



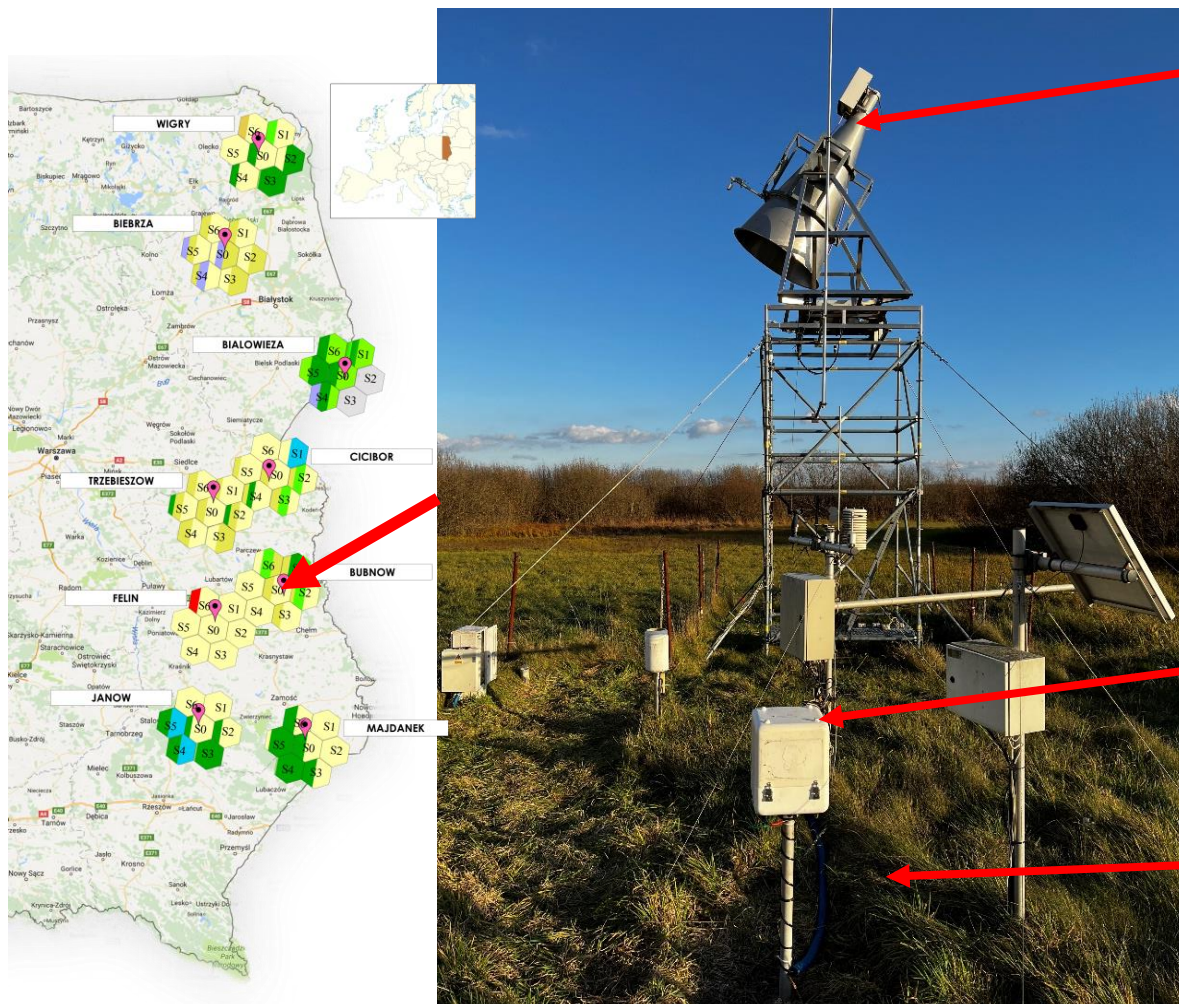
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***Data fusion approach to develop new
method of soil moisture assessment***

Kamil Szewczak, Mateusz Łukowski

Institute of Agrophysics of Polish Academy of Science, Lublin, POLAND

Sekow Test Site



ELBARA instrument

Reuter-Stokes RSS-131 Gamma detector

PR2 (5-100 cm) Point Profile Soil Moisture Detector

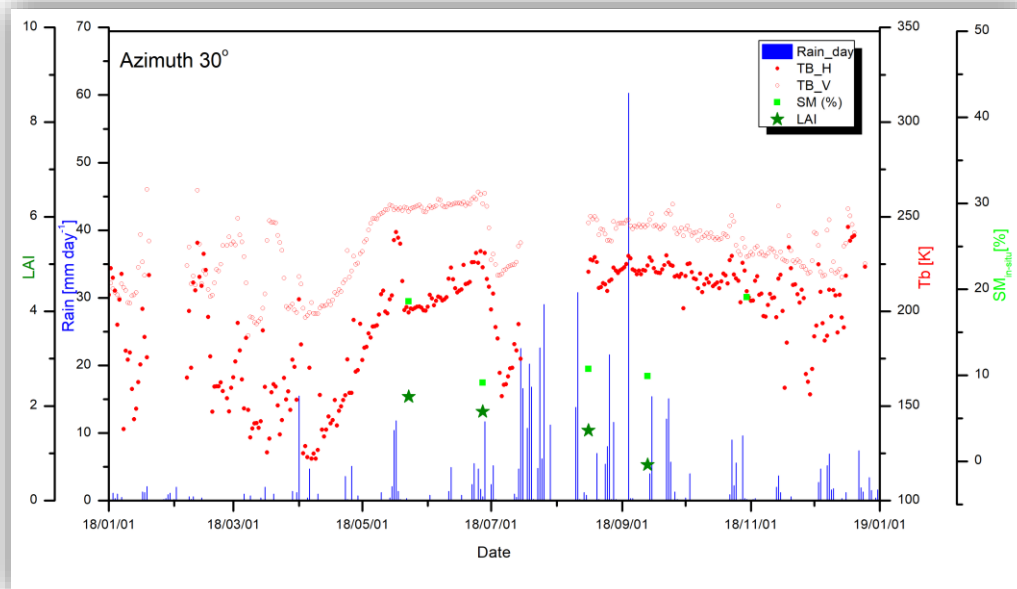
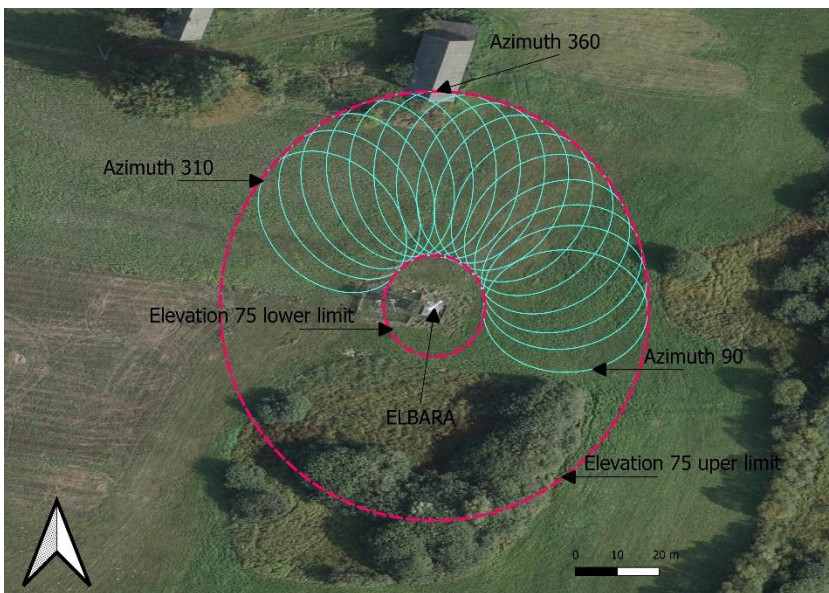
Sekow Test Site



ESA L-band Radiometer - ELBARA



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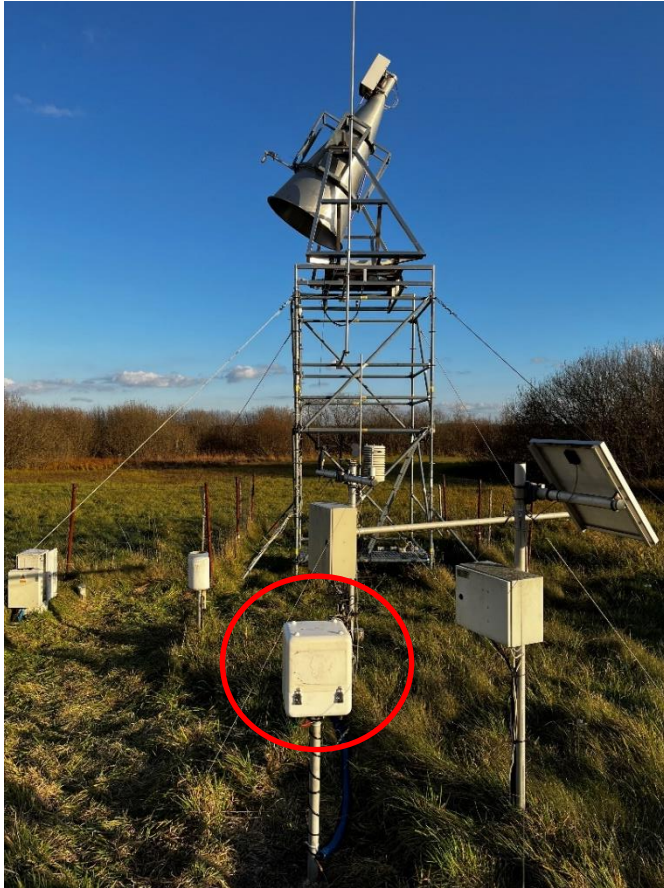
Brightness Temperature

L-MEB

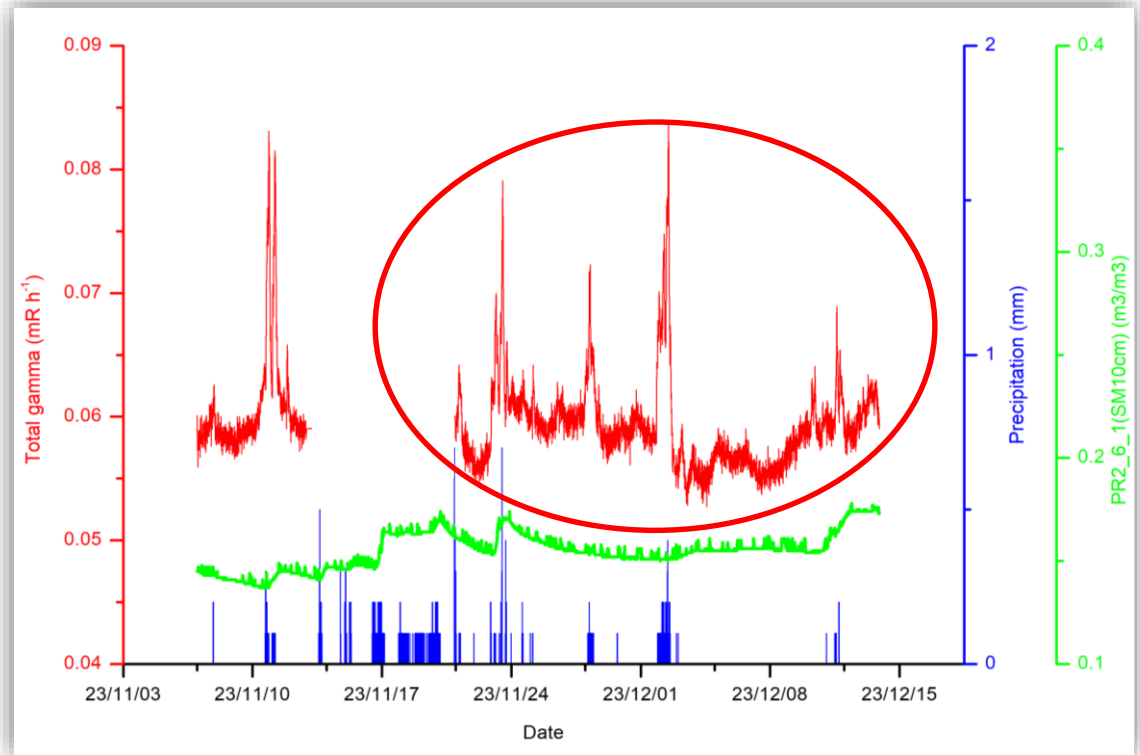
- Algorithm for TB-SM evaluation

Soil Moisture

Total Gamma (TG) measurements



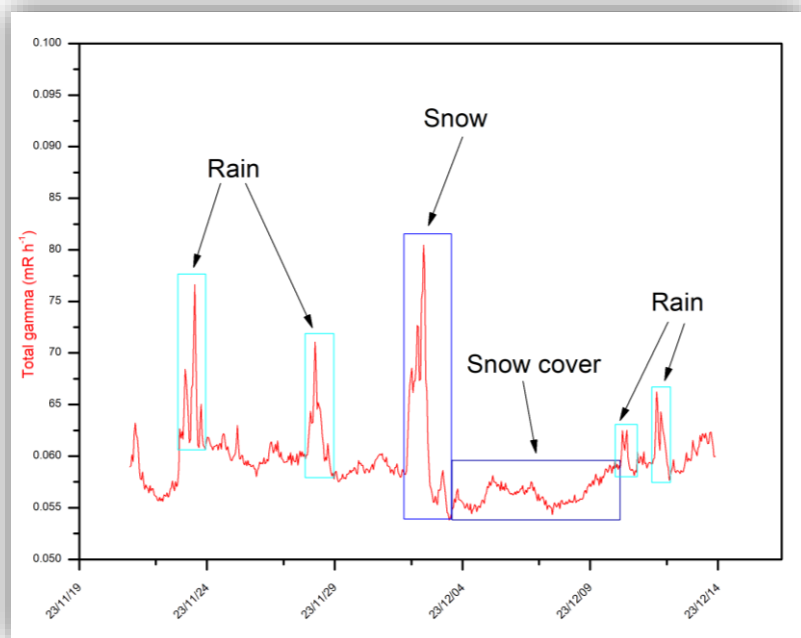
Sekow test site view



Total gamma data registered by RSS-131 detector

Total Gamma (TG) measurements

Total gamma -> rain events (already some publications)



**Total gamma -> soil moisture ???
or
Total gamma -> snow cover ???**



sensors



Article

Rainfall Intensity and Quantity Estimation Method Based on Gamma-Dose Rate Monitoring

Valentina Yakovleva ¹, Grigori Yakovlev ², Roman Parovik ³, Aleksey Zelinskiy ¹ and Aleksey Kobzev ⁴

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PUBLISHED BY IOP PUBLISHING FOR SISSA MEDIALAB

RECEIVED: May 31, 2017

REVISED: August 28, 2017

ACCEPTED: September 26, 2017

PUBLISHED: October 12, 2017

Detection of rain events in radiological early warning networks with spectro-dosimetric systems

Data Fusion in SoMMeT project

SoMMeT - Metrology for multi-scale monitoring of soil moisture



Activity 4.1.1: Review for data Fusion methods used in soil moisture assessments



n = 121 n = 8960

Merging search results, excluding
duplications and first screening
n = 234

Secound screening basing on title
n = 127

Third screening basing on abstract
n = 82

Final selection for detailed review
n = 43

24 % - Neural Networks techniques
37 % - Machine Learning
39 % - other/mixed methods

Data fusion classification?

Data In – Data
Out

Data In –
Features Out

Features In –
Decision Out

Features In –
Feature Out

Defining aims of data fusion?

Data
improvement

Missing data
evaluation

New
information

Data Fusion Methodology



Products Solutions Learn ▾ Company ▾

MATLAB for Artificial Intelligence

Design AI models and AI-driven systems

https://www.mathworks.com/?s_tid=user_nav_logo

timedelaynet

Time delay neural network

narxnet

Nonlinear autoregressive neural network
with external input

Data used from ELBARA:

Elevation: 40° and 75 °

Azimuths: 30 °, 90 °, 180 ° and 320 °

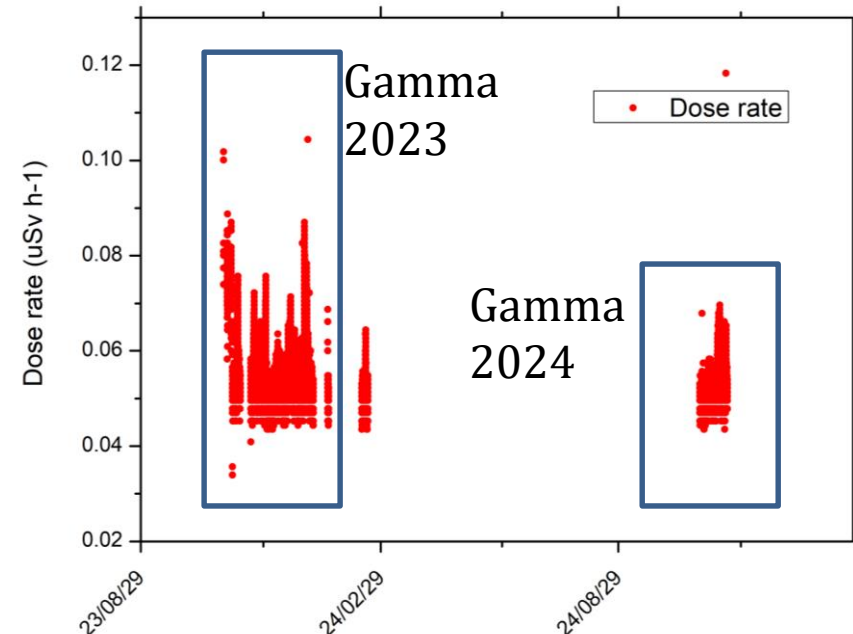
Neural Network model testing conditions:

10 hidden

75% training

15% testing

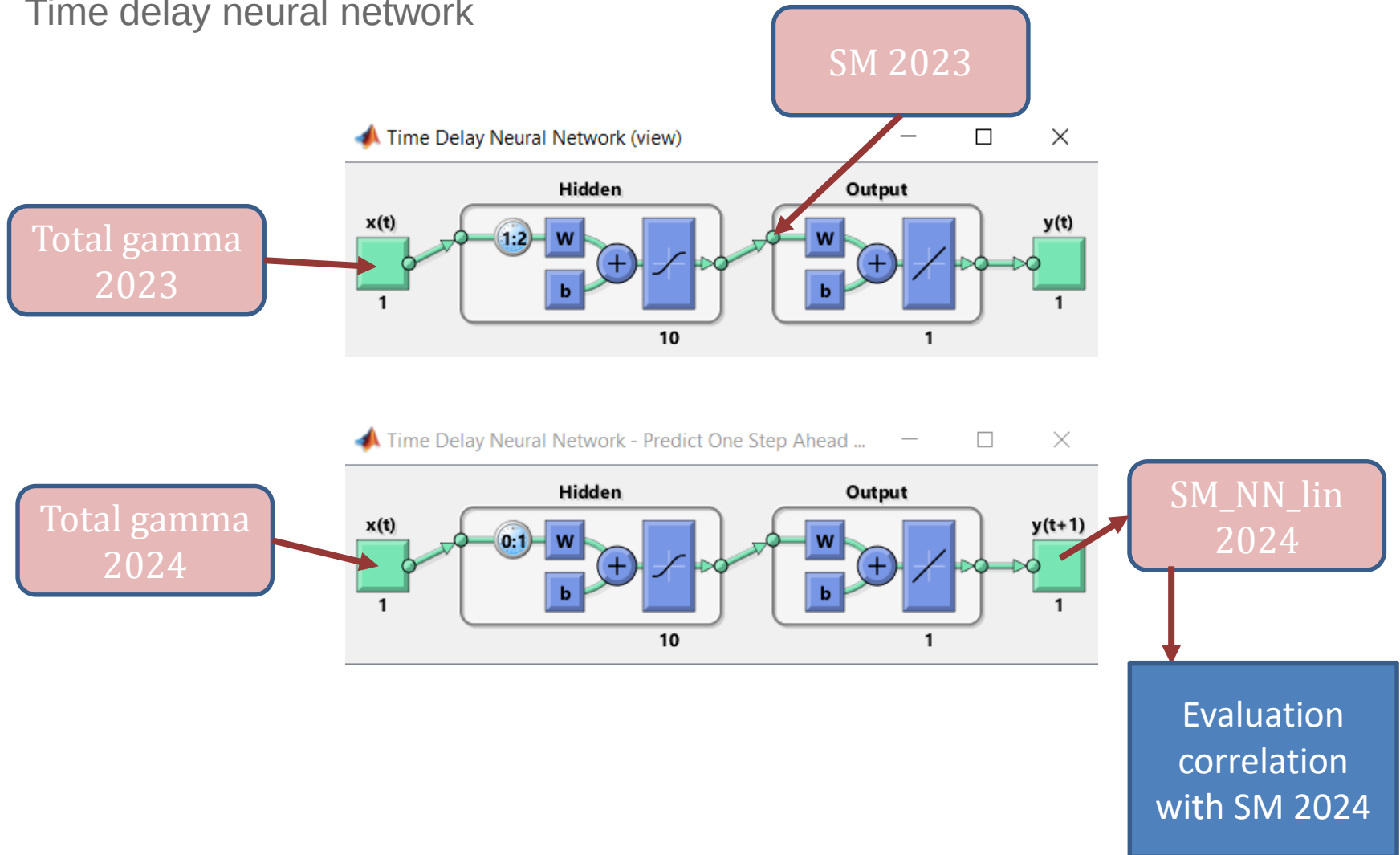
15% validating



Data Fusion Methodology

timedelaynet

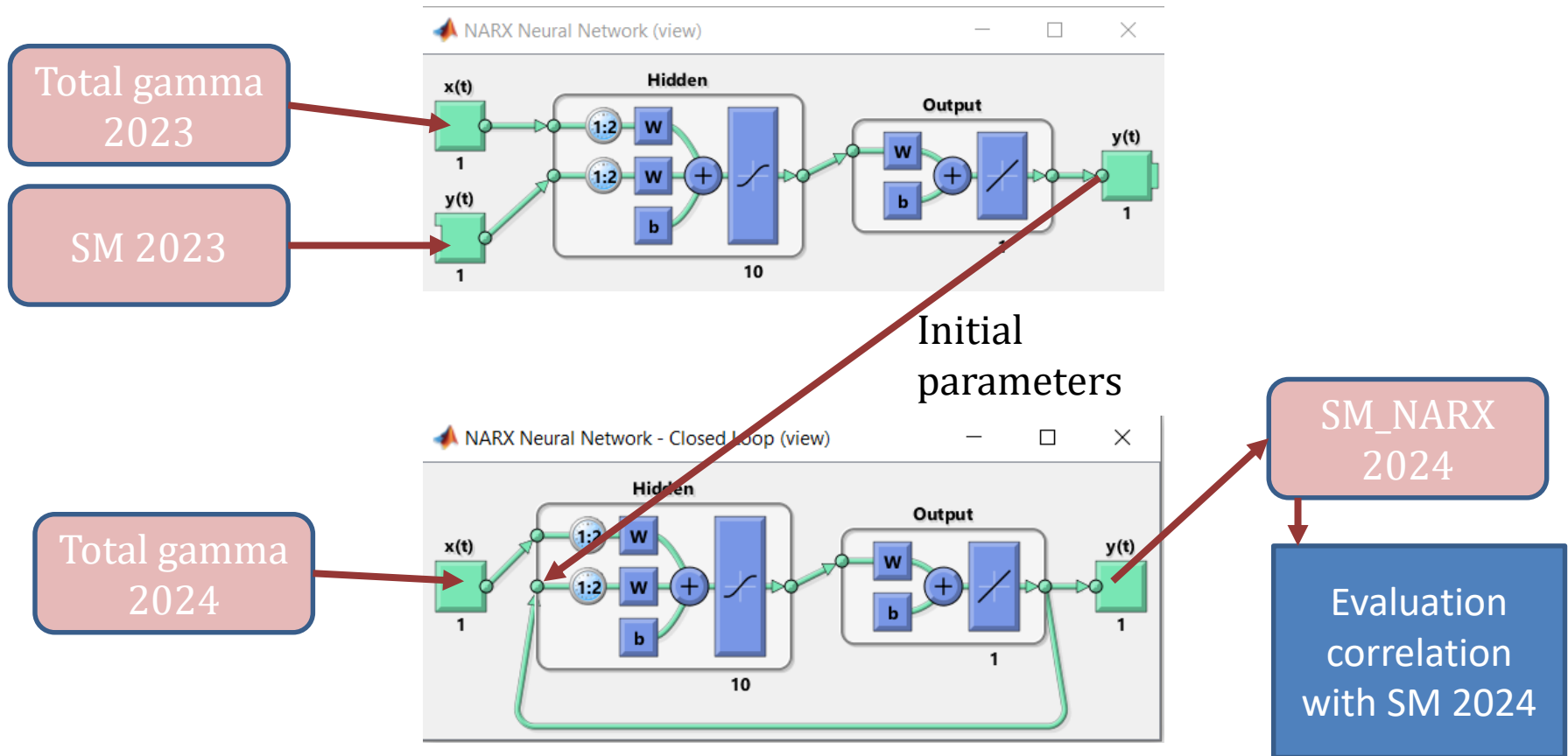
Time delay neural network



Data Fusion Methodology

narxnet

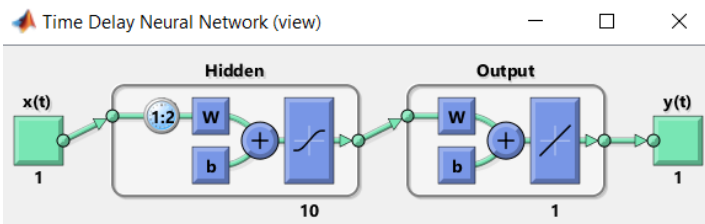
Nonlinear autoregressive neural network
with external input



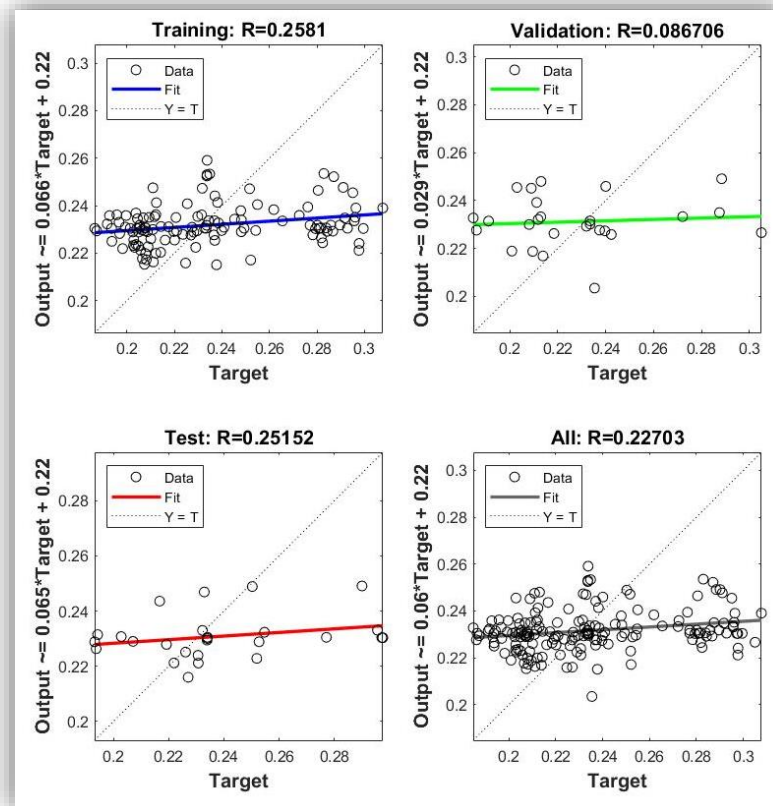
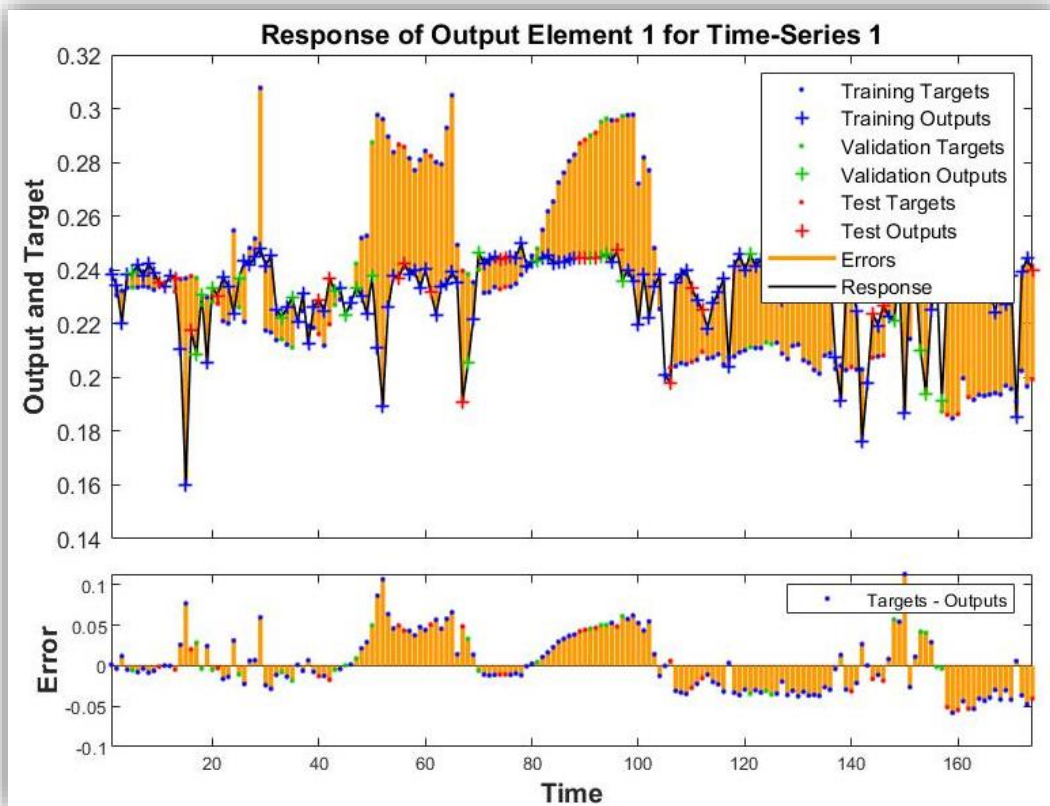
Results for NN_lin

timedelaynet

Time delay neural network



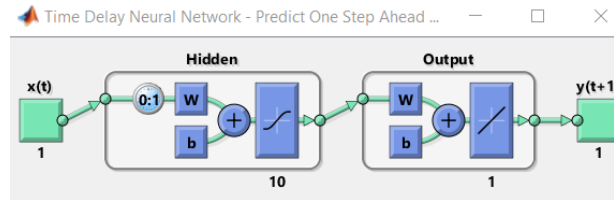
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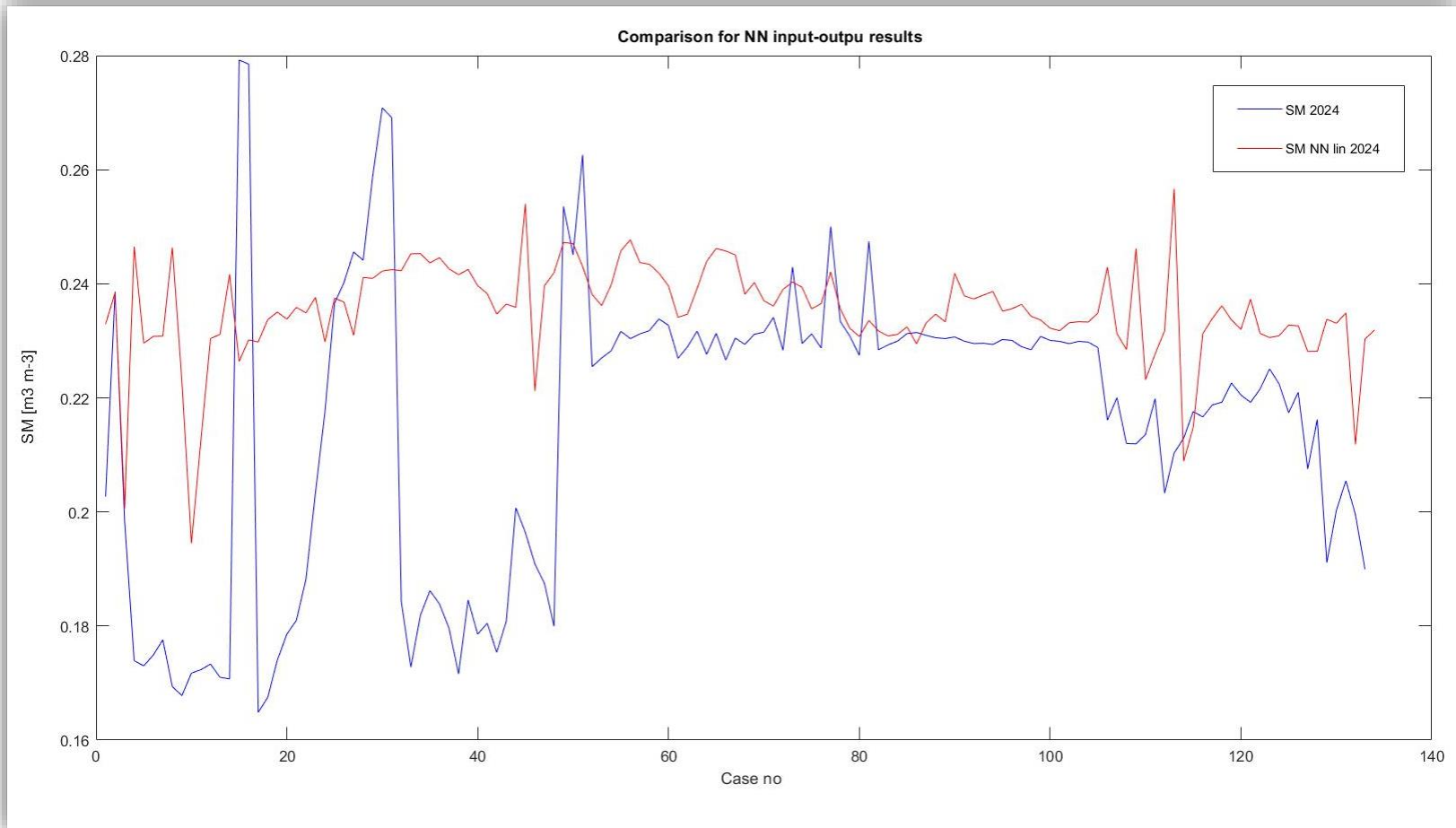
Results for NN_lin

timedelaynet

Time delay neural network



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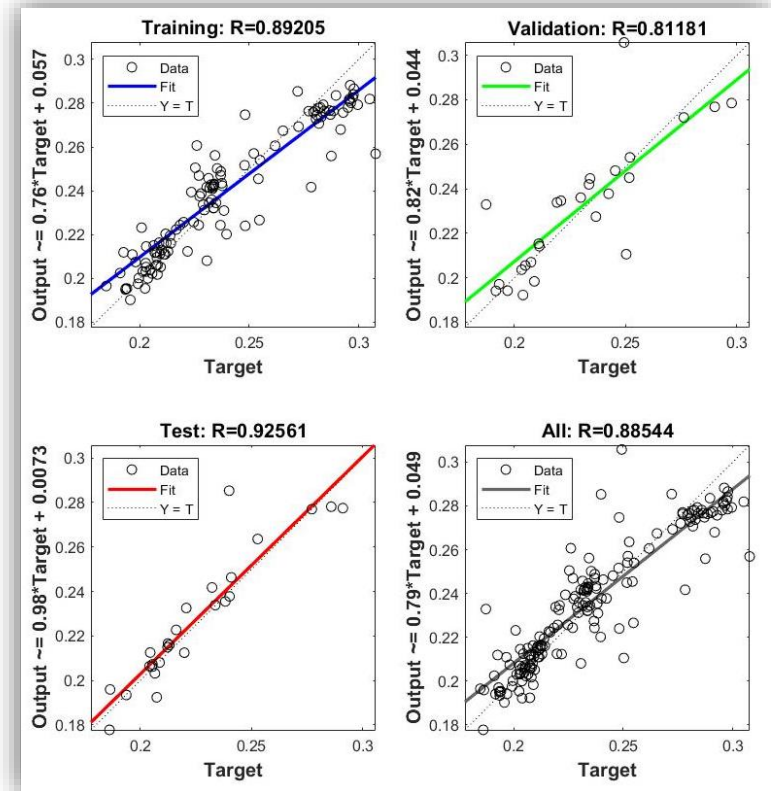
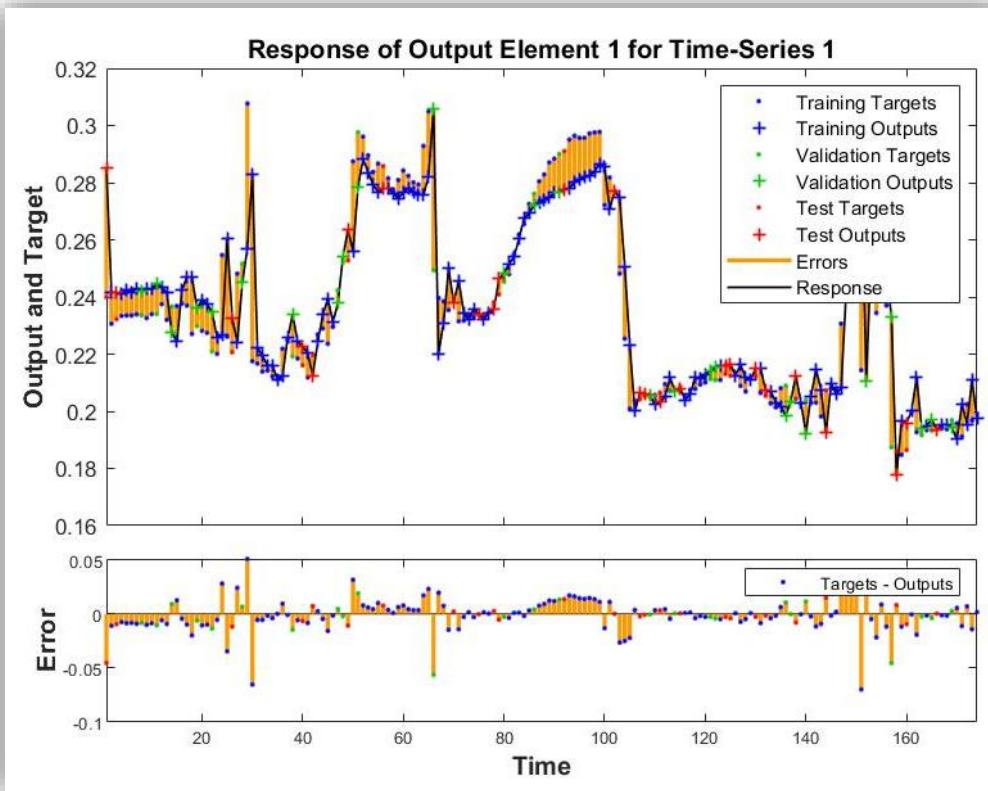
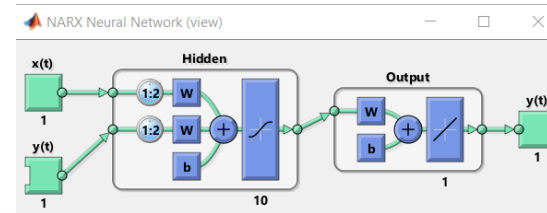
Results for NARX

narxnet

Nonlinear autoregressive neural network
with external input



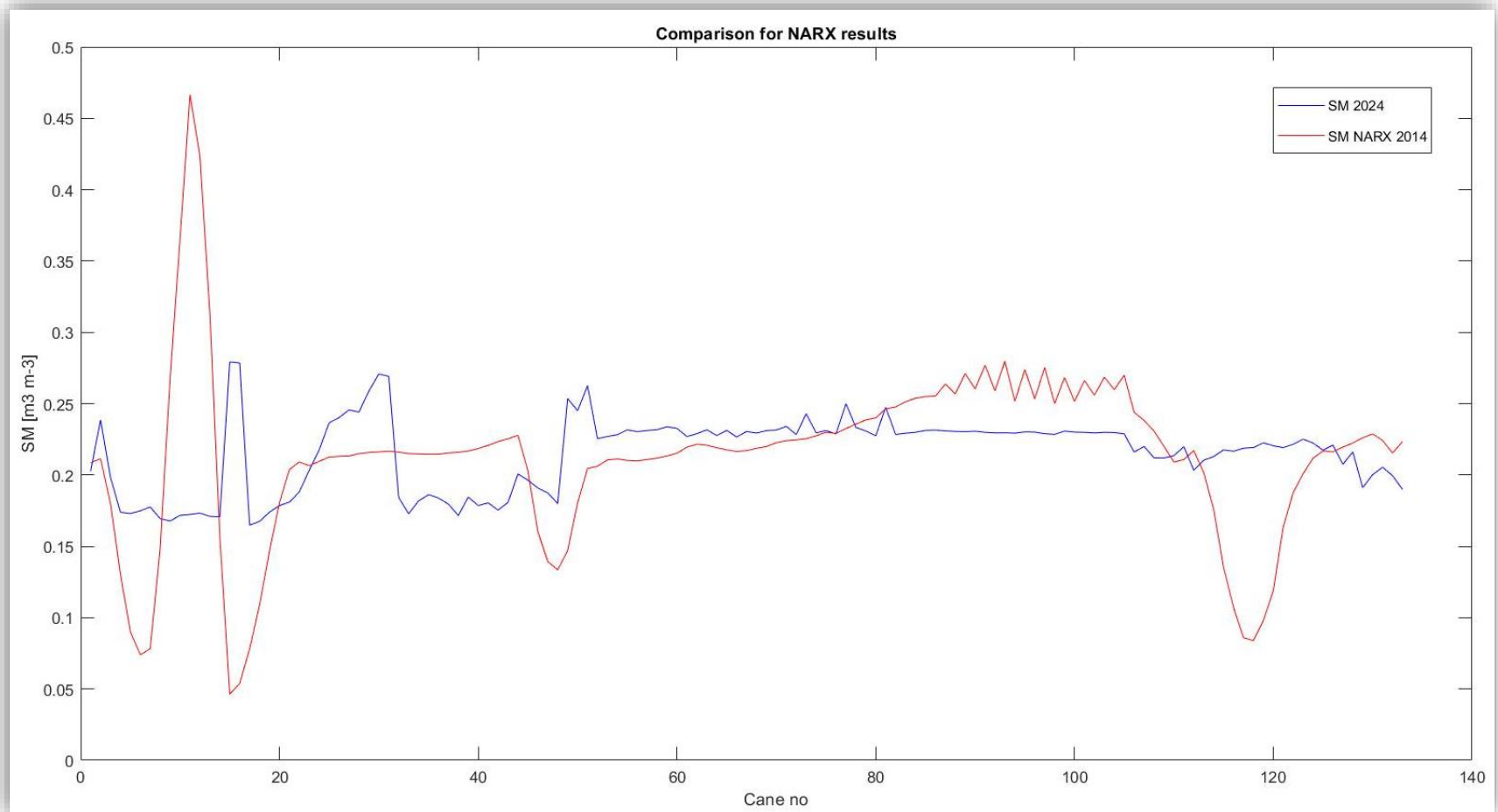
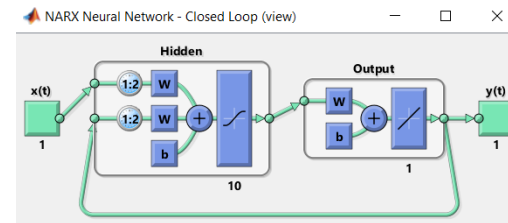
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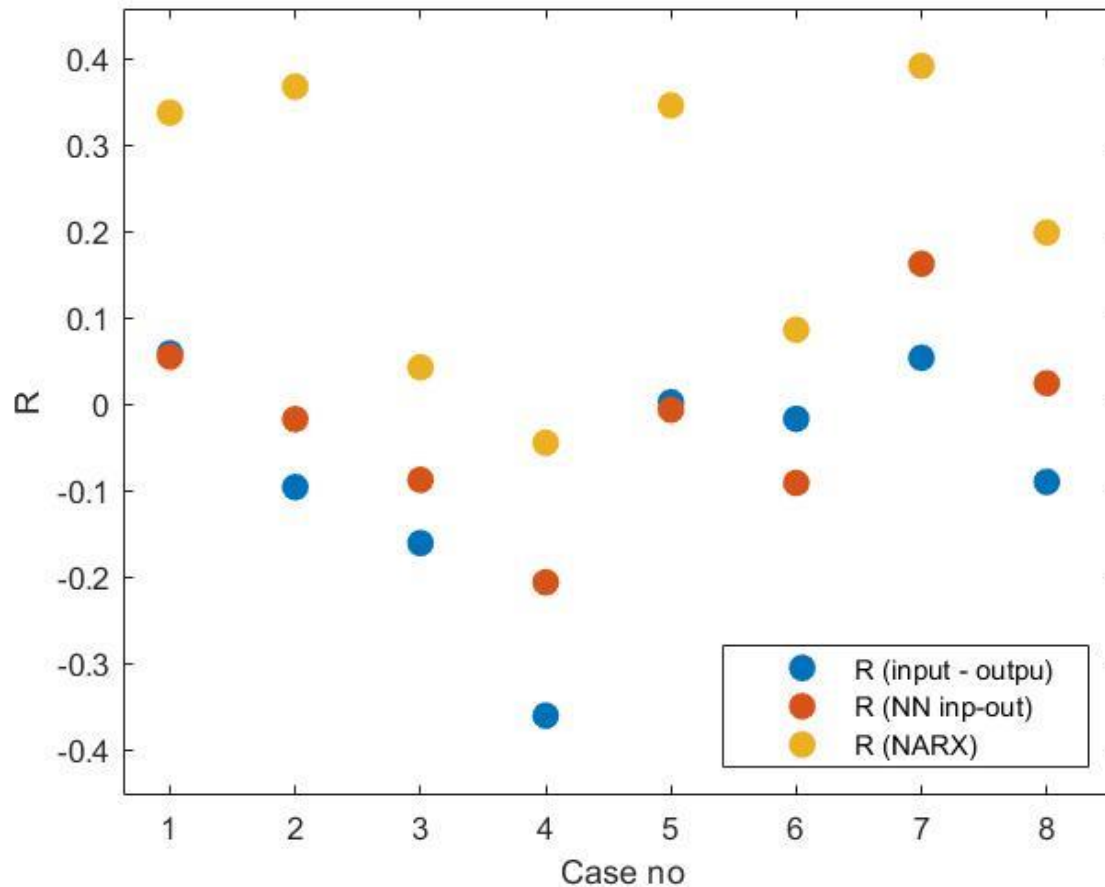
Results for NARX

narxnet

Nonlinear autoregressive neural network
with external input



Results for correlation



Only application of NARX NN model gave the perspective results for future research:

In progress:
Application additional input data as precipitation and temperature

Is it worth to work on it?



Gamma radiation monitoring system in Europe
(<https://remap.jrc.ec.europa.eu/Advanced.aspx>)



Bubnów Wetland Tourist Path



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THANK YOU FOR YOUR ATTENTION!



The project 21GRD08 SoMMet has received funding from the European Partnership on Metrology, co-financed by the European Union's Horizon Europe Research and Innovation Programme and from by the Participating States.