Improving existing post-processing methods: Use of MLR, adaptive/recursive LMS and/or ANN techniques

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1. Introduction

2. Done

3. Examples

4. To-dos & conclusions



Differences...

- 1. In Sub-task 3.1 verification of **DMO** against observations
- 2. In Sub-task 4.2 verification against observations of various **post-processed results** (In parameterization we trust...)
- 3. The quality of (any) post-processing is assessed via <u>continuous</u> <u>verification</u> MAE, RMSE <u>only</u>.



Various methods of post-processing

- 1. Multi-Linear Regression (MLR) class of LMS method with multidimensional input data vector, yet constant over time
- 2. Adaptive/Recursive LMS methods
- 3. ANN transferring the problem from EPS- to deterministic forecasts
- Various set-ups of post-processing of various methods have been tested over the five-years period.

Improving existing post-processing methods: Use of MLR, A/R-LS and/or ANN techniques Introduction (3)



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Observations: lightnings (C2G, C2C) from the Polish lightning detection network PERUN, covering Poland + parts of neighbouring countries

Forecast: CAPE-based FLR (Flash Rates) as follows:

$$W = 0.3 \cdot \sqrt{2 \cdot CAPE}$$

$$FR = \left(\frac{W}{14.66}\right)^{4.54}$$

$$if \quad CTT > -15^{\circ}C \quad FR = FR \cdot \left[\max\left(\frac{-CTT}{15}, 0.01\right)\right]$$

$$if \quad CBT < -5^{\circ}C \quad FR = FR \cdot \left[\max\left(\frac{CBT + 15}{10}, 0.01\right)\right]$$

Archive observations vs. forecasts (2011-2015) Learning/testing period: 2011-2014, verification: 2015

Again, VOD (cross-correlation) procedure was applied afterwards.

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7

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Examples (2)

MAE/RMSE with cross-correlation





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	ANN #hidden neurons		MLR #predictors		RLS value of λ	
MAE	1	2.0026	2	2.5164	1	2.2201
RMSE		12.0356		13.5631		12.7763
MAE	2	1.9967	4	2.4745	0.99	1.9991
RMSE		11.9851		13.4249		12.0144
MAE	3	1.9374	5	2.2776	0.98	1.9978
RMSE		11.8873		12.9676		12.0135
MAE	4	1.9000	6	2.0438	0.95	1.9959
RMSE		11.7330		12.1262		12.0046

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	ANN #hidden neurons		MLR #predictors		RLS value of λ	
MAE	1	1.8432	2	1.9036	1	1.8901
RMSE		11.4176		13.0037		12.7763
MAE	2	1.8331	4	1.8719	0.99	1.8691
RMSE		11.3423		12.8211		12.0144
MAE	3	1.7993	5	1.8483	0.98	1.8212
RMSE		11.2712		12.6636		12.0135
MAE	4	1.7081	6	1.8336	0.95	1.7959
RMSE		11.2330		12.2624		12.0046

Applied VOD

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Conclusions and to-dos (?)



1. Best method?



2. ... with VOD?



3. RLMS not necessarily works as good as expected, still, better than MLR...



