Enhanced flow rating using neural networks with water stage and EC as predictors

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The point of departure:

• What we usually get on a continuous basis, is stage
• The typical rating function is discharge vs. stage

The idea:

• EC can be recorded continuously at comparatively low cost
• So, why not use both?
Result (scaled), ANN (MLP) 2-5-1

ANN output vs measured flow rate graph.
The Q-EC relationship is hysteretic

- Both stage and EC are available (quasi-)continuously
- So is the time derivative of either
- ANN can be improved
- 2 more inputs: trends of stage, EC

4-5-1 MLP
Result (scaled), ANN (MLP) 4-5-1

ANN output vs. measured flow rate graph.
RMSE (testing):

- 0.043 for 1-3-1 MLP (W $\rightarrow$ Q)
- 0.022 for 2-5-1 MLP (W, EC $\rightarrow$ Q)
- 0.014 for 4-5-1 MLP (W, $\Delta$W, EC, sgn($\Delta$EC) $\rightarrow$ Q)
Conclusions:

- Use of stage and EC improves performance over stage alone.
- Inclusion of temporal trends in stage and EC permits concentrating, flushing, anti-diluting and diluting conditions to be reproduced and results in notable further improvement of Q computed.