Forecaster's added value with respect to NWP in Switzerland

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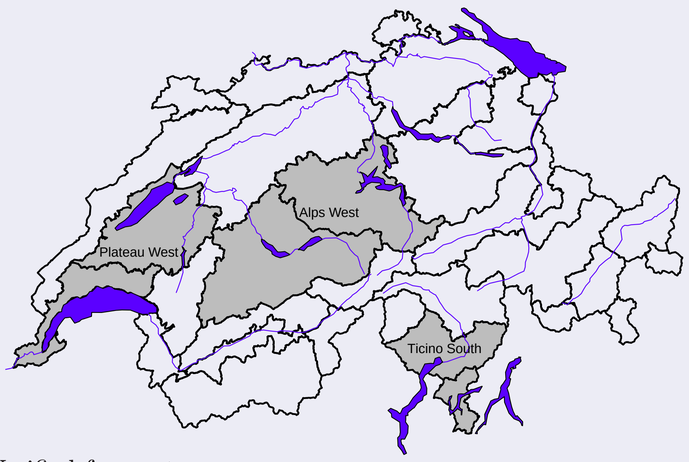
What we do

We perform a verification of the deterministic precipitation forecasts for selected regions of Switzerland issued by the bench forecasters and compare them to ECMWF's IFS outputs (HRES and EPS).

Verified Precipitation Forecasts

Precipitation amounts are predicted by forecasters for regions and represent spatial averages. The number of regions depends on the forecast time-range: it is 27 (D1-D2), 11 (D3-D5) or 6 (D6-D7).



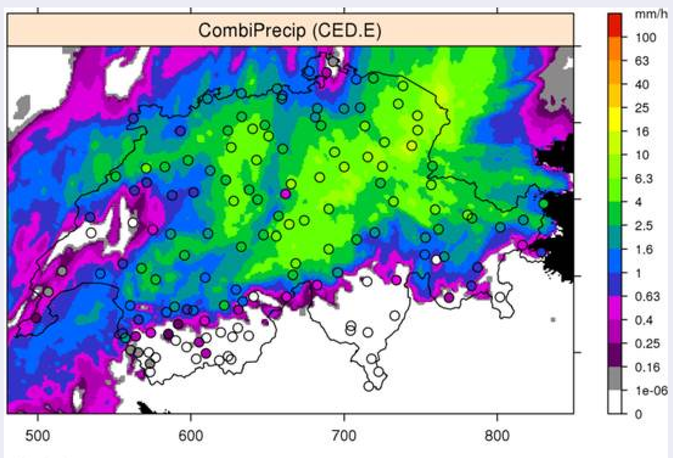
Verified forecasts:
VAL: daily regional mean amounts predicted by forecasters;
IFS HRES: spatial average over same regions than VAL;
IFS EPS: spatial average of the ensemble median.

In this exploratory study, the focus is on the shaded regions shown on the map. A sample "climatology" of these regions during the studied period:

(2010-2013)	ratio of rainy days (>0.2mm)	average daily amount [mm]
Plateau W	0.45	5.31
Alps W	0.55	6.42
Ticino S	0.40	10.93

Observations Used for the Verification

Forecasts are compared with regional average observations provided by a tool recently developed at *MeteoSwiss* [1] which combines high resolution radar images with raingauge measurements.

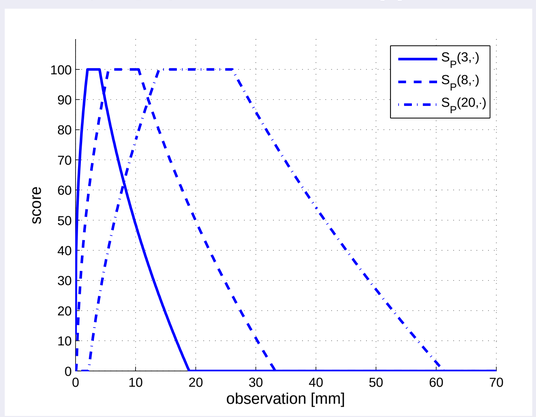


Verification

The following measure of **accuracy** is used in the verification ($x = fcst$, $y = obs$):

$$S(x,y) = \begin{cases} 100 & \text{if } |x-y| \le \mu(x), \\ 100 \cdot \left(1 - \frac{y^p - (x+\mu(x))^p}{d}\right) & \text{if } 0 < y^p - (x+\mu(x))^p < d, \\ 100 \cdot \left(1 - \frac{(x-\mu(x))^p - y^p}{d}\right) & \text{if } 0 < (x-\mu(x))^p - y^p < d, \\ 0 & \text{otherwise,} \end{cases}$$

with $p = 2/5$, $d = 3/2$ and $\mu(x) = 0.3x + 0.1$ a tolerance threshold. This scoring rule is a part of the global quality score for communication and administration newly deployed at *MeteoSwiss* [2].



The **skill** of $FCST$ against REF is measured according to

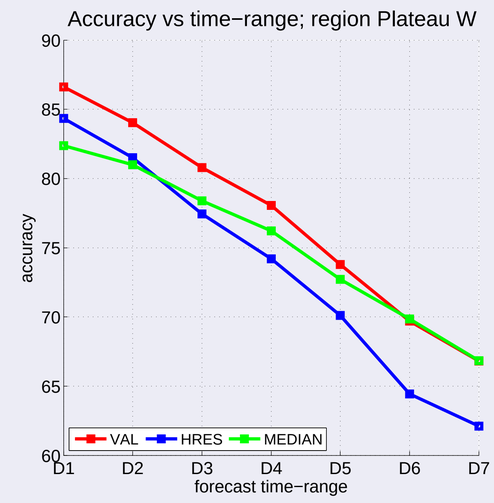
$$\text{skill} = \frac{S_{FCST} - S_{REF}}{100 - S_{REF}} \cdot 100.$$

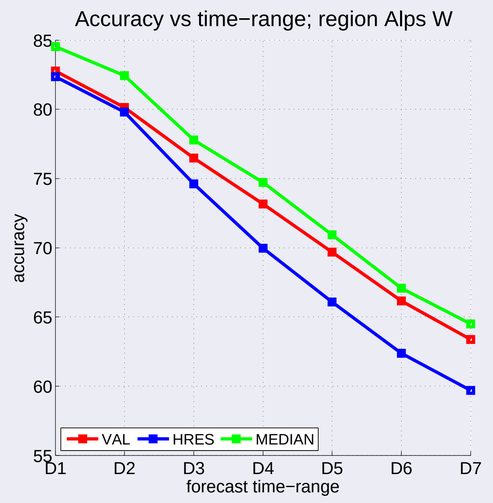
References

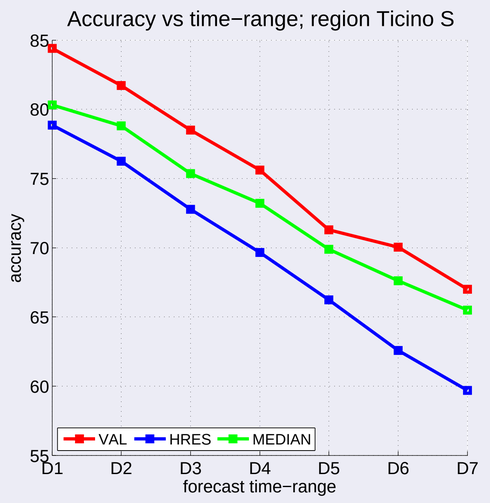
[1] I. V. Sideris, M. Gabella, R. Erdin, and U. Germann. Real-time radar-raingauge merging using spatiotemporal co-kriging with external drift in the alpine terrain of switzerland. *Quaterly Journal of the Royal Meteorological Society*, 00:1–22, 2011.

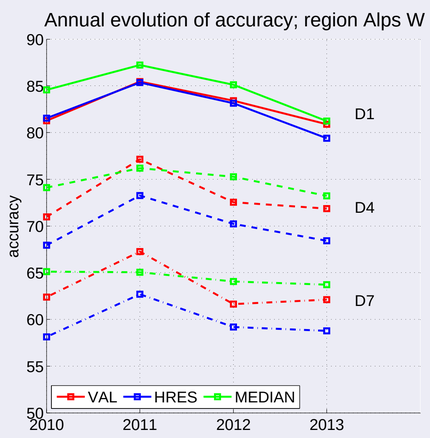
[2] D. Cattani, A. Faes, M. Giroud Gaillard, and M. Matter. COMFORT: continuous MeteoSwiss forecast quality score. Submitted.

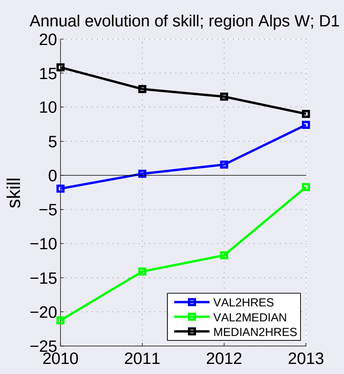
Forecaster's added value (2010-2013)

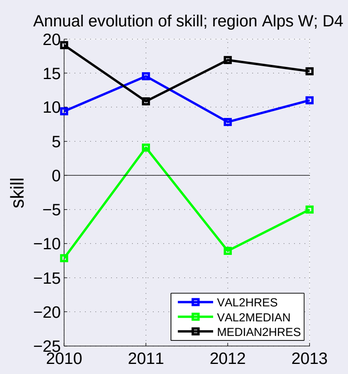


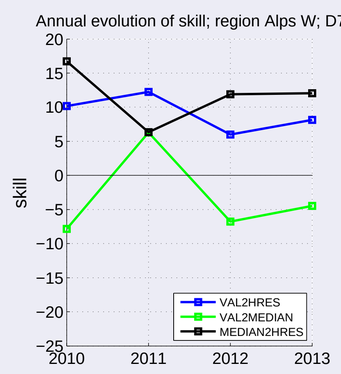


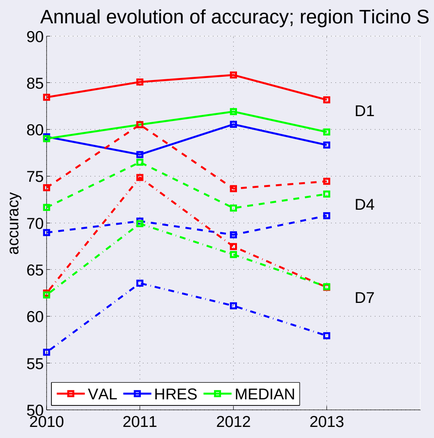


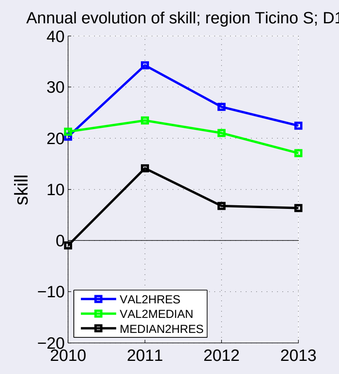


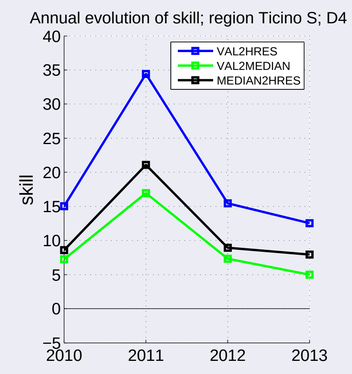


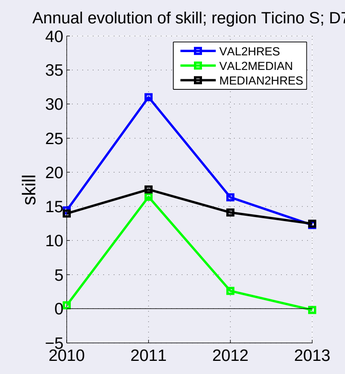




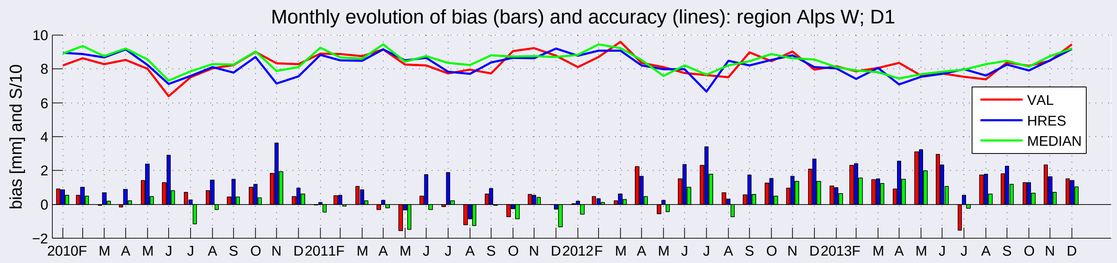


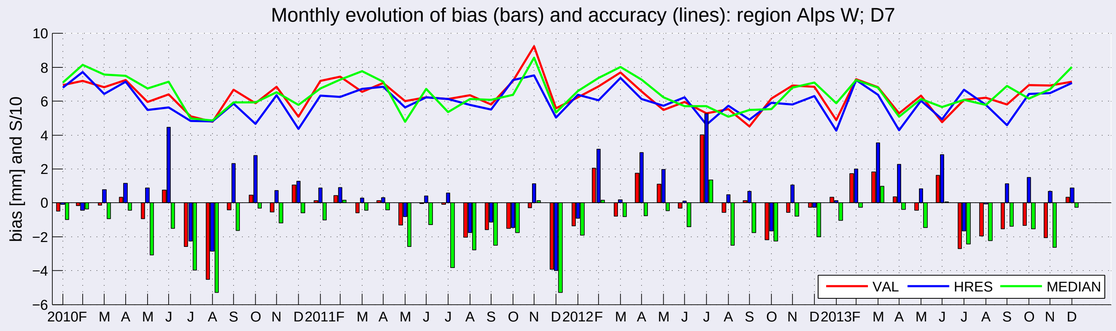






More Detailed Analysis

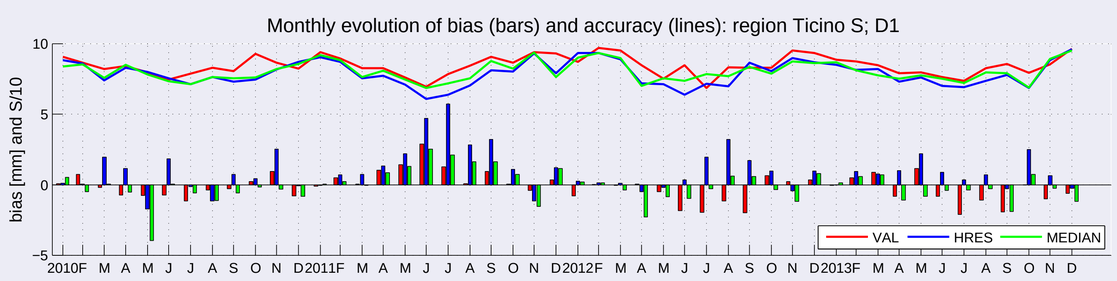


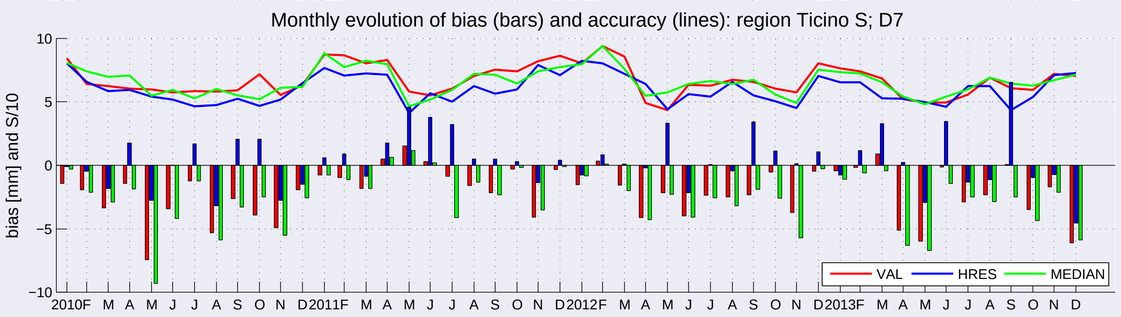


Region Alps West:

Bias D1	VAL	HRES	MEDIAN
Winter	0.82	0.95	0.33
Spring	0.61	1.18	0.35
Summer	0.72	1.50	0.13
Autumn	1.11	1.50	0.62
global	0.82	**1.29**	0.36

Bias D7	VAL	HRES	MEDIAN
Winter	-0.02	0.31	-1.17
Spring	0.22	1.27	-0.74
Summer	-0.72	0.37	**-2.20**
Autumn	-1.01	0.65	-1.55
global	-0.39	0.66	**-1.42**





Region Ticino South:

Bias D1	VAL	HRES	MEDIAN
Winter	-0.03	0.31	0.09
Spring	0.18	0.76	-0.58
Summer	-0.58	**1.75**	0.24
Autumn	-0.20	1.07	-0.15
global	-0.16	**0.98**	-0.10

Bias D7	VAL	HRES	MEDIAN
Winter	-1.31	-0.26	**-1.36**
Spring	-2.50	0.51	-3.01
Summer	-2.15	0.33	-2.73
Autumn	-2.51	0.87	-3.04
global	**-2.13**	0.38	**-2.57**

Conclusion

Advices to forecasters:
Alps W: consider the EPS median rather than the HRES for all terms; pay attention to precipitation underestimation of EPS median for long-term forecasts, especially in Summer and Autumn.
Ticino S: pay attention to underestimation of long-term forecasts.
Remarks about model outputs:
Alps W: HRES exhibits significant overestimation at short-term. EPS median underestimates precipitation at long-term, especially during Summer.
Ticino S: HRES overestimates at short-term especially during Summer. EPS median strongly underestimates at long-term.
Further work: Consider other quantiles from EPS, by region/season/time-range, to determine the best first guess.