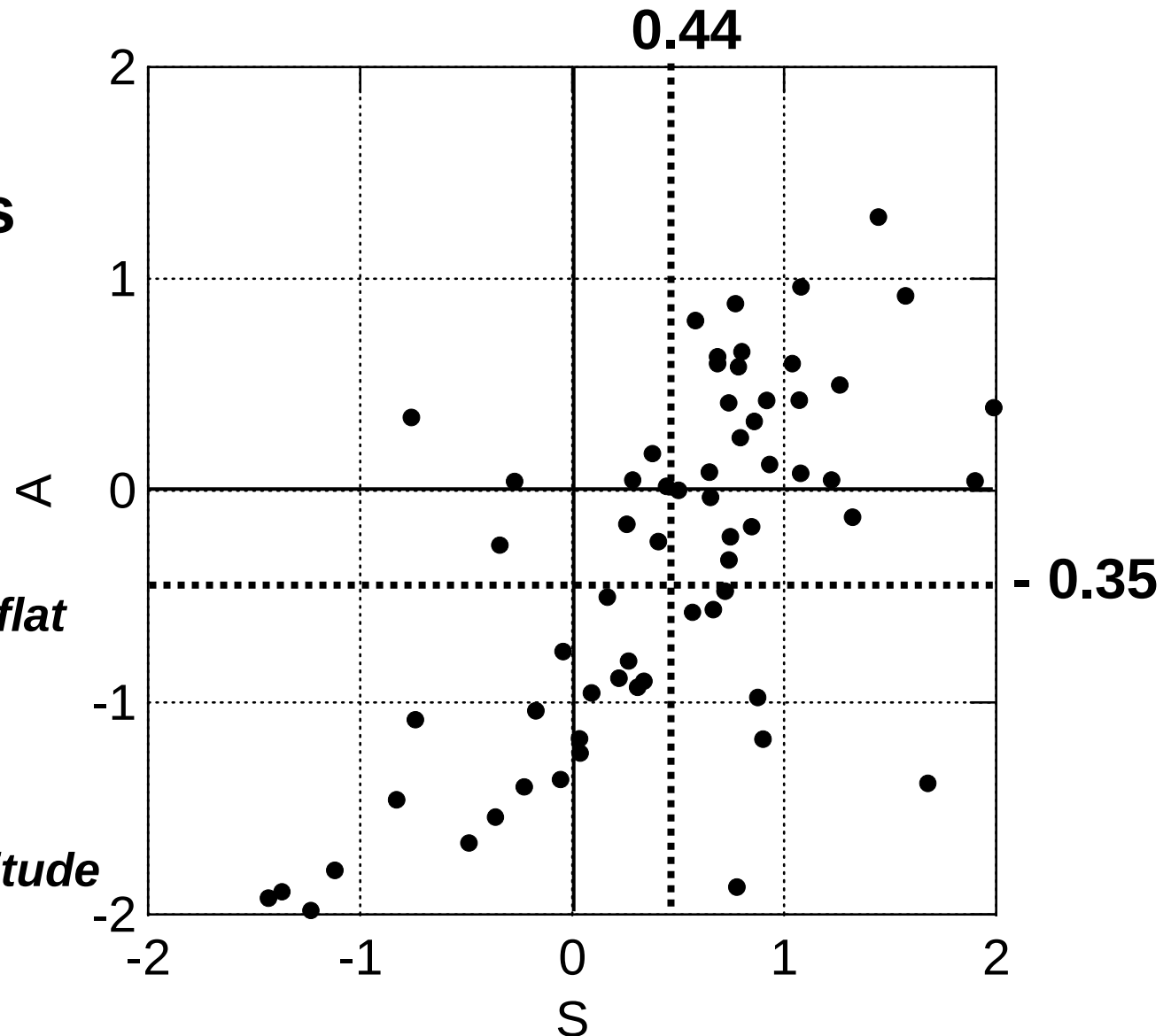
(63 cases)

Met Edit

(EndProduct)

- *Slightly too large/flat
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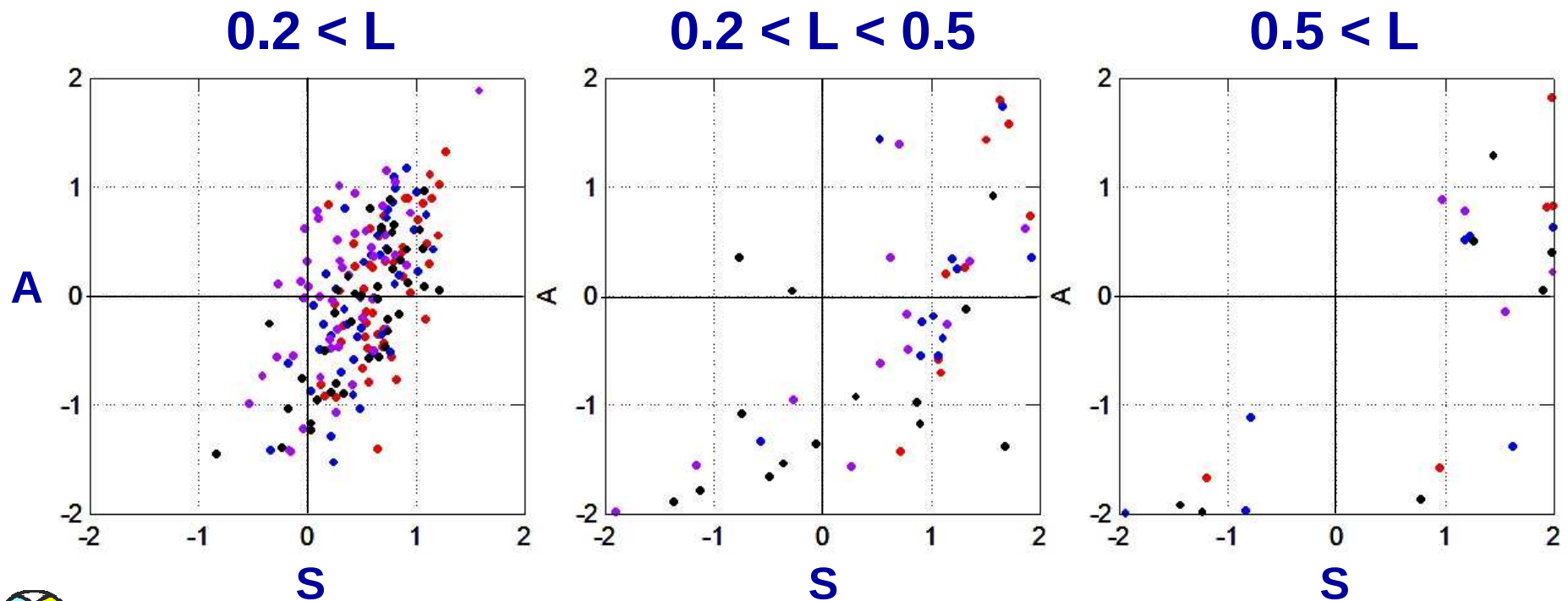
- *Frequent under-
estimation of amplitude*



Medium-size catchment

Winter 07-08
SAL Statistics

All fcs aggregated - Stratified on parameter “L”



Future ... (potentially)



- Need to better understand SAL behaviour
- Include AROME ~ 2.5 km model ⇔ Already initiated !
- Cover more / all catchments (incl. Lake catchments)
- Apply gauge ⇔ radar ⇔ *merged QPE* as “truth” info
i.e. **analyse observation uncertainty** ⇔ **Verification**
 ➤ **Already started !**
- Compare with other object-based schemes (e.g. CRA)
- Operational implementation... (?)





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Grazie!
for your
attention