CGMS

Introduction to CGMS and the CGMS database

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Content

- TODAY (afternoon)
  - CGMS system
  - Database
- TOMORROW (morning)
  - Maintenance CGMS
  - Visualization

Content

- CGMS overview
- Level 1: Weather monitoring
- Level 2: Crop simulation
- Level 3: Yield forecasting

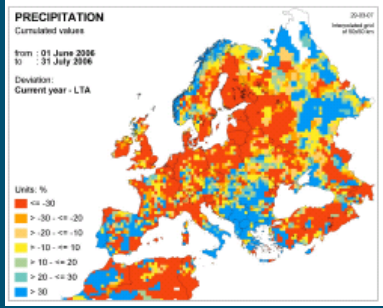
CGMS overview

Weather

± 2000 stations

Daily values 1975-today

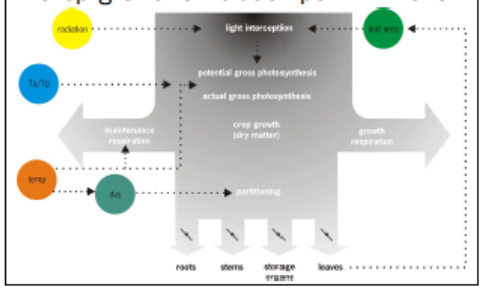
Data quality checking and interpolation to agro climatic zones

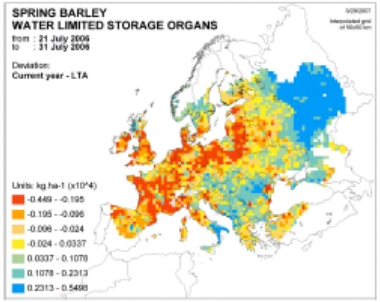


Crop, soil, land use

AEZ zone (combination of agro climatic zones and soil mapping units)

Crop growth simulation per AEZ zone





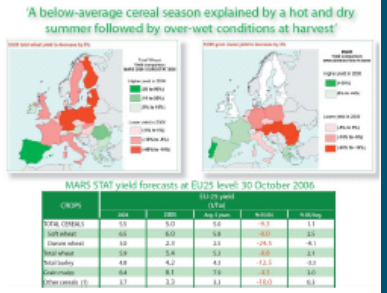
Official harvested yields

Administrative regions

1975-last year

Estimate current year's crop yield based on regression analysis of historic simulated indicators and yield statistics

$$stat\_yield = trend + f(sim\_yield)$$



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CGMS overview

- From point model to regions
  - Files => Tables
- Store tables in relational database
  - Base and derived tables (views)
  - Domains
  - Constraints
  - Primary keys
  - Foreign key
  - Stored procedures
  - Indices

CGMS overview

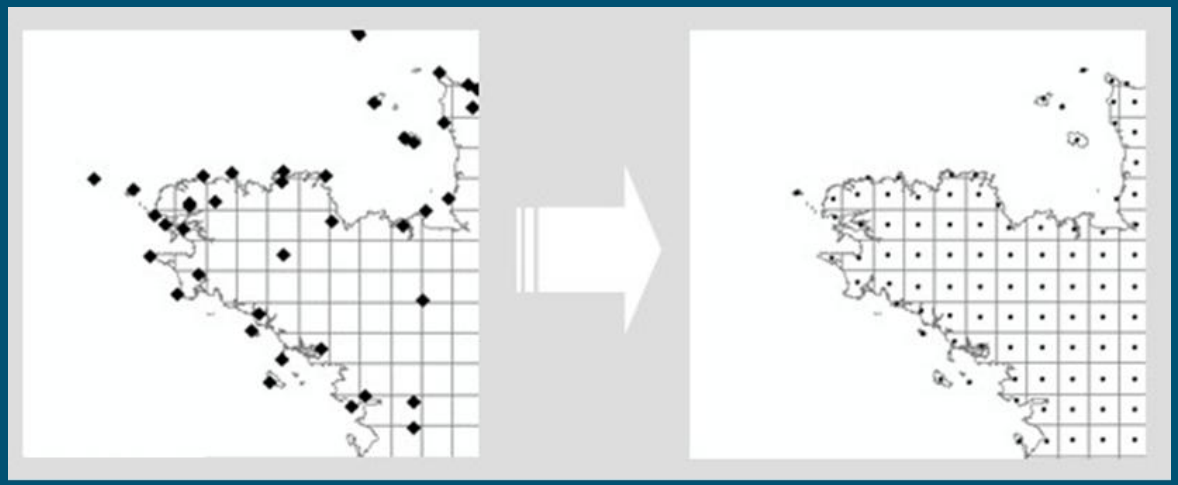
- Collection of software
  - Oracle / MS Access
  - SqlDeveloper / sqlplus
  - Cgms.exe
  - SupitConstants.exe
  - CgmsStatTool.exe
  - scripts / procedures / packages
- Visualization
  - ArcGis / FME / QGIS / ...
  - Custom build viewers

Weather Monitoring: objective

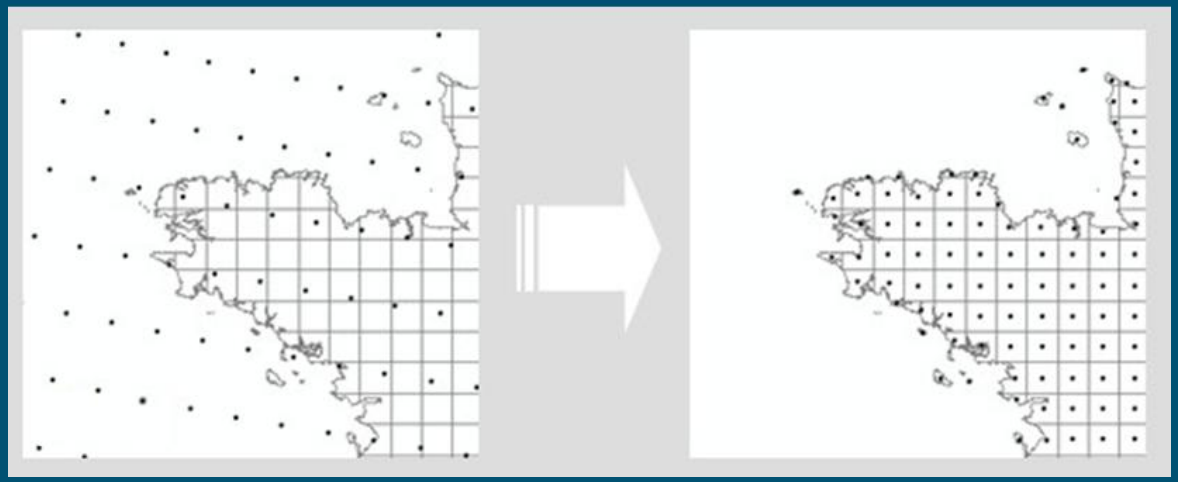
- Monitoring weather conditions
  - Evaluation of abnormal and alarming situations
  - Drought
  - Extreme temperatures
  - Extreme rainfall during flowering or harvest
  - etc.
- Input for the crop simulation
  - Station weather or model weather
  - Quality checked
  - Complete spatial & temporal coverage

Weather Monitoring: interpolation to grid

- Interpolation



- Downscaling



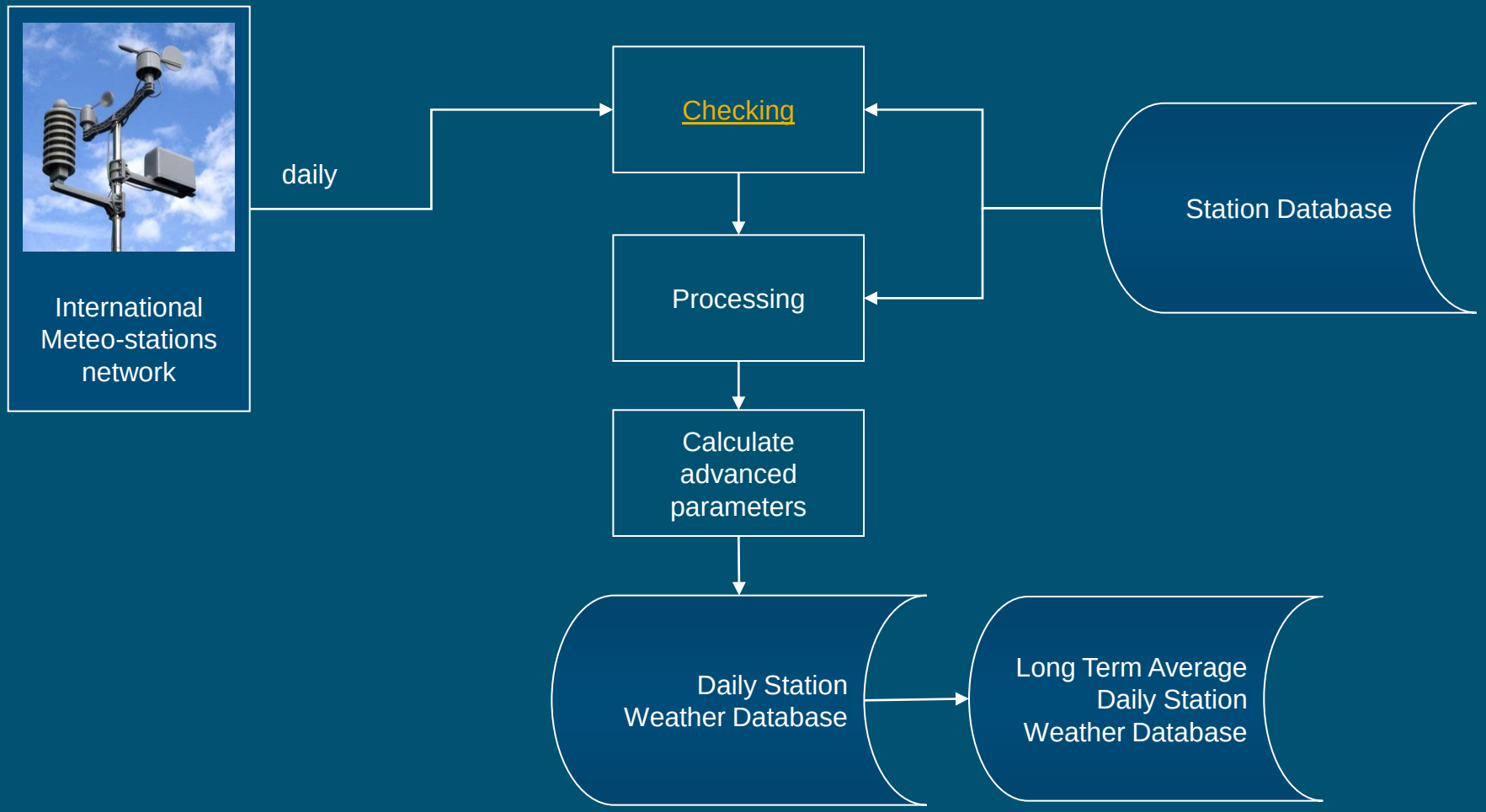
Weather Monitoring: observed weather

- Observations
  - Precipitation
  - Temperature (maximum, minimum)
  - Measured radiation
  - Sunshine
  - Cloud cover
  - Vapour pressure
  - Wind speed
  - Snow
  - Humidity

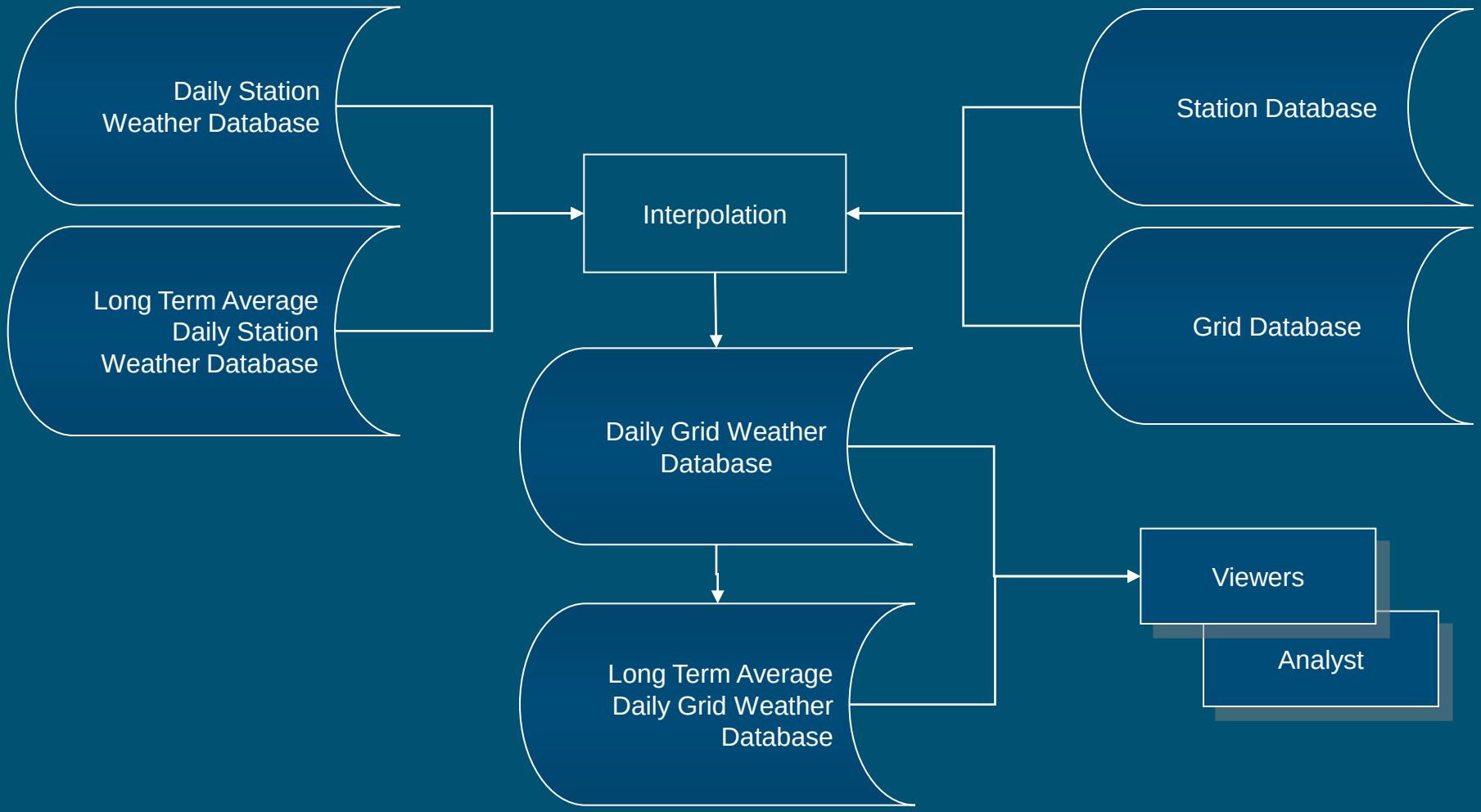
Weather Monitoring: observed weather

- Calculation advanced parameters
  - Calculated radiation at surface (Angström / Supit / Hargreaves)
  - Evaporation of water surface (E0)
  - Evaporation of wet bare soil (ES0)
  - Reference evapotranspiration (ET0)

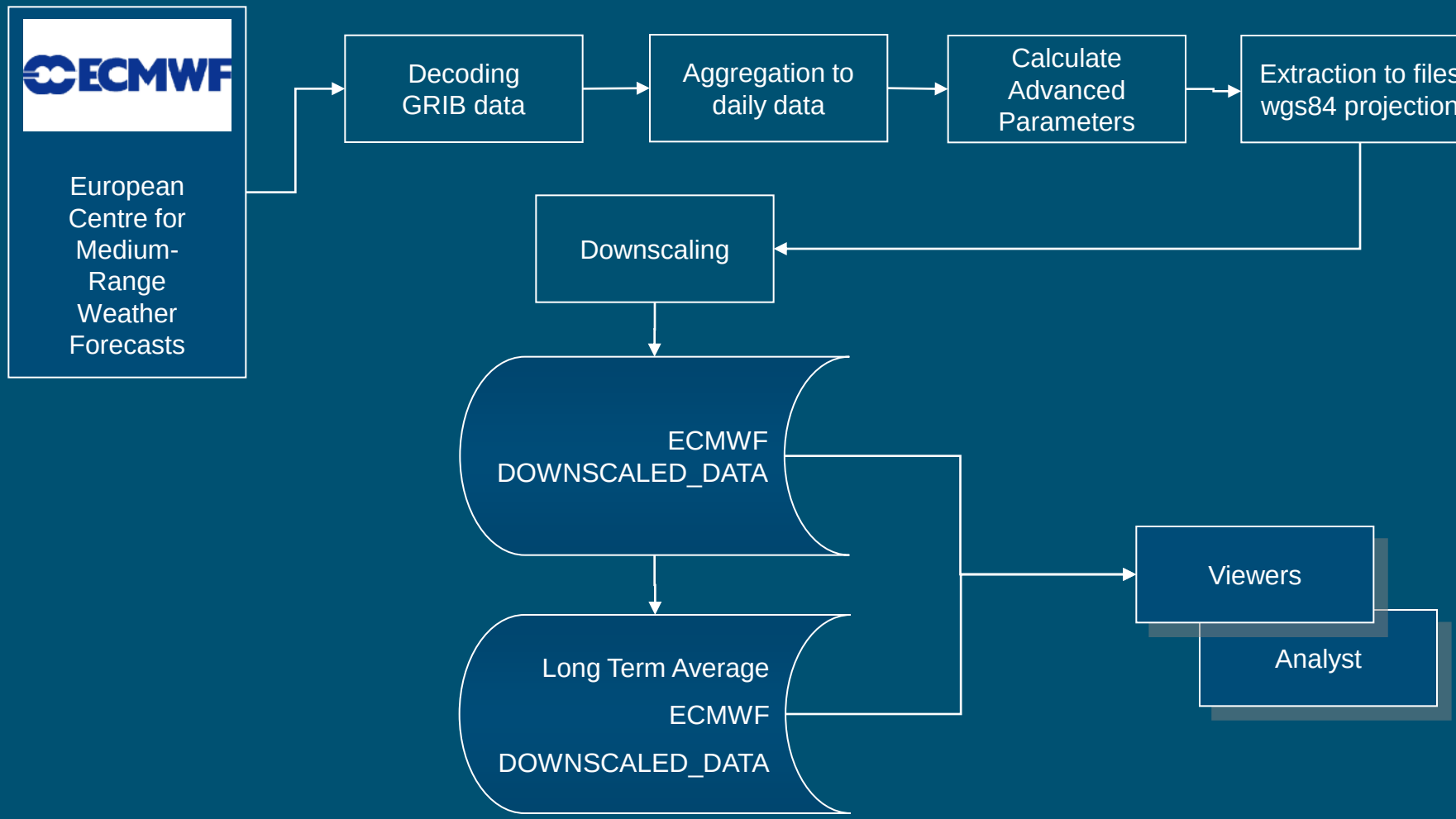
Weather Monitoring: observed weather



Weather Monitoring: observed weather

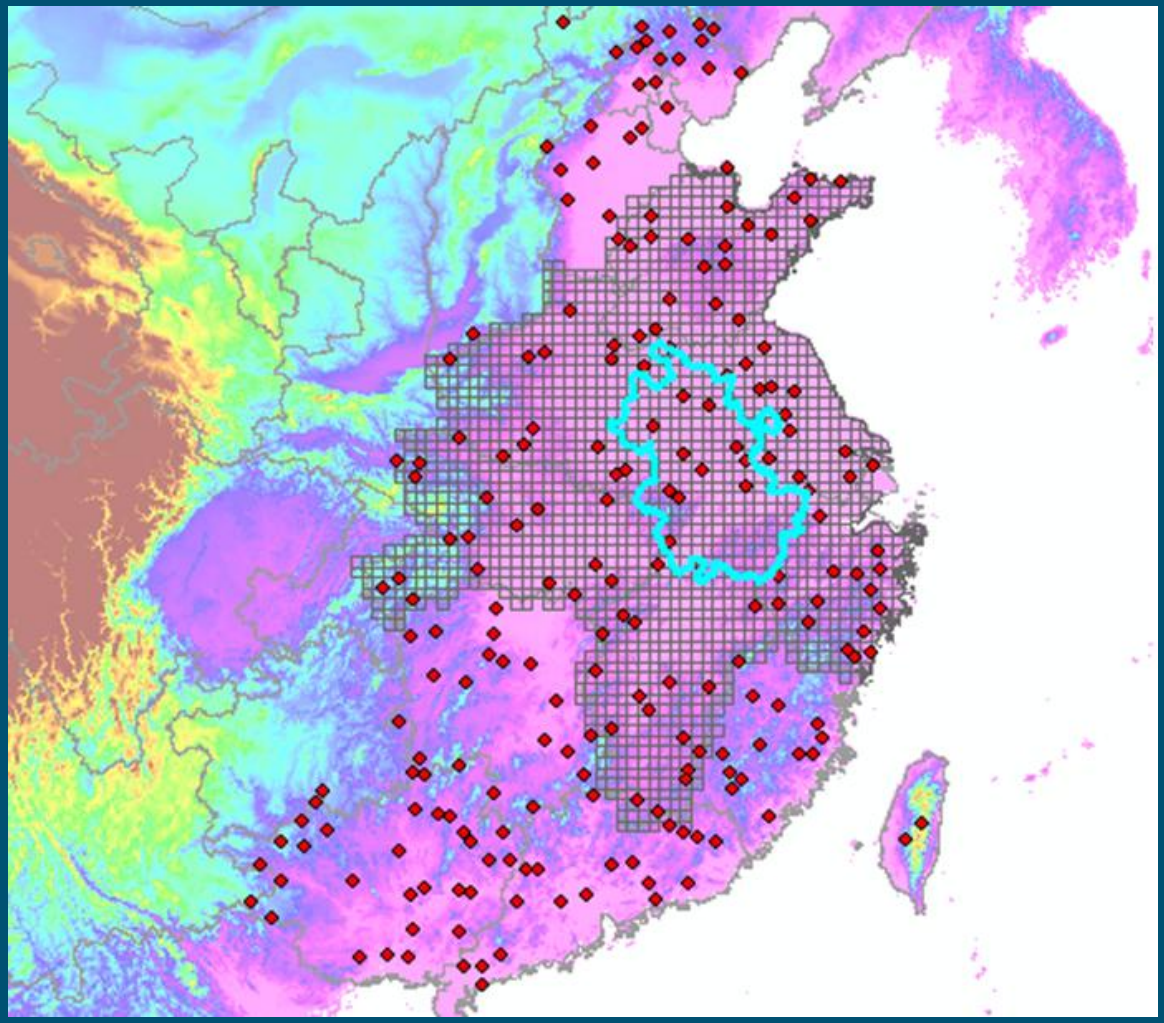


Weather Monitoring: forecasted weather



Weather Monitoring: input tables

- Anhui db:
  - 25 km grid
  - Admin regions
  - Pseudo stations



Weather Monitoring: input tables

- GRID (description of grid)
- WEATHER_STATION (description of weather stations)
- METDATA (meteo data)
- SYSCON (system constants)
- SUPIT_REFERENCE_STATIONS

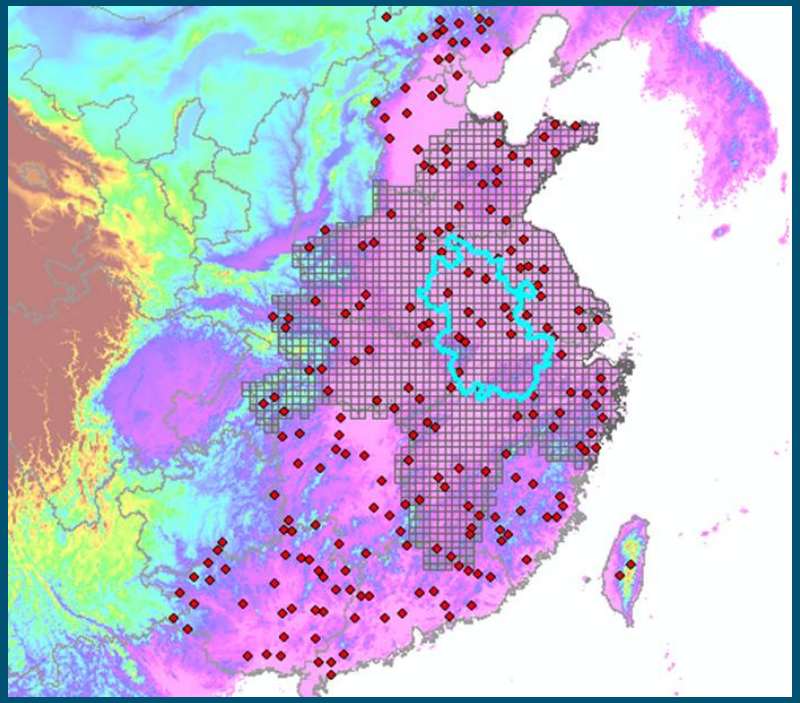
- CROP (list of crops)
- CROP_GROUP (list of crop groups)
- STAT_CROP (relation statistics - simulation)
- NUTS (description of admin regions)

Weather Monitoring: input tables

- Open CGMS_ANHUI.mdb
- Questions:
  - What data is stored in tables GRID / METDATA?
  - What is the primary key of table GRID / METDATA?
  - What is the relation between METDATA and WEATHER_STATION?
  - What attributes have WEATHER_STATION and GRID in common?

Weather Monitoring: input tables

- GRID & WEATHER_STATION
  - Latitude / Longitude
  - Altitude
  - Distance to coast
  - Climate barrier (uniform region)



- Similarity (set)score
  - Groups: Rain / Temp / Rest
  - (average) Distance
  - (average) Difference in altitude
  - (average) Difference in distance to coast
  - Different or same uniform region
  - (Distance between grid and center of gravity of stations)
  - (Factor based on number of stations)

Weather Monitoring: output tables

Name	Source	Procedure
CGMS_SYSLOG	-	-
SUPIT_CONSTANTS	SUPIT_REFERENCE_STATIONS WEATHER_STATION	SupitConstants.exe
CALCULATED_WEATHER	METDATA SUPIT_CONSTANTS WEATHER_STATION	CGMS.exe
REFERENCE_WEATHER	WEATHER_STATION METDATA CALCULATED_WEATHER	long term average based on reliable stations
WEATHER_DATA_AVAILABILITY	METDATA CALCULATED_WEATHER WEATHER_STATION REFERENCE_WEATHER	CGMS.exe
GRID_WEATHER STATIONS_PER_GRID STATIONS_PER_GRID_CURRENTYEAR	METDATA CALCULATED_WEATHER WEATHER_STATION REFERENCE_WEATHER WEATHER_DATA_AVAILABILITY GRID SYSCON	CGMS.exe
LONG_TERM_AVERAGE_GRID_WEATHER	GRID GRID_WEATHER	lta_grid_weather.sql

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Weather Monitoring: output tables

- Questions:
  - What is the difference between SUPIT_REFERENCE_STATIONS and SUPIT_CONSTANTS
  - Can you think of an alternative way to fill SUPIT_CONSTANTS?
  - What is the relation between METDATA and CALCULATED_WEATHER?
  - Which stations were used to interpolate weather for grid cell 75170 in the year 2002?
  - What were the similarity scores?

Weather Monitoring

- Questions:
  - How long is the grid weather archive in ANHUI.mdb?
  - Interpolate the next year with CGMS.exe
  - Check the length of the grid weather archive in ANHUI.mdb

Weather Monitoring

- Questions on weather monitoring?

Crop simulation: objective

- Assess influence of weather on crop growth
  - Above ground biomass
  - Storage organs biomass
  - Leaf Area Index
  - Total water requirement
  - Total water consumption
  - Relative soil moisture
  - Crop development stage
  - Precocity
  - Nr and duration of heat waves around crop development stage
  - Rain or temperature around crop development stage
- Input for the quantitative yield forecasting

Crop simulation: input data

- Weather data
- Crop parameters
- Soil map
- Administrative regions
- Spatial schematization

Crop simulation: crop parameters

- Growth behaviour category
  - CROP_PARAMETER_VALUE
  - PARAMETER_DESCRIPTION
  - VARIETY_PARAMETER_VALUE
- Spatial/temporal variation category
  - CROP_CALENDAR
  - CROP_GROUP: suitability for soil types

Crop simulation: crop parameters

- Questions:
  - In what spatial resolution are the crop parameters stored?
  - What tsum1 and tsum2 are used for winter wheat?
  - How is the start of the season defined?
  - How is the end of the season defined?

Crop simulation: Soil map

- Soil characteristics
  - SOIL_TYPOLOGIC_UNIT (STU)
  - ROOTING_DEPTH
  - SOIL_PHYSICAL_GROUP
  - SUITABILITY (suitable stu per crop_group)
  - SITE (infiltration and surface storage parameter)
- Spatial distribution of STU's
  - SOIL_MAPPING_UNIT (SMU)
  - SOIL_ASSOCIATION_COMPOSITION
  - SMU_SUITABILITY (suitability of smu per crop_group)

Crop simulation: Administrative regions

- Hierarchical structure of regions
  - NUTS
  - Different levels
- Aggregation
  - EUROSTAT (YIELD)
  - AGGREGATION_AREAS (CULTIVATED AREA)

Crop simulation: Spatial schematization

- Wofost acts on weather, soil and crop

- Unique combination of weather, soil and crop
  - Intersection GRID and Soil map units (SMU's)

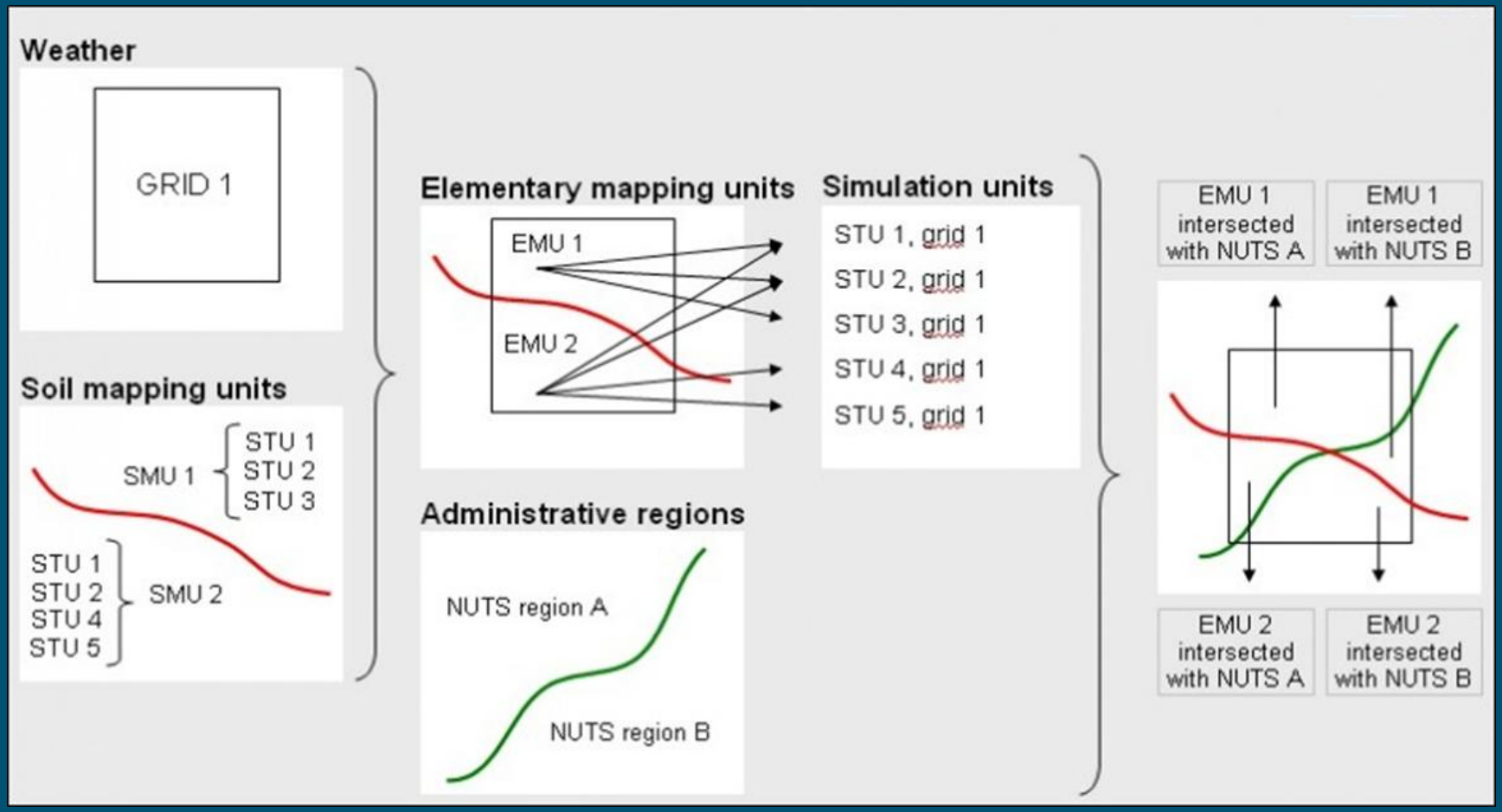
  ELEMENTARY_MAPPING_UNIT (EMU)
  - Intersection EMU and NUTS:

  EMU_PLUS_NUTS

  EMU_PLUS_NUTS_LANDCOVER

  SIMULATION_UNIT

Crop simulation: Spatial schematization



Crop simulation: Spatial schematization

- Question:
  - How many times is Wofost run for grid cell 69163?

Crop simulation: output tables

Name	Source	Procedure
INITIAL_SOIL_WATER	SIMULATION_UNIT SOIL_PHYSICAL_GROUP SOIL_TYPOLOGIC_UNIT ROOTING_DEPTH	isw_01_first_year.sql isw_02_other_years.sql isw_03_update.sql
CROP_YIELD	CROP CROP_CALENDAR CROP_PARAMETER_VALUE PARAMETER_DESCRIPTION VARIETY_PARAMETER_VALUE GRID GRID_WEATHER ELEMENTARY_MAPPING_UNIT SIMULATION_UNIT SIMULATION_LOG INITIAL_SOIL_WATER SYSCON SITE SOIL_TYPOLOGIC_UNIT ROOTING_DEPTH SOIL_PHYSICAL_GROUP SMU_SUITABILITY SOIL_ASSOCIATION_COMPOSITION	CGMS.exe
GRID_YIELD	CROP CROP_YIELD EMU_PLUS_NUTS_LANDCOVER SMU_SUITABILITY	CGMS.exe
NUTS_YIELD (level 3)	CROP NUTS CROP_YIELD EMU_PLUS_NUTS_LANDCOVER SMU_SUITABILITY	CGMS.exe or aggr_nuts_yield.sql
NUTS_YIELD (level 2, 1, 0)	CROP NUTS NUTS_YIELD AGGREGATION_AREAS	CGMS.exe or aggr_nuts_yield.sql

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Crop simulation

- Questions:
  - How long is the CROP_YIELD archive in ANHUI.mdb?
  - Simulate the next year with CGMS.exe
  - Check the length of the CROP_YIELD archive in ANHUI.mdb

Crop simulation

- Questions:
  - How long is the GRID_YIELD archive in ANHUI.mdb?
  - Aggregate the next year with CGMS.exe
  - Check the length of the GRID_YIELD archive in ANHUI.mdb
  - Do the same for NUTS_YIELD

Crop simulation

- Questions on crop simulation?

Yield forecasting: objective

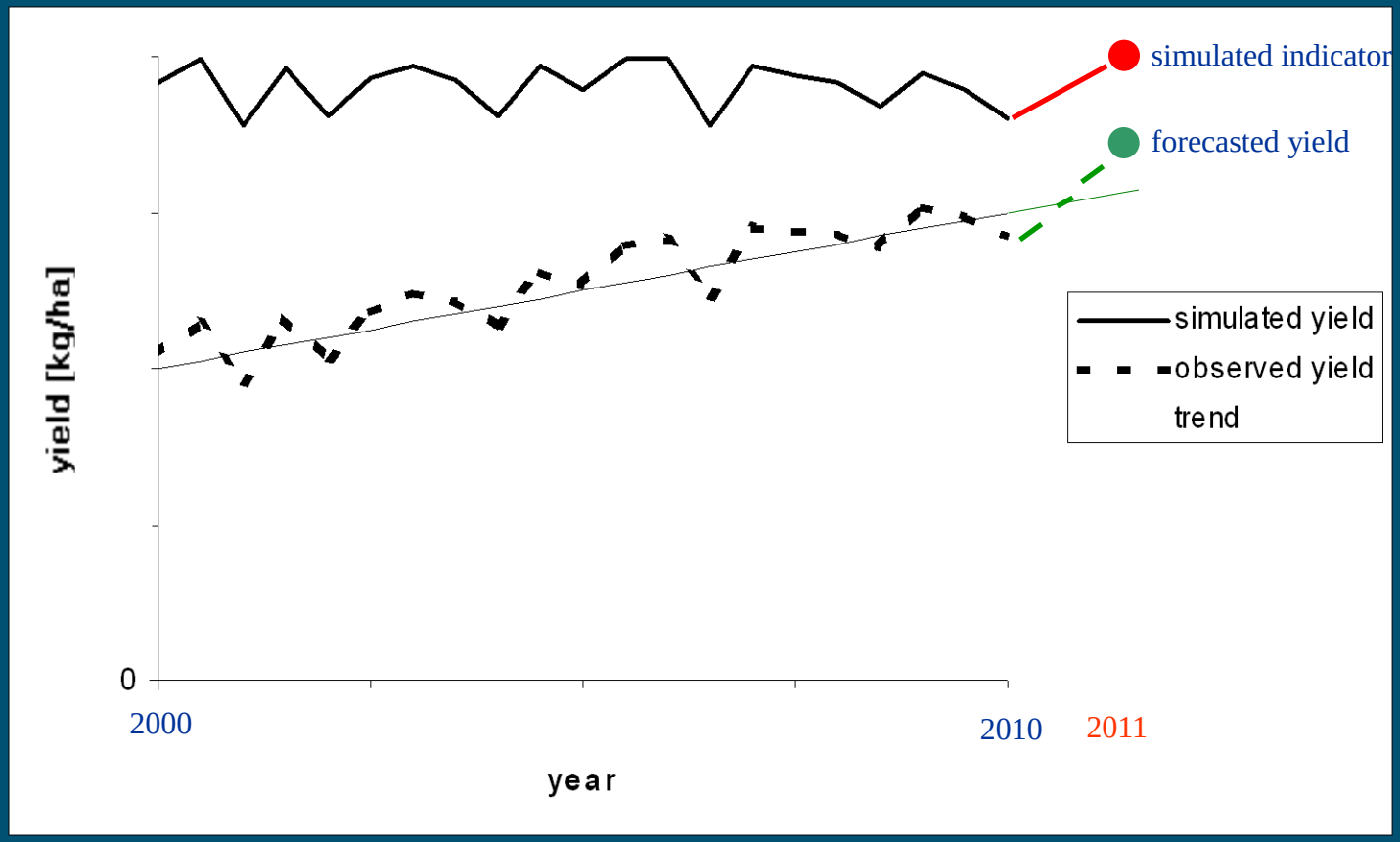
- Provide yield statistics of major crops at EU and national level, as accurate and quick as possible, while ensuring independence from all external sources.

- Predict the "official statistical" crop yield:

  forecasted_yield = trend + f(simulated_yield)

Yield forecasting: overview

- Long term technological trend
- CGMS predicts deviation from trend caused by weather



Yield forecasting: tables

- Input
  - EUROSTAT
  - DATA_FOR_YIELD_FORECAST
  - MODEL_EXCL_YEARS
  - MODEL_INCL_INDICATORS
  - MODEL_REGR_INDICATORS
  - RUN
- Output
  - FORECASTED_NUTS_YIELD
  - FORECASTED_NUTS_YIELD_HIS

- Any questions?

End

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