Development of Modeling System Based On the SWAT Model as a Tool for Water Management Institution

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Our dream

Modeling system, which would provide information needed for EU and national water reporting and provide capacity to analyze different pollution abatement strategies.
Short history

• Before 2004
  • National requirements
  • Preparation projects
  • Helsinki convention
• Since 2004 implementation of EU directives
Water modeling needs

- Nitrate Directive (91/676/EEC)
- Helsinki Convention (implementation of BSAP)
- Environmental Impact Assessment Directive (2011/92/EU)
- Rural Development Programme
- Climate Convention (greenhouse gas reporting)
- Flood Directive (2007/60/EC)
- Others
Past

- Before 2003 consideration of freely available models (SWAT, HSPF)
- In 2003 DHI company study
- MIKE BASIN model for 1st iteration of RBPMs
- Evaluation of results
Rethinking

- Developing criteria
- Analysis of scientific literature
- Selected SWAT model
- Collection of data and testing on a pilot basin
Flow Cal $R^2 = 0.81$, $RSR = 0.45$, $NSE = 0.78$, $PBIAS = -9.21$
Flow Val $R^2 = 0.69$, $RSR = 0.42$, $NSE = 0.69$, $PBIAS = -3.15$

Nitrate loads Cal $R^2 = 0.63$, $NSE = 0.62$, $PBIAS = 13.73$
Nitrate loads Val $R^2 = 0.53$, $NSE = 0.53$, $PBIAS = -0.92$
Project in 2011

“Development of methodics and modeling system of nitrogen and phosphorus load calculation for surface waters of Lithuania”

SIA „Procesuanalīzes un izpētescentrs” & UAB „Estonian, Latvian & Lithuanian Environment” and

16 months
Finished in 2012

Main results:

- Input data collected and prepared
- Model setups for all Lithuania
- Phyton scripts to manage input databases and updating setups
- Setup integration tools (batch and exe files)
- Output analysis software - PAIC-SWAT (integrated with monitoring data)
Division and integration

- 4 levels
- 129 setups
- >1000 subbasins
- 19 major rivers for calibration
Overall model performance

• Median Flow Daily NSE 0.5, Monthly NSE 0.6
• Median Flow PBIAS 9%
• Median Nitrate loads Daily NSE 0.27, Monthly NSE 0.17
• Median Nitrate loads with >5 years monitoring Daily NSE 0.37, Monthly 0.26
• Median Nitrate loads PBIAS 41%
• Median Phosphorus loads PBIAS 39%
Output analysis
Output analysis
Next

- Updating of input data, adding new
- Detailed calibration
- Attention to processes, activation of important
- Develop methodic and tools multi-objective spatial optimization, CSA and other
- Structural agriculture change scenarios
- More info into RBMPs
Major challenges

- Data (soil, fertilization, etc)
- Lack of experience and similar examples
- Lack of understanding on higher level
- Lack of possibilities to attract and keep specialists
Conclusion

No conclusion 😊…