International SWAT Conference, Jeju Island-2025

SWAT+
SOIL & WATER ASSESSMENT TOOL

DEVELOPING A HYDROLOGICAL MODEL FOR AN AGRICULTURAL WATERSHED USING SWAT+ TOWARDS WATER QUALITY ASSESSMENT

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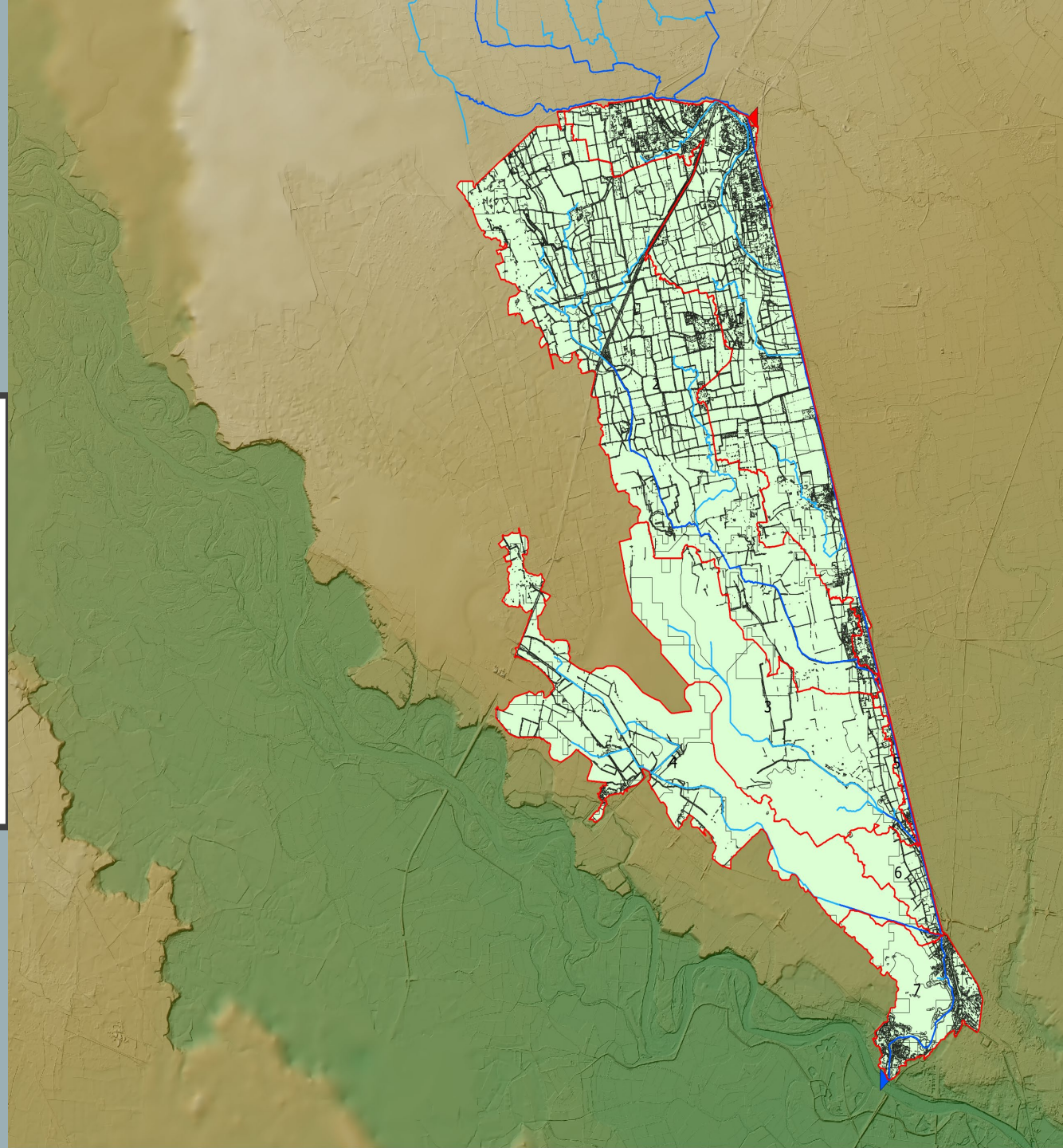

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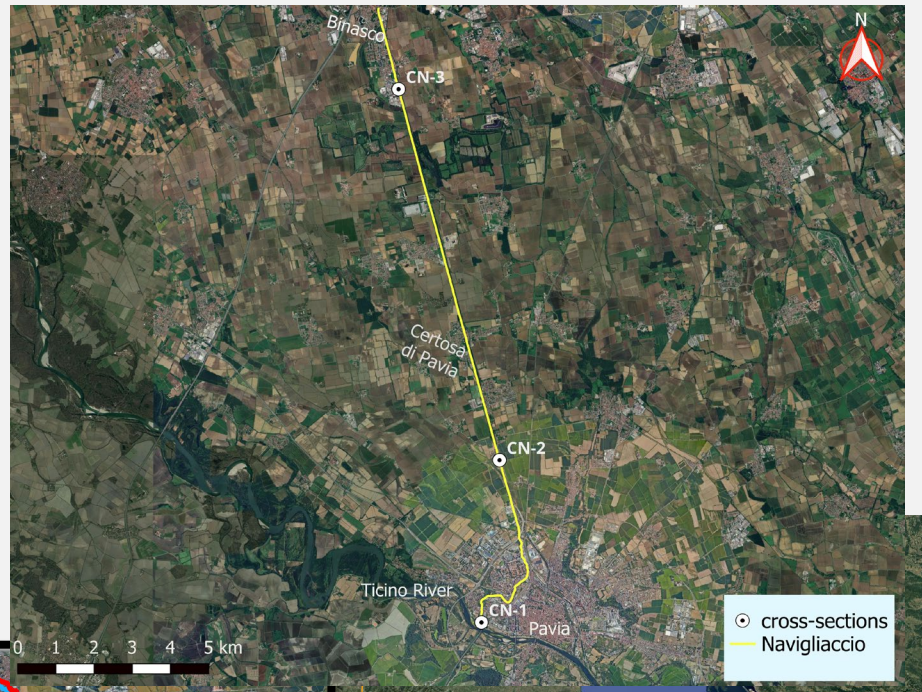
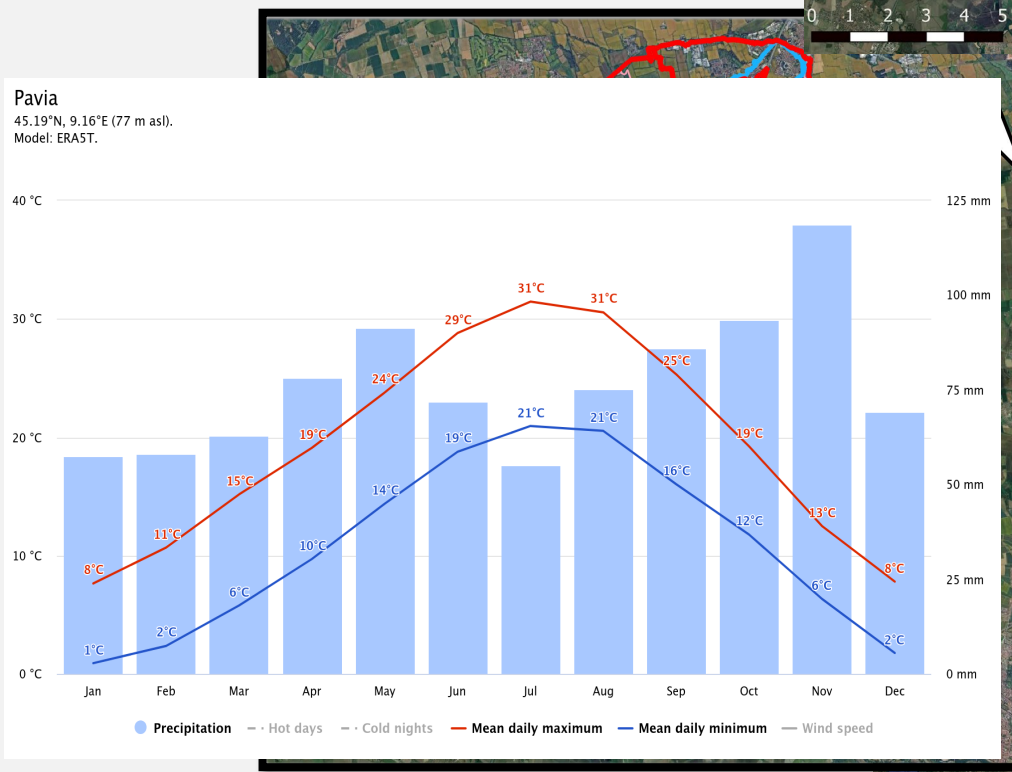
OVERVIEW OF THE PRESENTATION

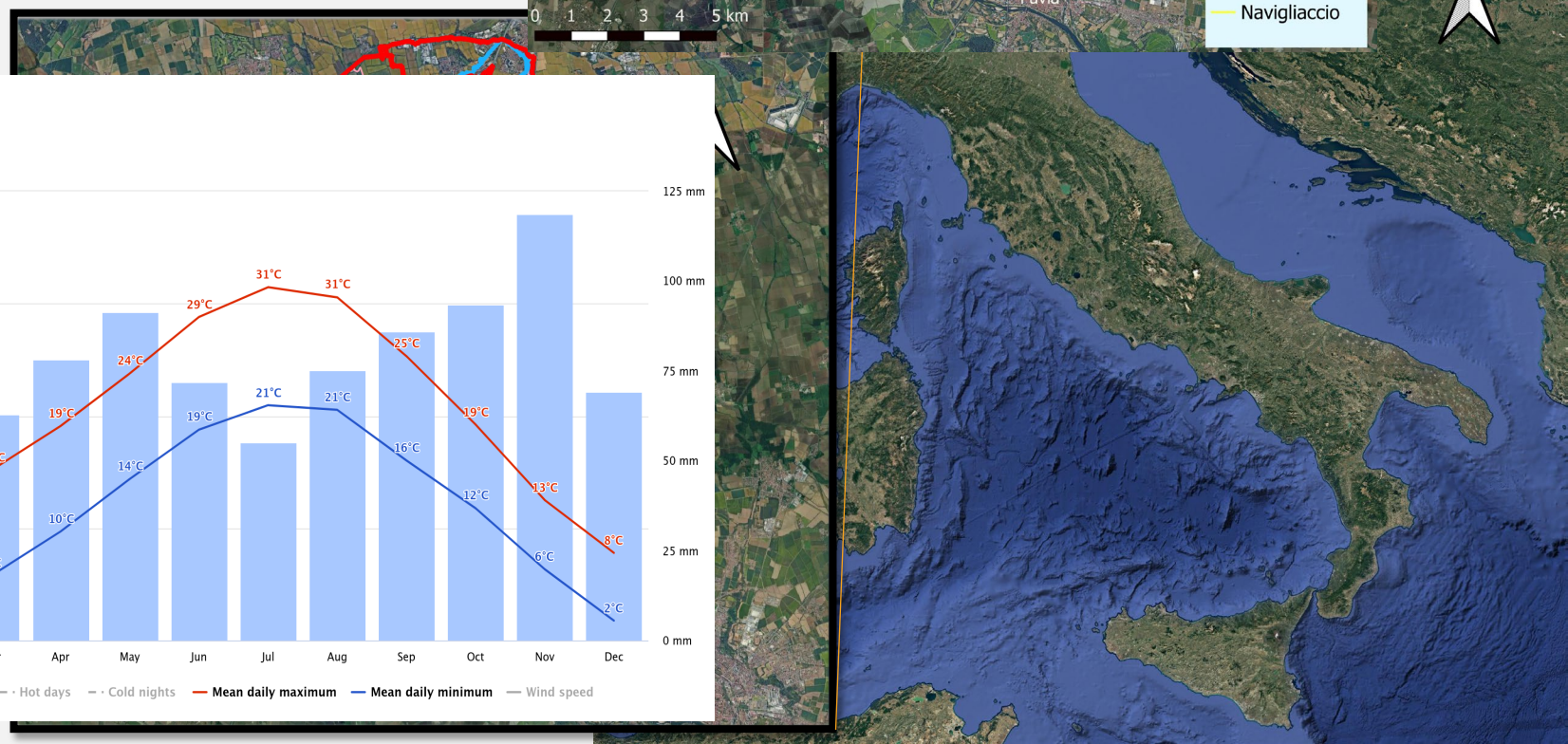
- Study Area: The Navigliaccio Canal
- Field Measurements and Hydraulic Data
- SWAT+ model setup and current progress
- Preliminary Results and Limitations
- Next Steps Toward Water Quality Assessment

STUDY AREA: THE NAVIGLIACCIO CANAL WATERSHED

- Located in northern Italy, ~18 km canal from Binasco to Ticino River
- Functions as a drainage channel (not for irrigation)
- Receives urban drainage, agricultural runoff, and several tributaries
- Discharges into Ticino River
- Surrounded by a flat agricultural plain with dominant rice cultivation
- Total watershed area 70 km^2
- Cross-sections for measurement:
  - CN-3: Inlet
  - CN-2: Midpoint
  - CN-1: Outlet

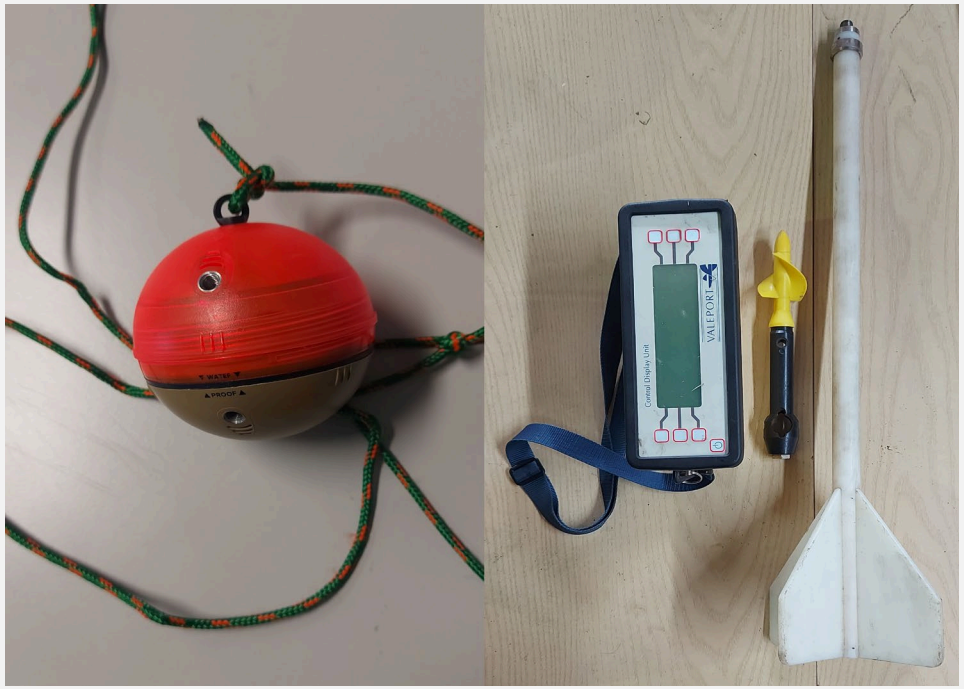


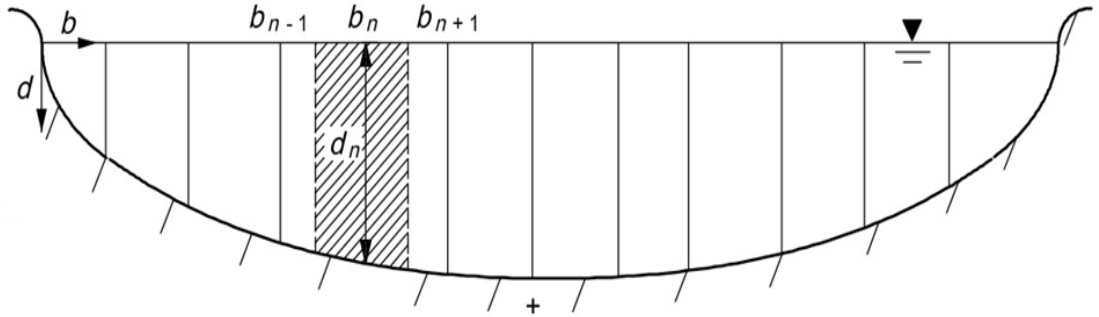




FIELD MEASUREMENTS AND HYDRAULIC DATA

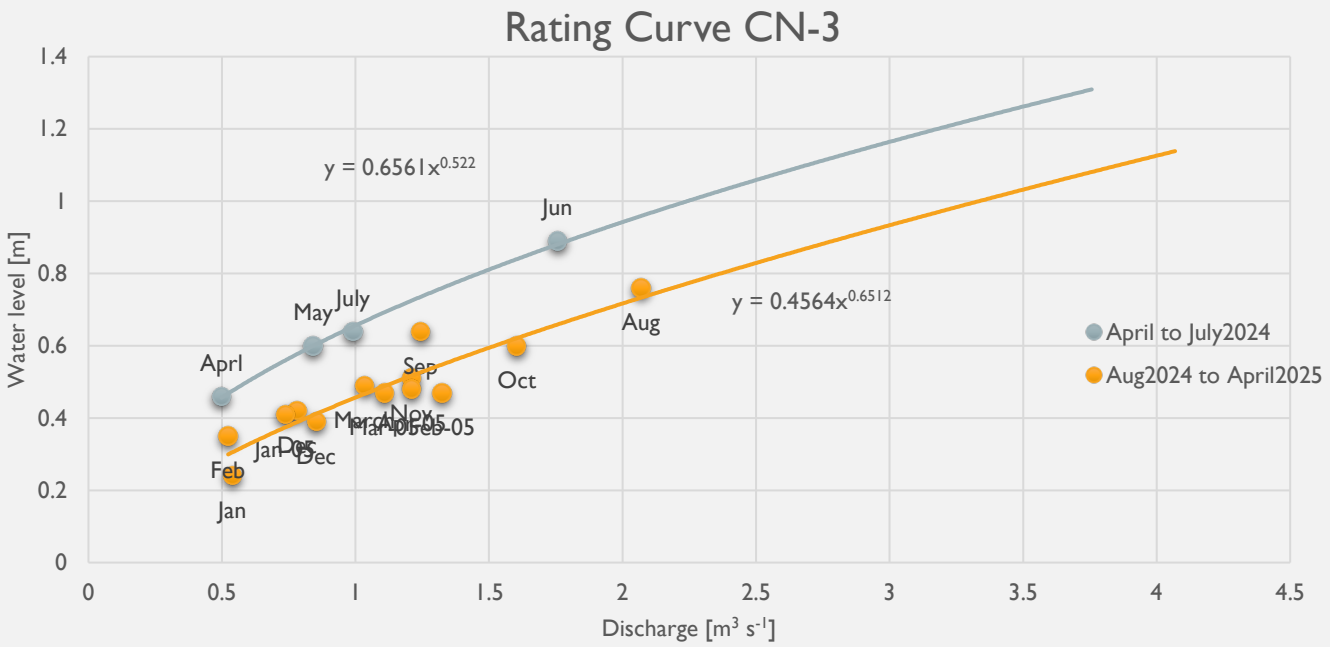
- Measurement campaign: January 2023 – April 2025
- Monthly discharge measurements at CN-3, CN-2, CN-1
- Measurements conducted on random dry days to prevent skewed data
- Instruments used:
  - Portable ultrasonic depth sensor
  - Electromagnetic flow meter
- Methodology: ISO 748 mid-section method
- Continuous pressure loggers installed at CN-3 and CN-2 since October 2024

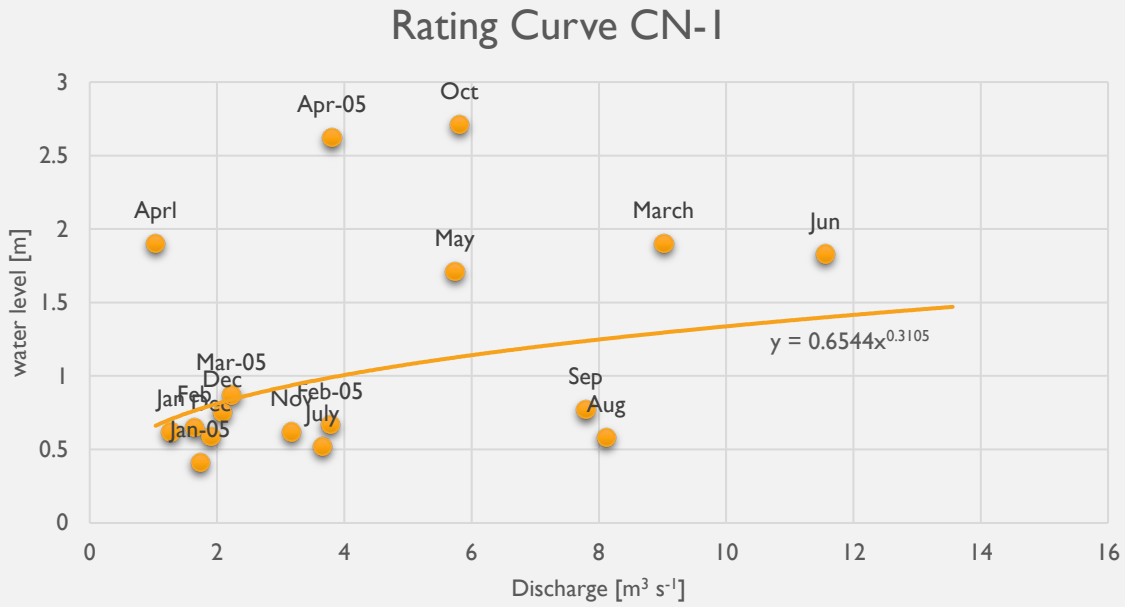


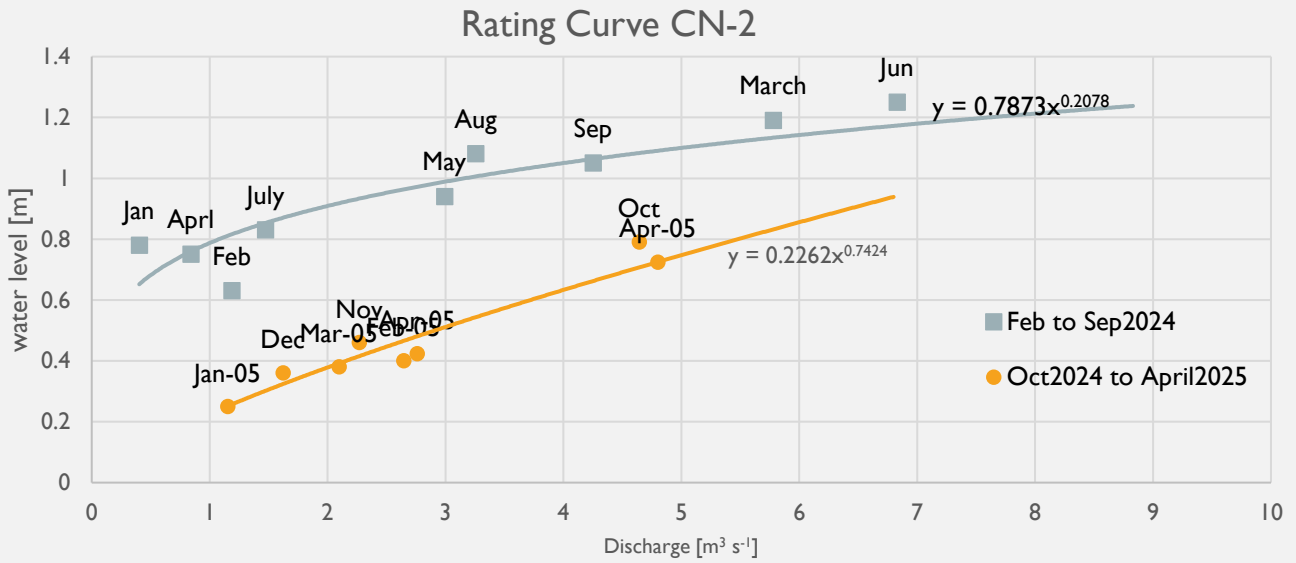


HYDRAULIC DATA ANALYSIS: RATING CURVES, SEASONAL TRENDS

- Rating curves developed for CN-3, CN-2, and CN-1 using monthly data
- CN-3 (inlet): Summer vs winter behaviour due to algae accumulation
- CN-2 (midpoint): Strong consistency – is going to be used for calibration reference
- CN-1 (outlet): Backwater effect from Ticino River distorts rating curve

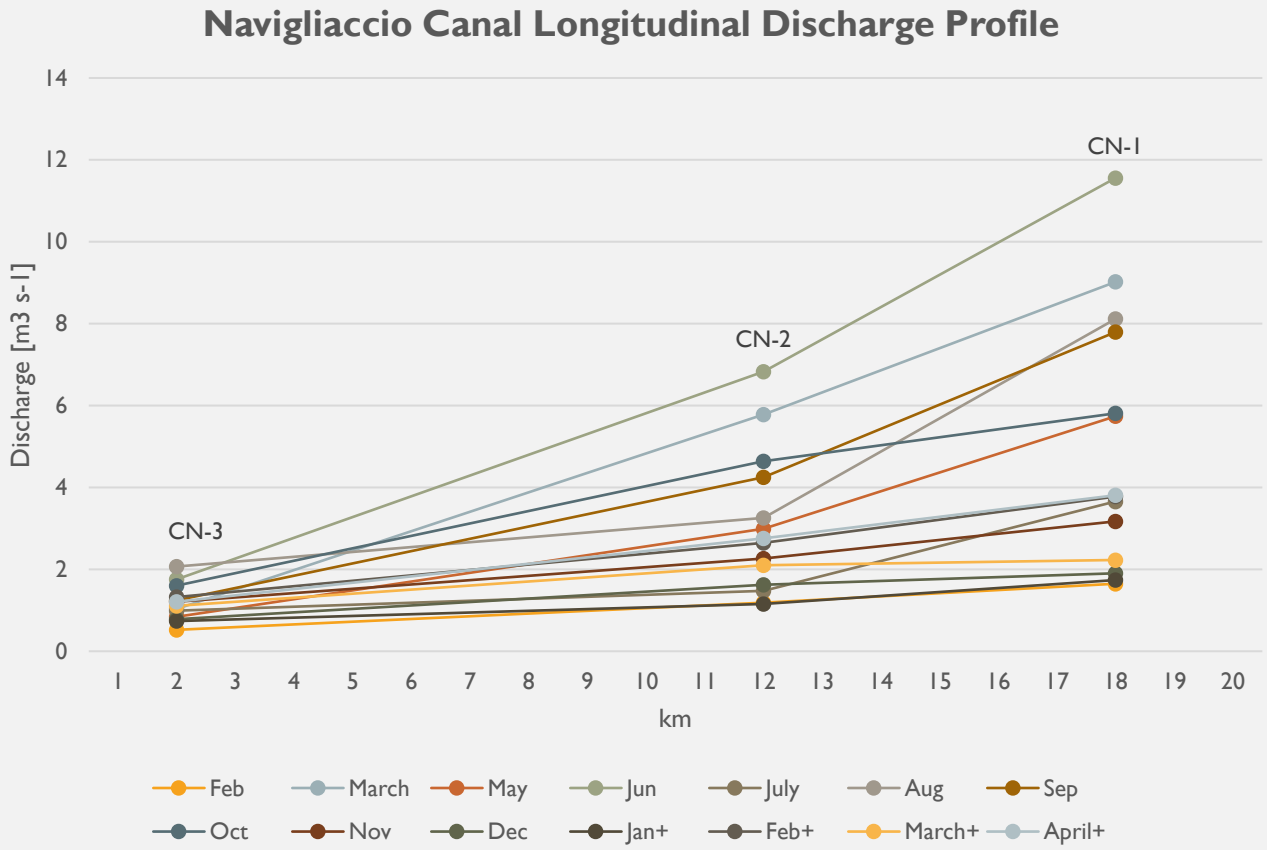


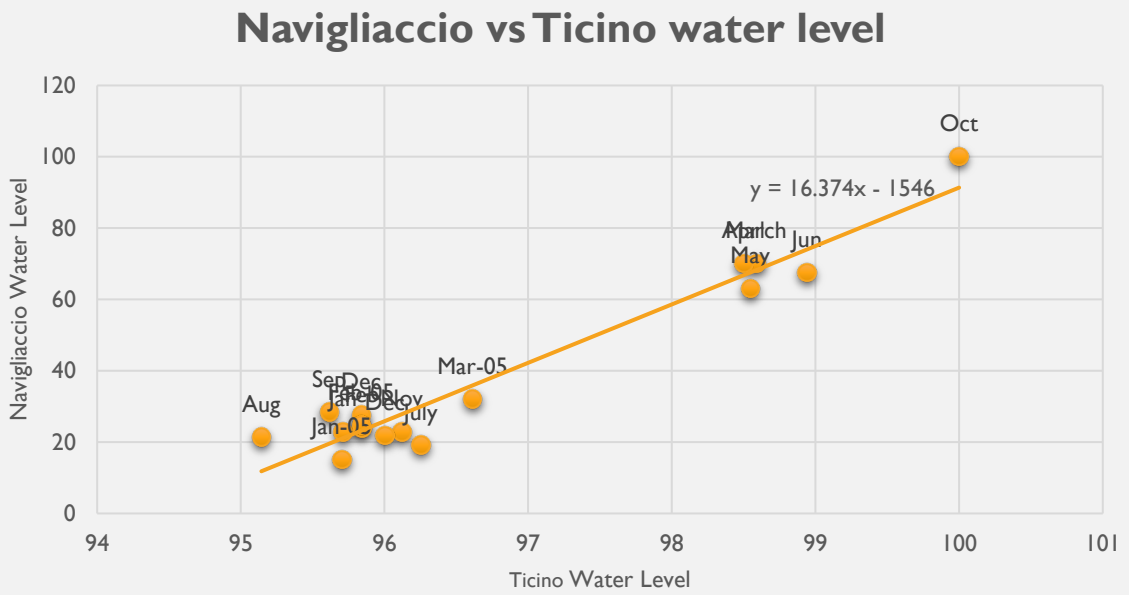


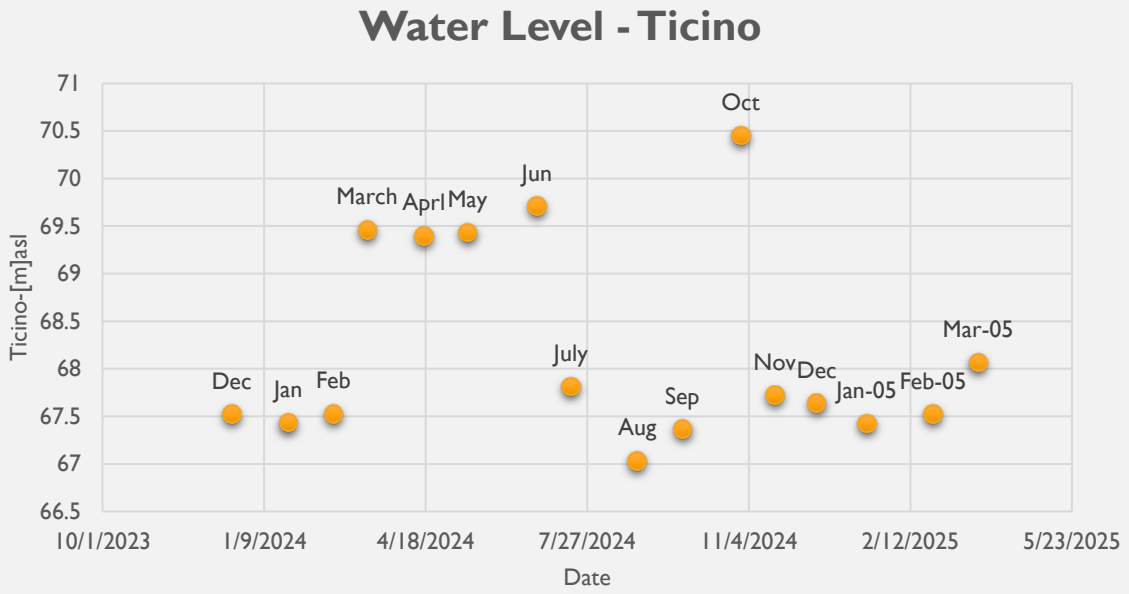


HYDRAULIC DATA ANALYSIS: RATING CURVES, SEASONAL TRENDS

- Longitudinal discharge profile shows increase from CN-3 to CN-1
- Ticino water level monitored to interpret CN-1 flow anomalies







SWAT+ MODEL SETUP AND CURRENT PROGRESS

Modelling tool: SWAT+ (Soil and Water Assessment Tool)

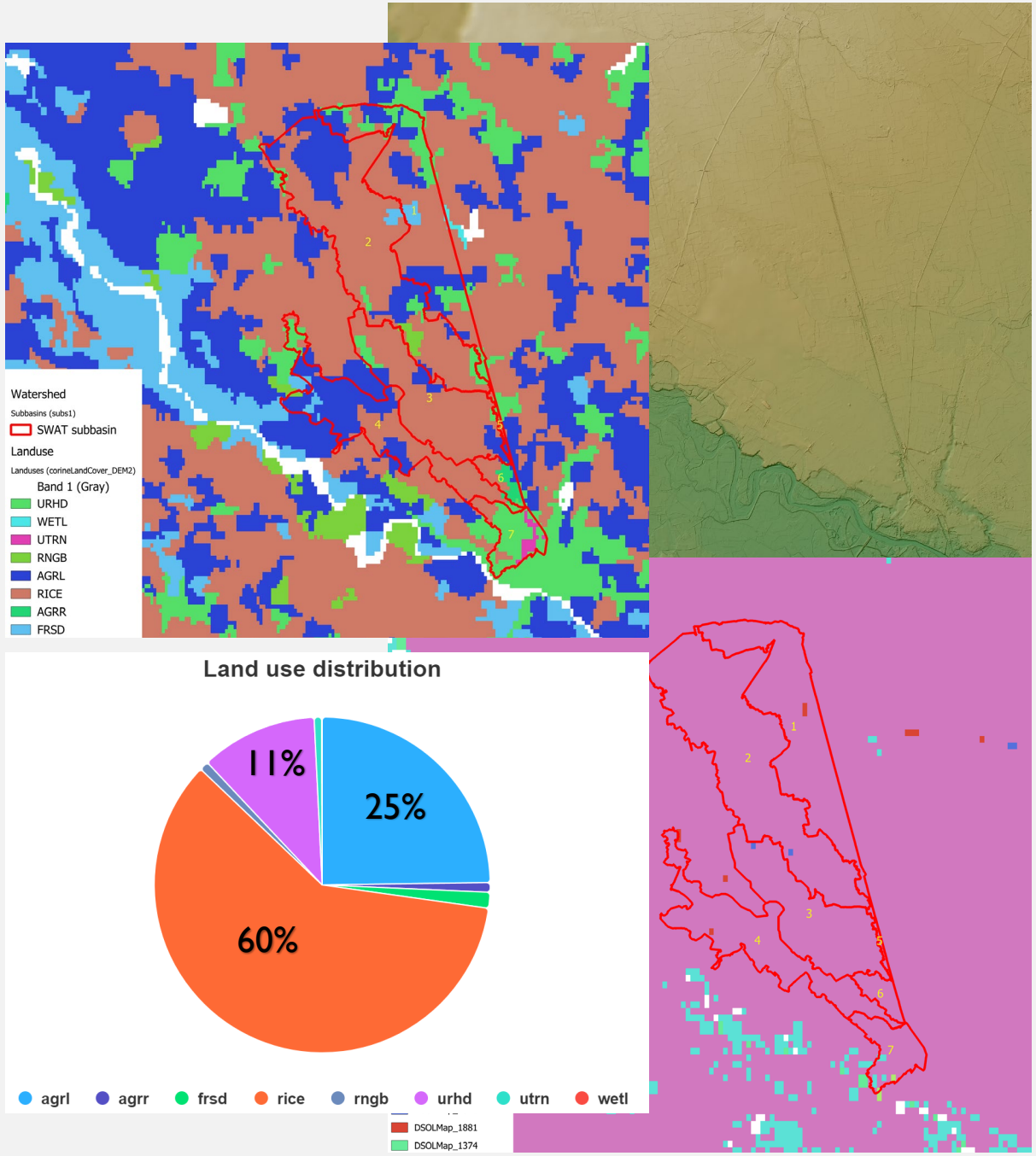
Watershed delineation based on:
- 5-meter DTM
- DSOL soil map
- CORINE 2018 land use

Weather data: Daily inputs from 4 nearby stations (precipitation, temperature, wind speed, relative humidity, solar radiation)

Model structure:
- 7 subbasins and 308 HRUs generated

Focus: Hydrological processes in Navigliaccio watershed as input to future water quality assessment

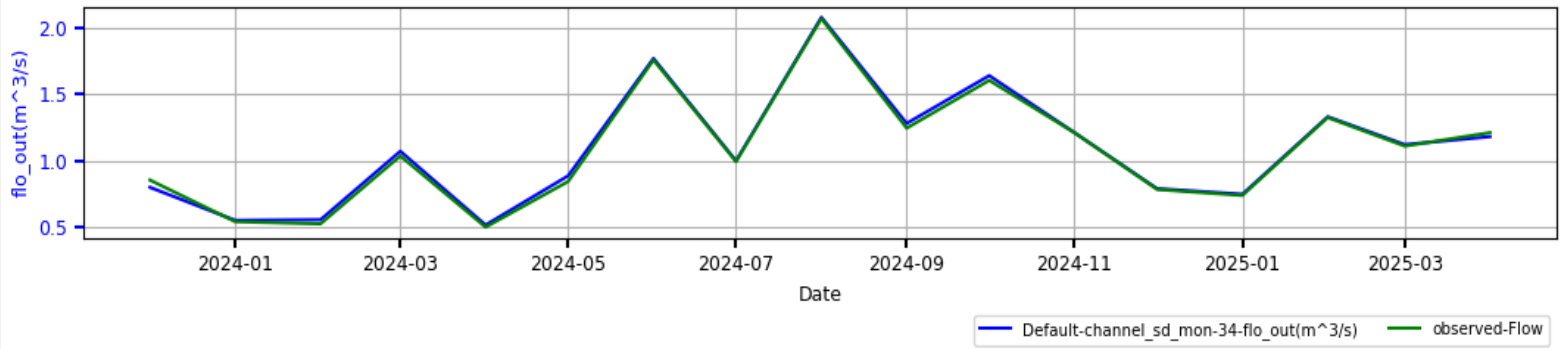
Current status:
- Model fully set up
- Preliminary simulation completed
- Calibration phase pending due to missing agricultural management data



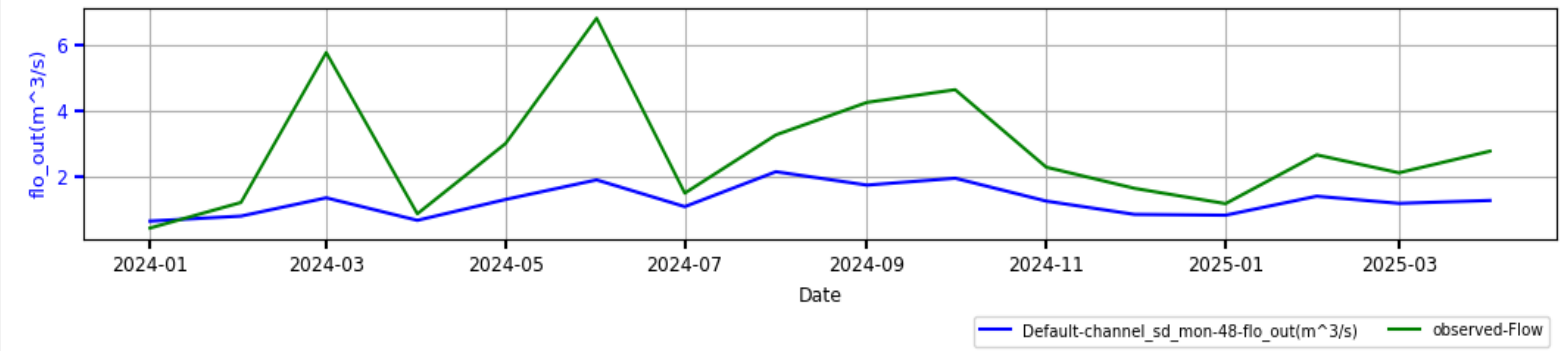
PRELIMINARY SIMULATION RESULTS – SWAT+ VS OBSERVED FLOW

- Monthly discharge comparison at all three cross-sections:
  - CN-3 (inlet)
  - CN-2 (midpoint)
  - CN-1 (outlet)
- Underestimation evident at CN-1 and CN-2
- CN-3 strong agreement because the observed data imported as the inlet flow
- No calibration yet performed

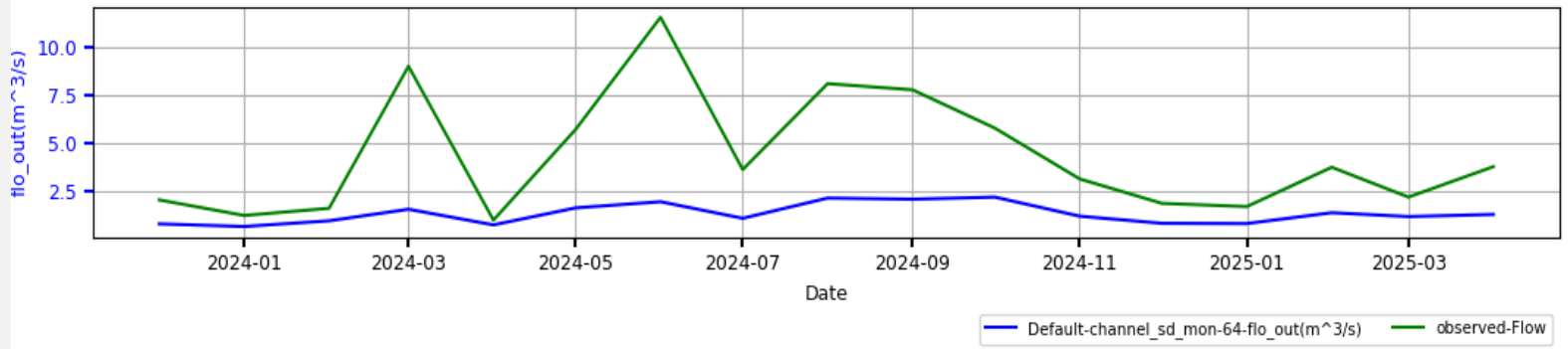
CN-3



CN-2



CN-1

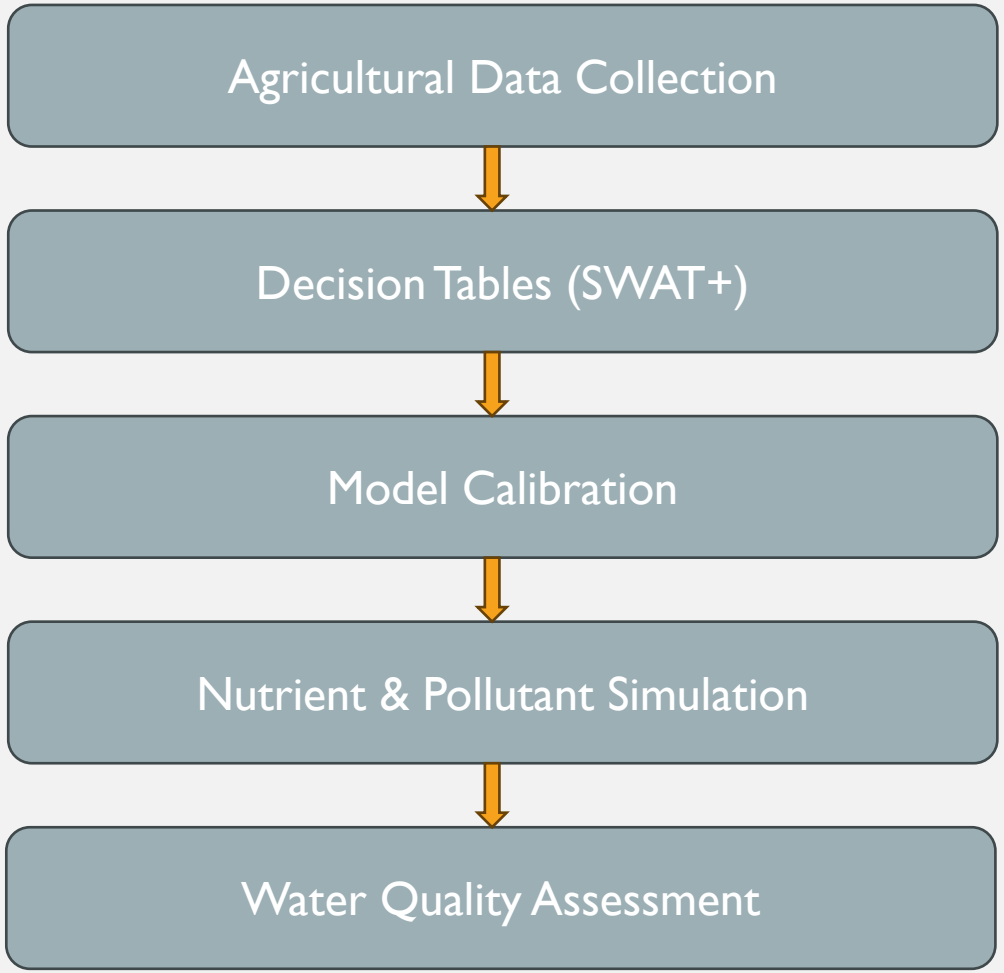


MODEL LIMITATIONS AND MISSING INPUTS

- Underestimation of discharge at CN-1 and CN-2
- Key missing inputs not yet integrated into the model:
  - Irrigation volumes and schedules
  - Fertilization practices
  - Tillage operations and crop rotations
- These inputs are essential to:
  - Simulate return flows from rice paddies
  - Capture evapotranspiration variability
  - Reflect seasonal management timing
- This information will enable the development of SWAT+ decision tables
  - More realistic simulation of agricultural practices
- Calibration not yet started
  - Will rely on CN-2 and CN-1

NEXT STEPS TOWARD WATER QUALITY ASSESSMENT

- Collect and integrate detailed agricultural management data:
  - Crop types and rotation schedules
  - Irrigation volumes and timing
  - Fertilization and tillage practices
- Develop SWAT+ decision tables for dynamic management simulation
- Calibrate the model using observed data at CN-2 and CN-1
- Simulate nutrient and pollutant transport in the Navigliaccio watershed
- Final goal: support sustainable watershed management through
  - Hydrological prediction
  - Nutrient load estimation
  - Scenario evaluation under agricultural variability



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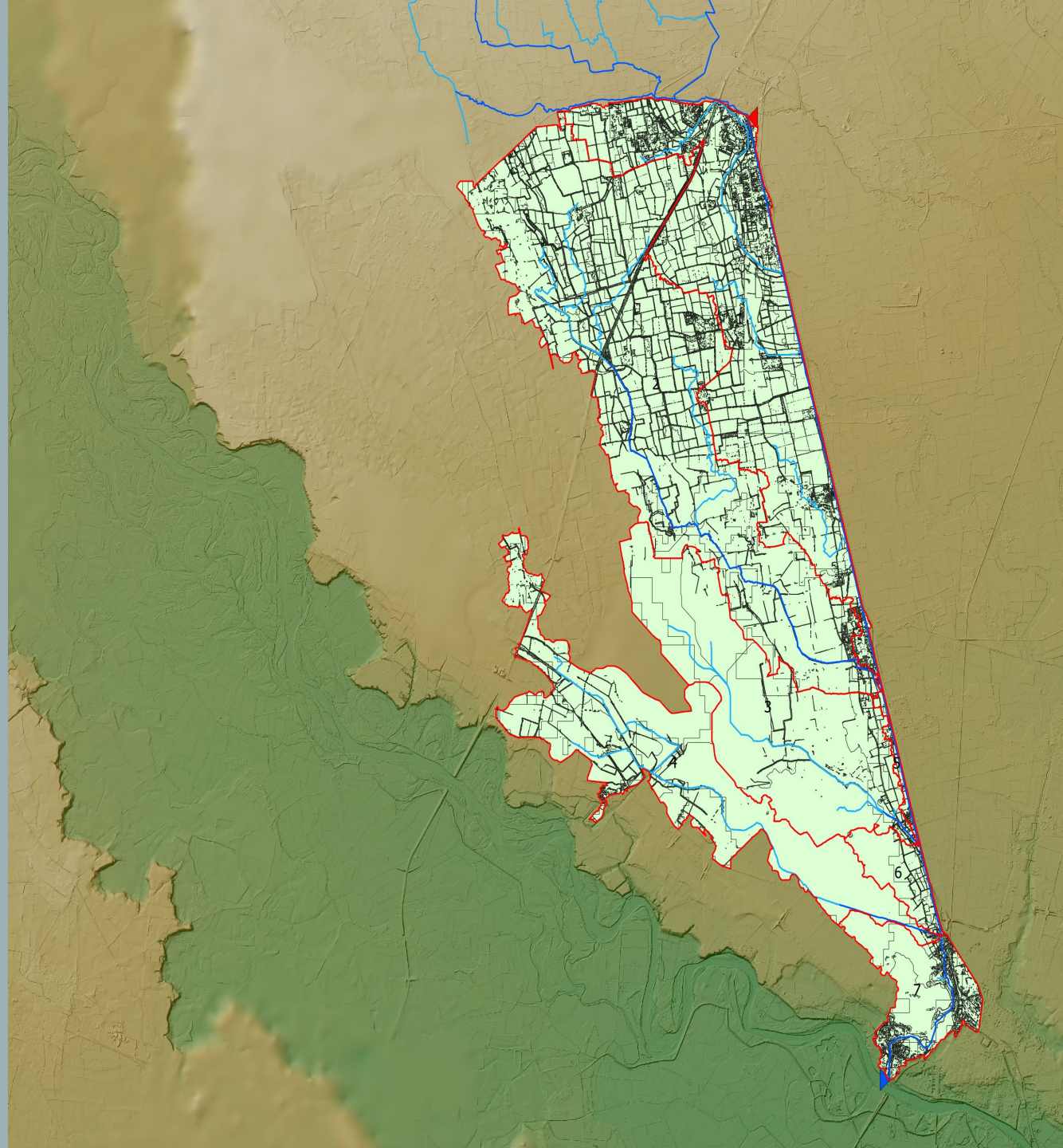
THANK YOU FOR YOUR ATTENTION



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