Ministry of Waters and Environmental Protection - Romania

Danish Environmental Protection Agency
DANCEE - Danish Co-operation for Environment in Eastern Europe

DANCEE Ref. No. 124/033-0072

Assistance to Romania on Transposition and Implementation of the EU Ambient Air Quality Directives

AirQUIS Training Workshop at NILU

DECEMBER 2001

COWI NILU

in association with

NERI

AGRARO

IDAQ

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DECEMBER 2001

Bjarne Sivertsen and Rune Ødegård, NILU

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Table of Contents

1 Introduction and background

Training on use of the AirQUIS system represents an integral part of the training on techniques for evaluation of existing data. The AirQUIS database system will serve as a database for preparing the input to future air quality modelling. A first introduction to the use of AirQUIS was given at NILU in September 2001 to one of our Romanian consultants and to the subcontractor responsible for air quality modelling in the IDAQ project.

The NILU developed AirQUIS system is a map oriented, user-friendly air quality management system to be used in urban and industrial areas. It contains all modules necessary to perform air quality assessment, such as databases for measurement and emissions, dispersion models and exposure module for health and materials. The AirQUIS system operates through menus and maps on Windows NT or Windows 2000 platform in network with several PC clients. The AirQUIS system was delivered to the IDAQ project on a server with 4 clients.

The workshop prepared and presented at NILU from 4 to 7 September 2001 contained an introduction to the system and demonstrations of the air quality database and the emission inventory module. During this workshop, maps and data from the Pilot EPIs were collected and used for demonstration purposes. Possibilities and future applications for Romania were presented and their future tasks and responsibilities were discussed.

Copies of overhead slides used during the presentations and discussions are presented in Chapter 4.

Further presentations of AirQUIS will be given in Bucharest (Sivertsen, F 9/2001). The programme for this workshop can be found in Mission 5 Report from NILU (Sivertsen, OR 65/2001).

2 Schedule

A tentative schedule for the workshop was prepared and agreed upon with the participants. The schedule is given in the following Table.

Date	Time	Activity	Responsible person(s) at NILU
4 September	12:00 – 16:00	**AirQUIS Introduction**	B. Sivertsen
5 September	09:00 – 12:00	**GIS and Measurement Database**	R. Ødegård
5 September	12:00 – 13:00	**Lunch**	
5 September	13:00 – 16:00	**Industry and Area Source Emission Database**	R. Ødegård
6 September	09:00 – 12:00	**Traffic Source Emission Database**	R. Ødegård
6 September	12:00 – 13:00	**Lunch**	
6 September	13:00 – 16:00	**Interface between the DMU models and AirQUIS Discussion**	R. Ødegård
7 September	09:00 – 12:00	**Measurement Database Exercises**	R. Ødegård
7 September	12:00 – 13:00	**Lunch**	
7 September	13:00 – 16:00	**Emission Database Exercises**	R. Ødegård

3 Participants

George Mocioaca, Air Quality Specialist
AGRARO CONSULT S.R.L.
36 Jean Louis Calderon St.
Scara A, Ap. 4, Sector 2
Bucharest
Telephone: +40 (1) 311 0350
Mobile tel: +40 94 350 123

Steen Solvang Jensen (SSJ@dmu.dk)
NERI (Danish Environmental Research Institute)
Postboks 358
Frederiksborgvej 399
DK-4000 Roskilde
Denmark
Tel: +45 4630 1200
Fax: +45 4630 1114

From NILU:

Rune Ødegaard
Bjarne Sivertsen
Hildegunn Jablonska

4 References

Sivertsen, B. (2001) AirQuis. Presented at the AirQuis Workshop, Bucharest, 25 October 2001. Kjeller (NILU F 9/2001).

Sivertsen, B. and Ødegård, R. (2001) Assistance to Romania on transposition and implementation of the EU ambient air quality directives. Mission 5; Report from NILU. Kjeller (NILU OR 65/2001).

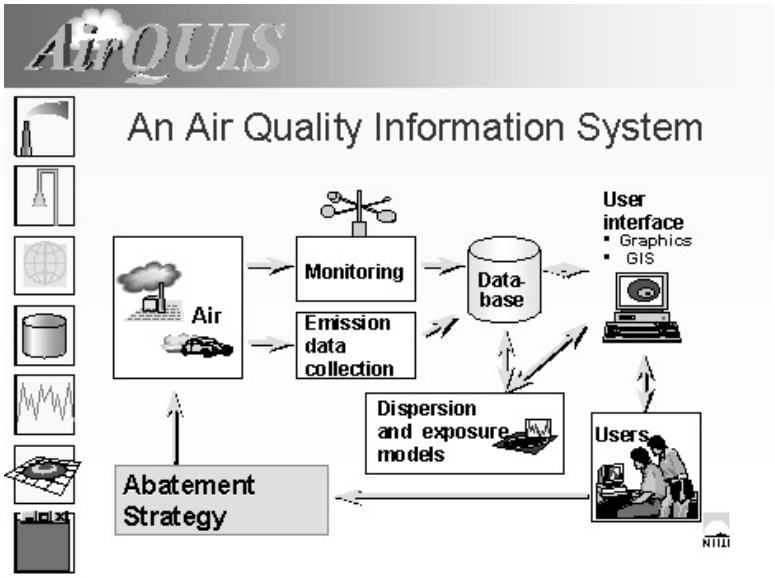
5 Presentations

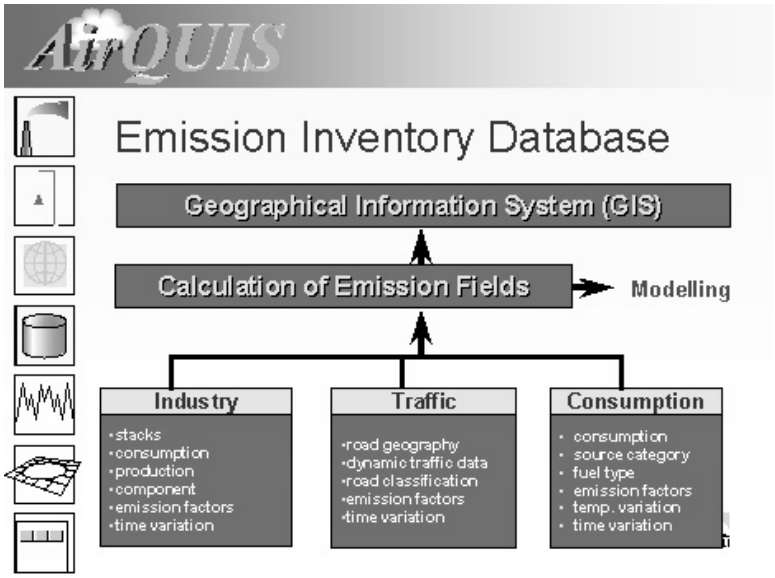
As part of the presentations and demonstrations some air quality data from Romanian Pilot areas should have been collected for input and to AirQUIS. Furthermore, we tried to collect some digital maps before the training at NILU. This, however, was a problem, but our consultant, George Mocioaca, had managed to collect some information, which he brought to NILU on CD. A status for the data collection was discussed and presented at the workshop at NILU.

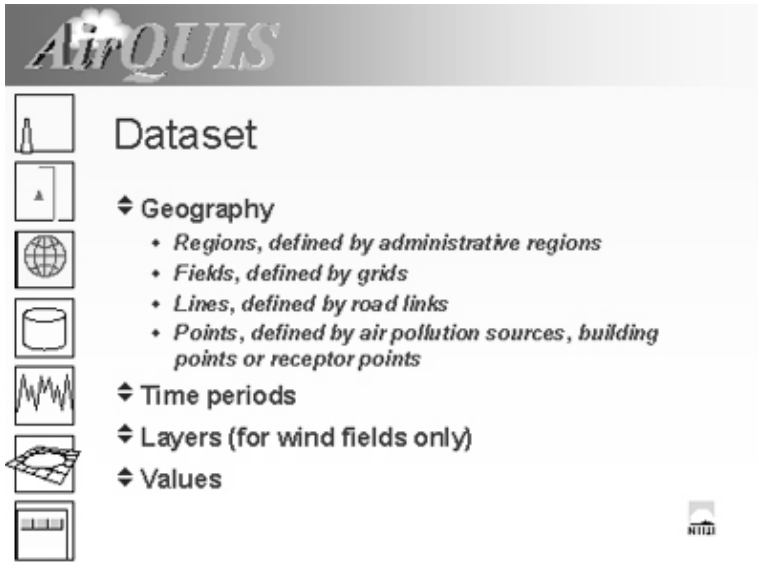
According to the work plan the following data should have been available (collected by the EPIs and delivered to AGRARO), also as part of the input to the NERI dispersion models:
- Selection of a limited number of street canyons in the pilot areas
- General description of the streets
- Maps of the streets with individual buildings
- Street configuration data

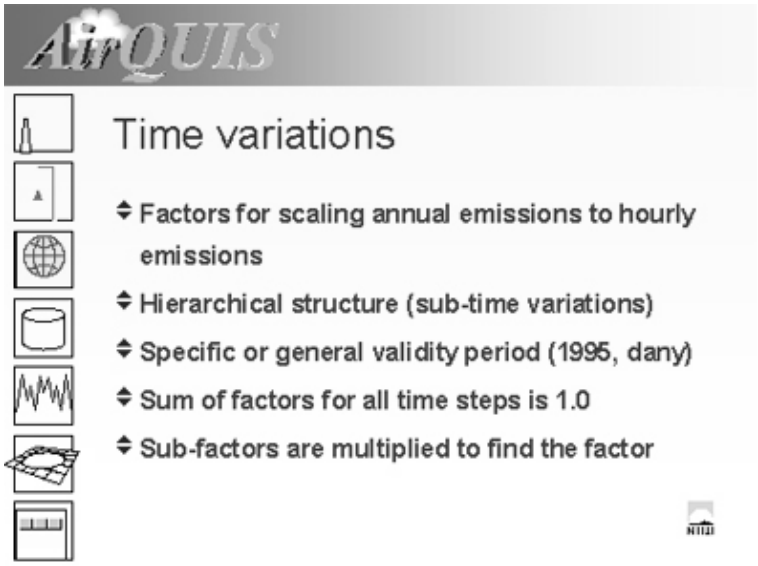
Also some source and emission data for point sources should be available. George Mocioaca also brought these data to NILU, and some of them were imported to AirQUIS and tested.

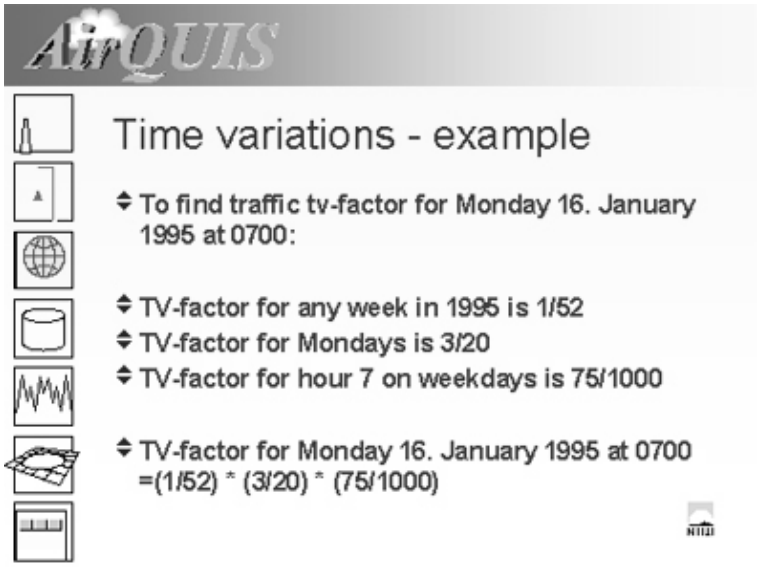
Concerning digital maps the collection started and available maps were import to AirQUIS.

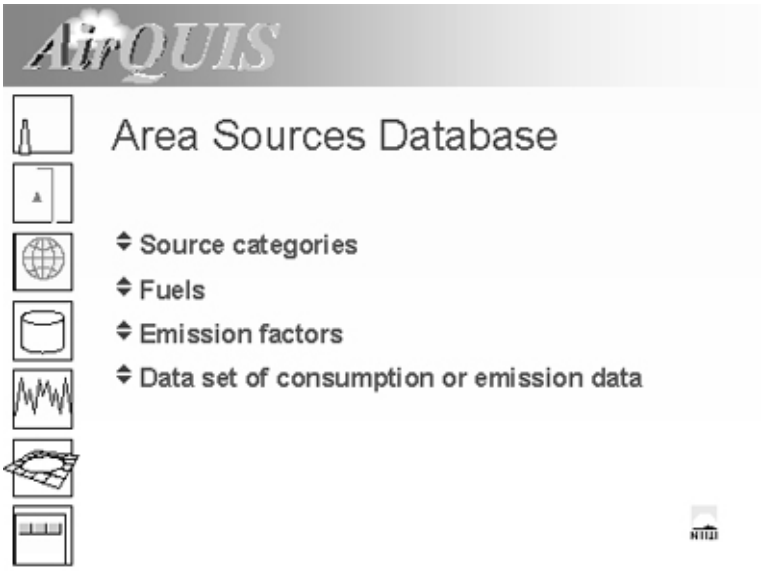

AirQUIS
An Air Quality Information System
Air
Monitoring
Emission data collection
Data-base
User interface
Graphics
GIS
Dispersion and exposure models
Users
Abatement Strategy


AirQUIS
Emission Inventory Database
Geographical Information System (GIS)
Calculation of Emission Fields
Modelling
Industry
•stacks
•consumption
•production
•component
•emission factors
•time variation
Traffic
•road geography
•dynamic traffic data
•road classification
•emission factors
•time variation
Consumption
• consumption
• source category
• fuel type
• emission factors
• temp. variation
• time variation


AirQUIS
Dataset
Geography
Regions, defined by administrative regions
Fields, defined by grids
Lines, defined by road links
Points, defined by air pollution sources, building points or receptor points
Time periods
Layers (for wind fields only)
Values


AirQUIS
Time variations
Factors for scaling annual emissions to hourly emissions
Hierarchical structure (sub-time variations)
Specific or general validity period (1995, dany)
Sum of factors for all time steps is 1.0
Sub-factors are multiplied to find the factor


AirQUIS
Time variations - example
To find traffic tv-factor for Monday 16. January 1995 at 0700:
TV-factor for any week in 1995 is 1/52
TV-factor for Mondays is 3/20
TV-factor for hour 7 on weekdays is 75/1000
TV-factor for Monday 16. January 1995 at 0700 =(1/52) * (3/20) * (75/1000)


AirQUIS
Area Sources Database
Source categories
Fuels
Emission factors
Data set of consumption or emission data

AirQUIS

Temperature Corrections

- Source is active when temperature drops below T_{start}
- Consumption/Emission is normalised with a factor K
- $K=(T_{measured}-T_{start})/(T_{average}-T_{start})$
- $T_{measured}$ is the temperature for the hour of calculation
- $T_{average}$ is the seasonal average temperature for the hour of the day

AirQUIS

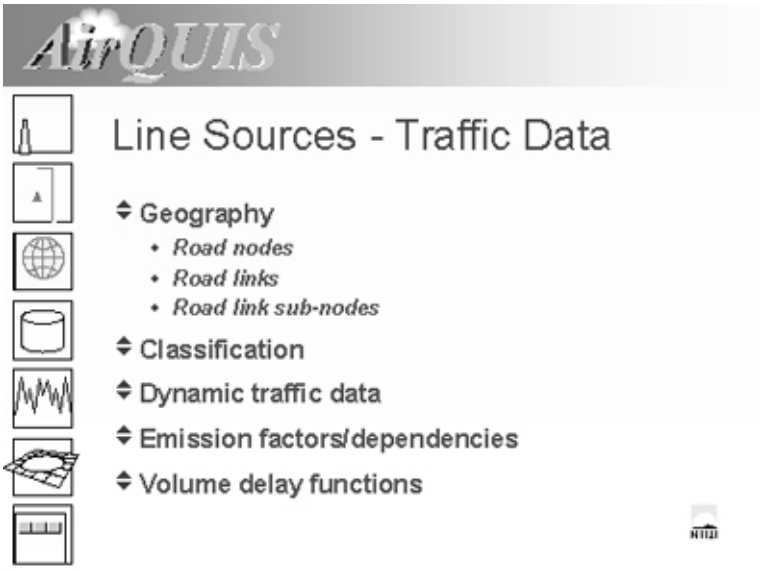
Point Sources

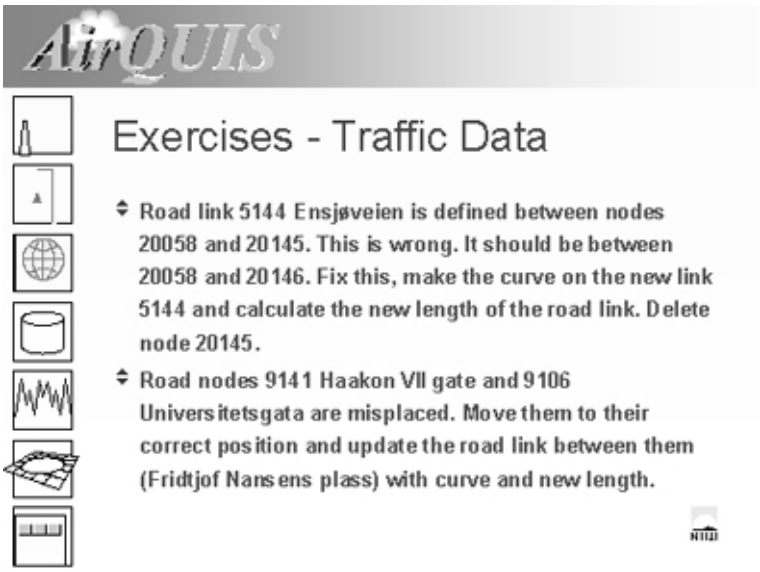
- Industries
- Stacks, physical data
- Processes, emission/consumption/production data
- Time variations
- Emission factors
- Cleaning devices

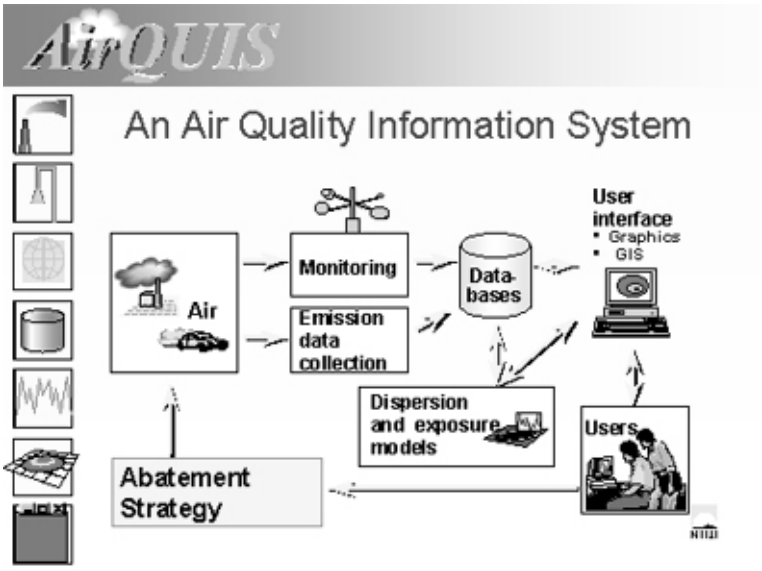
AirQUIS

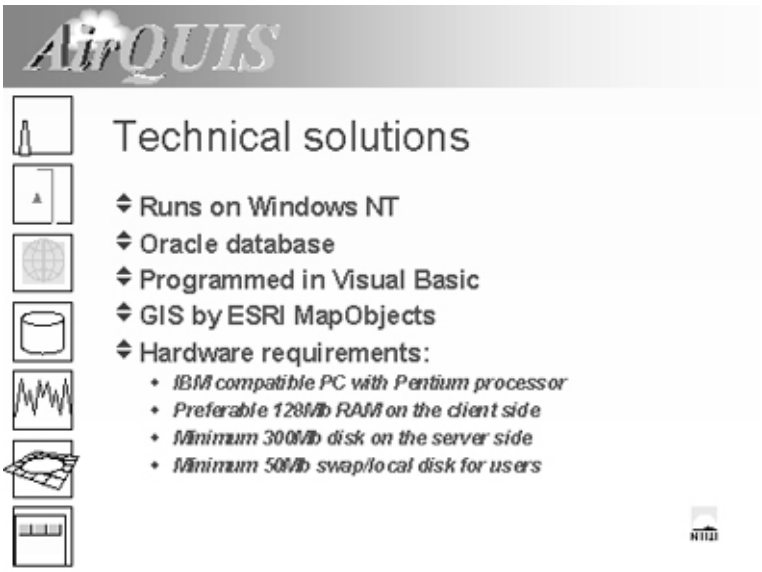
Exercises

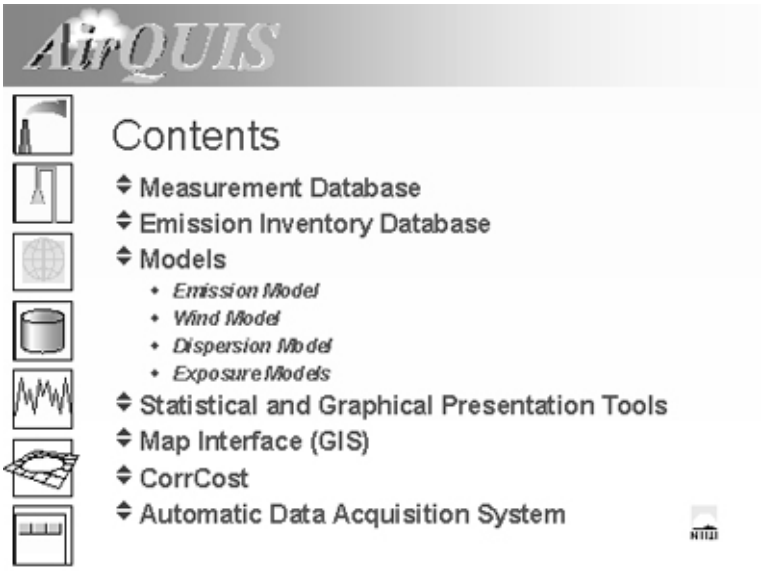
- Define a new region dataset with the following properties:
  - *Name: Test dataset*
  - *Data Type: Consumption data*
  - *Source category: Industry*
  - *Fuel: Light fuel oil*
  - *Unit: ton/year*
- Define the following time period and variation for the dataset:
  - *VP = 1995*
  - *TV = TV024*
- Enter some values to the dataset


AirQUIS
Line Sources - Traffic Data
Geography
Road nodes
Road links
Road link sub-nodes
Classification
Dynamic traffic data
Emission factors/dependencies
Volume delay functions

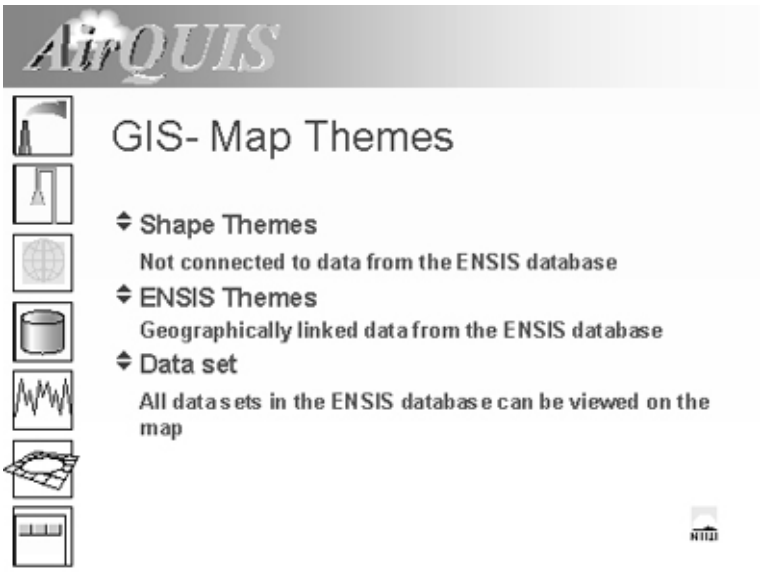

AirQUIS
Exercises - Traffic Data
Road link 5144 Ensjøveien is defined between nodes 20058 and 20145. This is wrong. It should be between 20058 and 20146. Fix this, make the curve on the new link 5144 and calculate the new length of the road link. Delete node 20145.
Road nodes 9141 Haakon VII gate and 9106 Universitetsgata are misplaced. Move them to their correct position and update the road link between them (Fridtjof Nansens plass) with curve and new length.

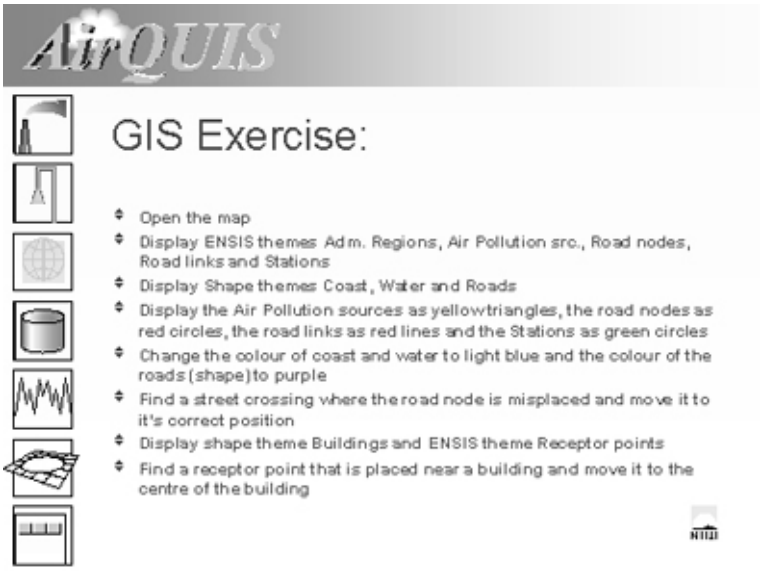

AirQUIS
An Air Quality Information System
Air
Monitoring
Emission data collection
Data-bases
User interface
Graphics
GIS
Dispersion and exposure models
Users
Abatement Strategy

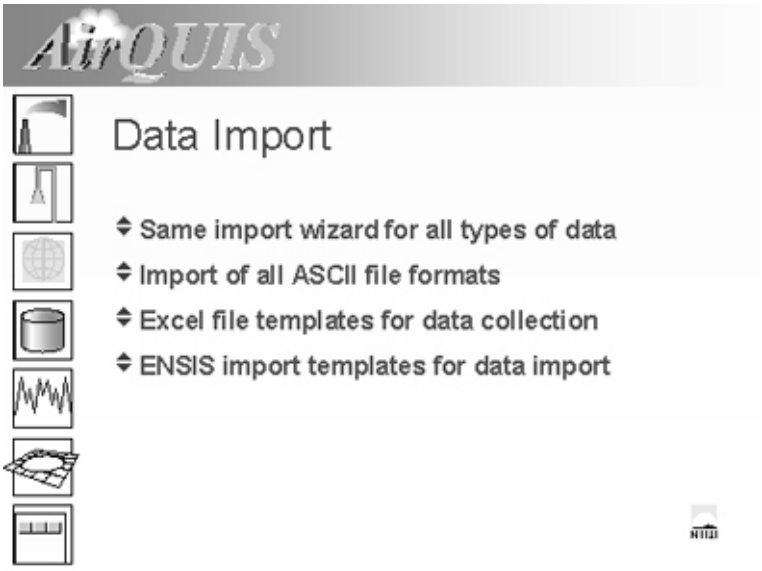

AirQUIS
Technical solutions
Runs on Windows NT
Oracle database
Programmed in Visual Basic
GIS by ESRI MapObjects
Hardware requirements:
IBM compatible PC with Pentium processor
Preferable 128Mb RAM on the client side
Minimum 300Mb disk on the server side
Minimum 50Mb swap/local disk for users

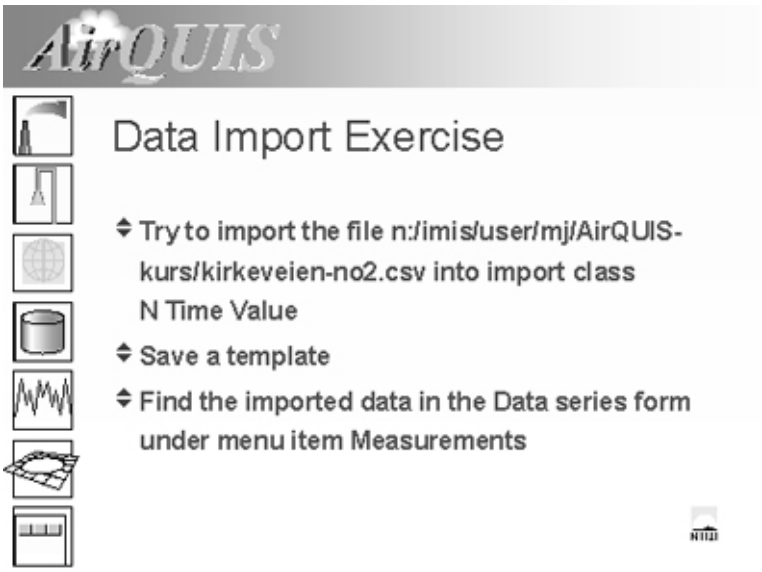

AirQUIS
Contents
Measurement Database
Emission Inventory Database
Models
Emission Model
Wind Model
Dispersion Model
Exposure Models
Statistical and Graphical Presentation Tools
Map Interface (GIS)
CorrCost
Automatic Data Acquisition System

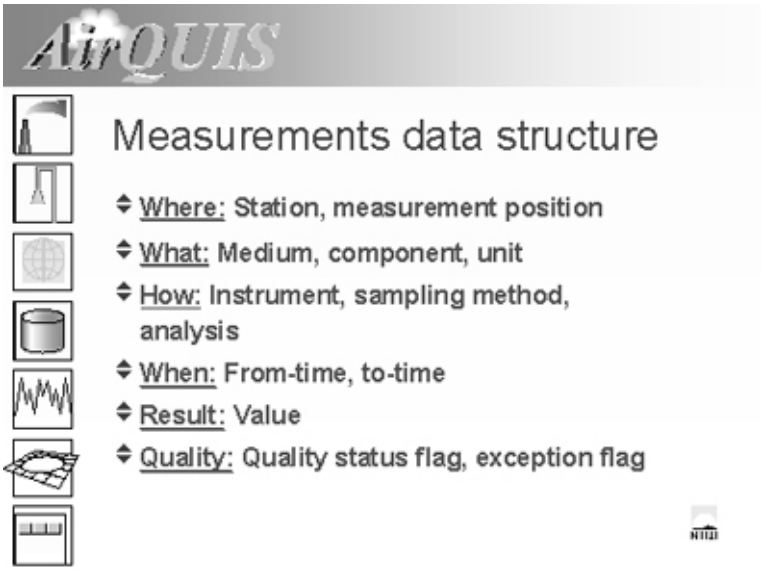

AirQUIS
ENSIS User Manager
Database organising:
Users
Projects
Users access to projects
Map setting for projects

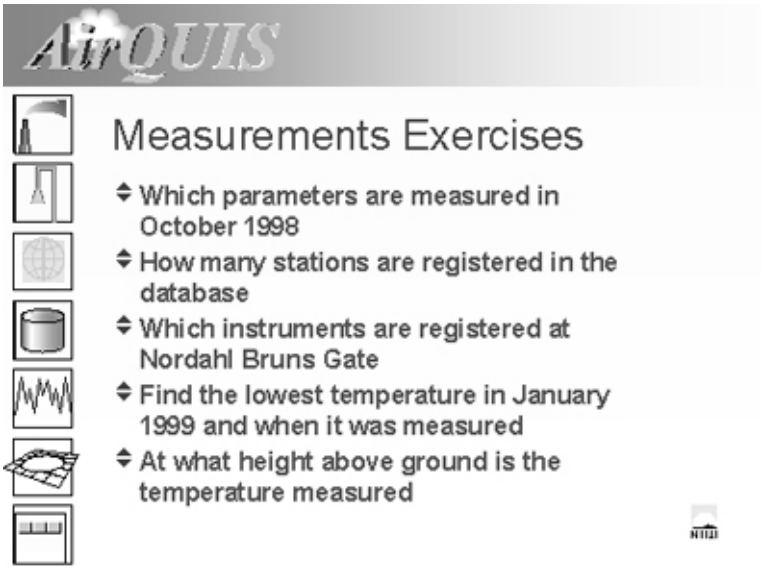

AirQUIS
GIS- Map Themes
Shape Themes
Not connected to data from the ENSIS database
ENSIS Themes
Geographically linked data from the ENSIS database
Data set
All data sets in the ENSIS database can be viewed on the map

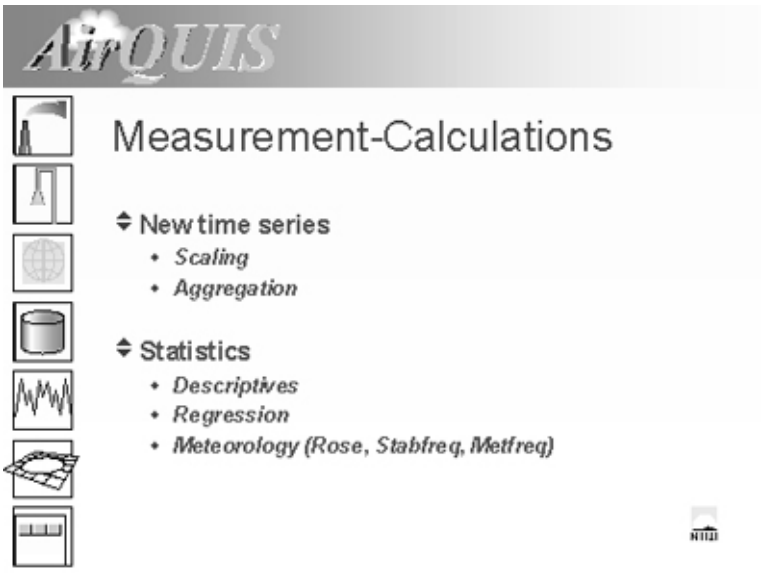

AirQUIS
GIS Exercise:
Open the map
Display ENSIS themes Adm. Regions, Air Pollution src., Road nodes, Road links and Stations
Display Shape themes Coast, Water and Roads
Display the Air Pollution sources as yellowtriangles, the road nodes as red circles, the road links as red lines and the Stations as green circles
Change the colour of coast and water to light blue and the colour of the roads (shape)to purple
Find a street crossing where the road node is misplaced and move it to it's correct position
Display shape theme Buildings and ENSIS theme Receptor points
Find a receptor point that is placed near a building and move it to the centre of the building

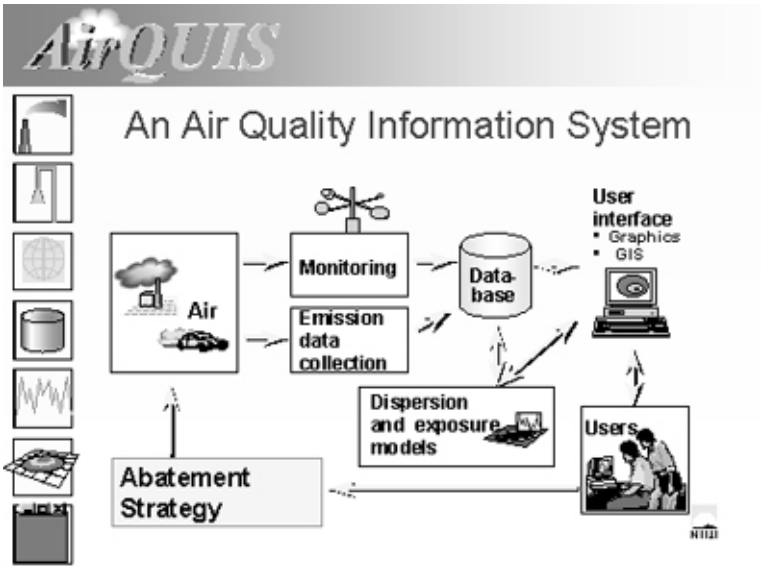

AirQUIS
Data Import
Same import wizard for all types of data
Import of all ASCII file formats
Excel file templates for data collection
ENSIS import templates for data import


AirQUIS
Data Import Exercise
Try to import the file n:/imis/user/mj/AirQUIS-kurs/kirkeveien-no2.csv into import class N Time Value
Save a template
Find the imported data in the Data series form under menu item Measurements


AirQUIS
Measurements data structure
Where: Station, measurement position
What: Medium, component, unit
How: Instrument, sampling method, analysis
When: From-time, to-time
Result: Value
Quality: Quality status flag, exception flag


AirQUIS
Measurements Exercises
Which parameters are measured in October 1998
How many stations are registered in the database
Which instruments are registered at Nordahl Bruns Gate
Find the lowest temperature in January 1999 and when it was measured
At what height above ground is the temperature measured


AirQUIS
Measurement-Calculations
New time series
Scaling
Aggregation
Statistics
Descriptives
Regression
Meteorology (Rose, Stabfreq, Metfreq)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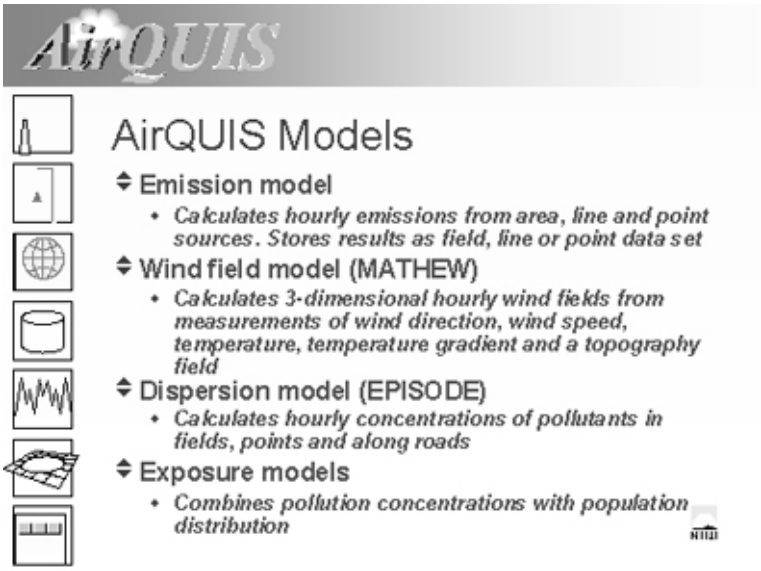
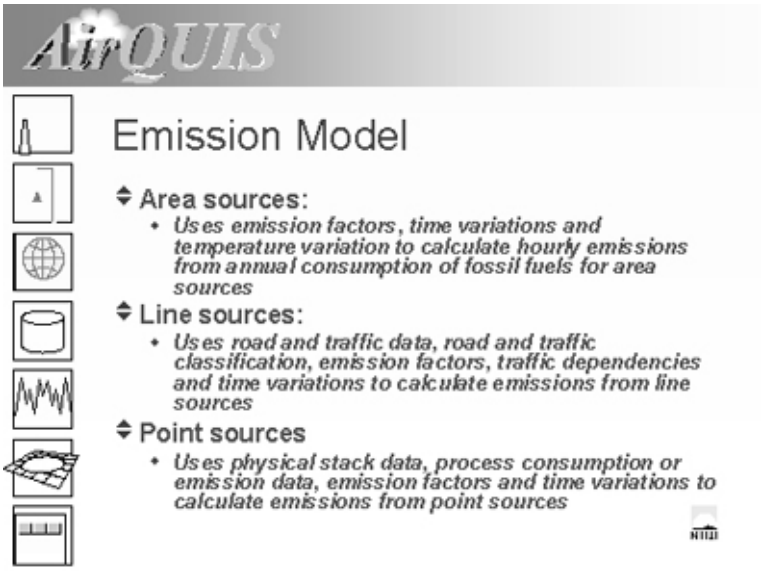
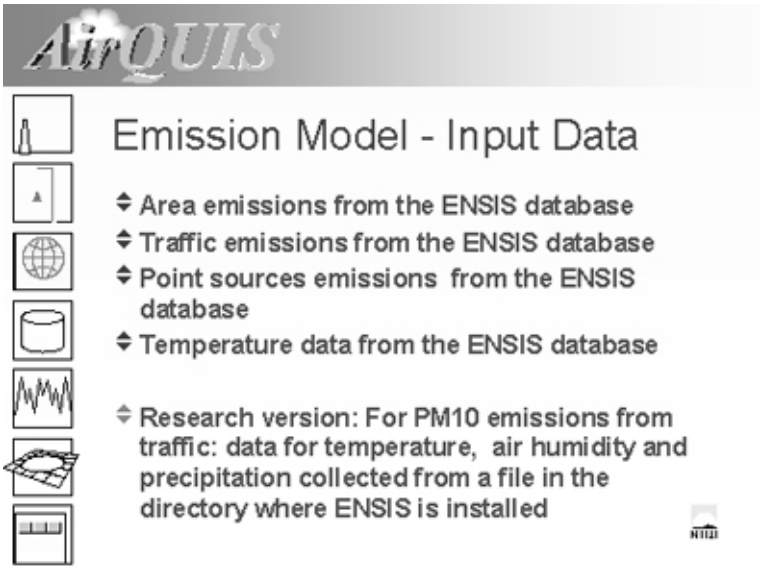
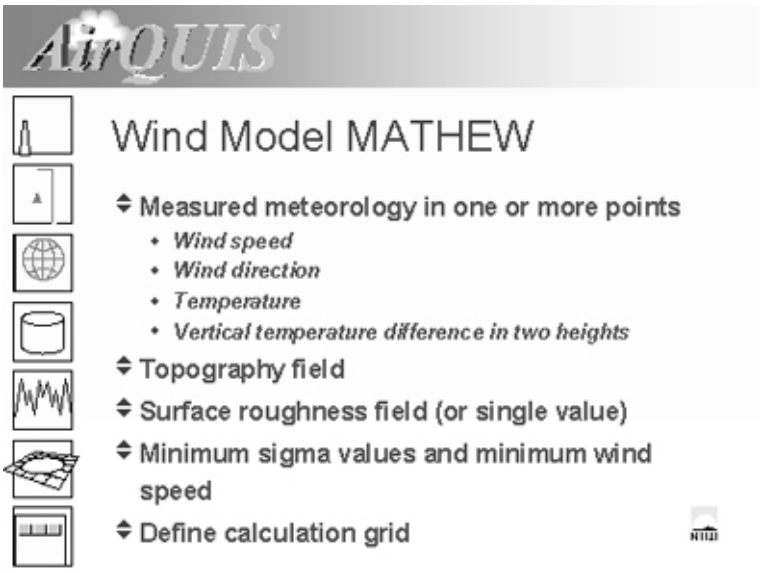
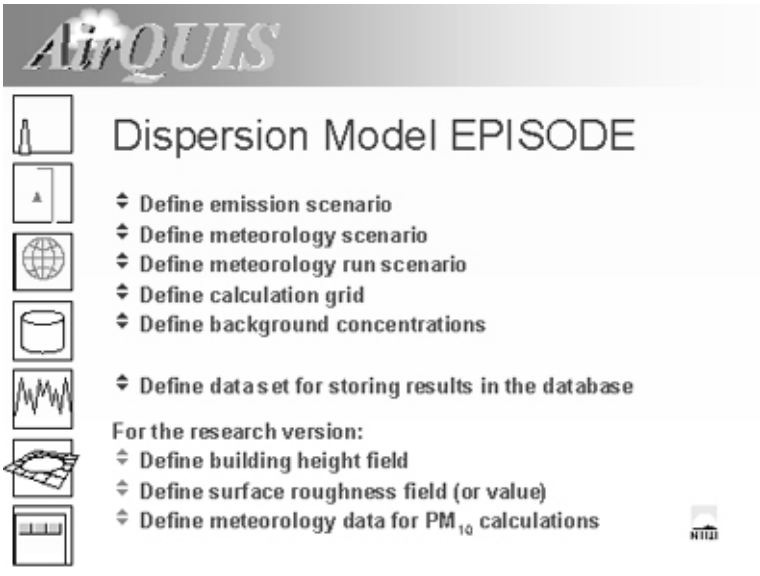
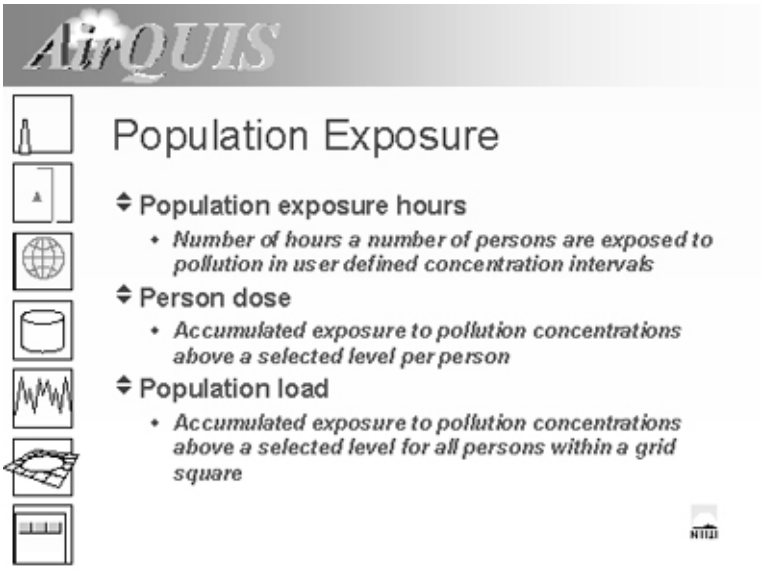

AirQUIS
AirQUIS Models
Emission model
Calculates hourly emissions from area, line and point sources. Stores results as field, line or point data set
Wind field model (MATHEW)
Calculates 3-dimensional hourly wind fields from measurements of wind direction, wind speed, temperature, temperature gradient and a topography field
Dispersion model (EPISODE)
Calculates hourly concentrations of pollutants in fields, points and along roads
Exposure models
Combines pollution concentrations with population distribution

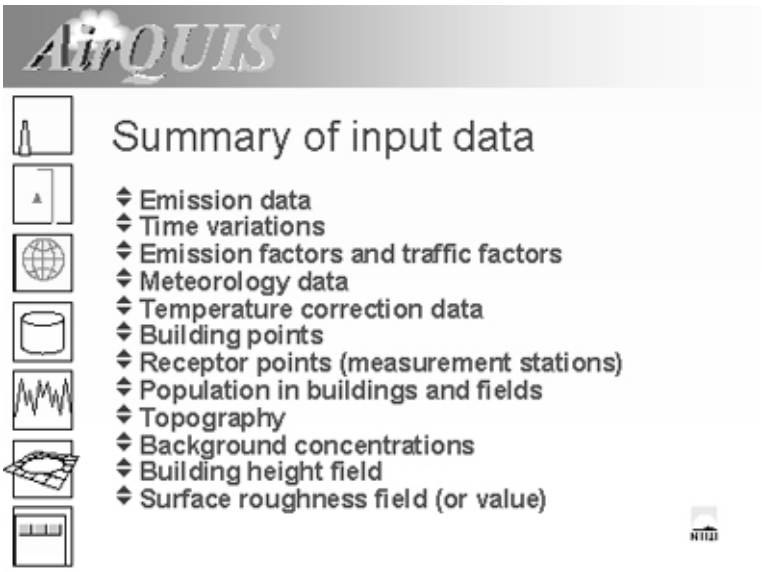

AirQUIS
Emission Model
Area sources:
Uses emission factors, time variations and temperature variation to calculate hourly emissions from annual consumption of fossil fuels for area sources
Line sources:
Uses road and traffic data, road and traffic classification, emission factors, traffic dependencies and time variations to calculate emissions from line sources
Point sources
Uses physical stack data, process consumption or emission data, emission factors and time variations to calculate emissions from point sources

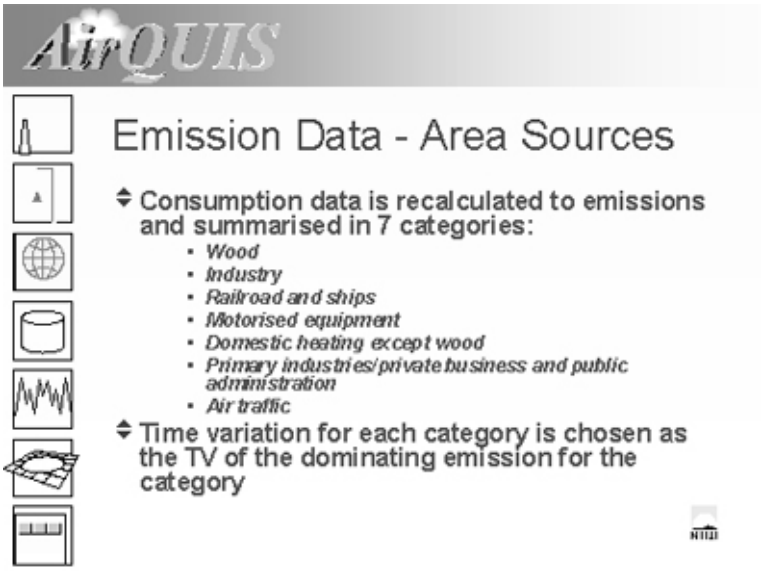

AirQUIS
Emission Model - Input Data
Area emissions from the ENSIS database
Traffic emissions from the ENSIS database
Point sources emissions from the ENSIS database
Temperature data from the ENSIS database
Research version: For PM10 emissions from traffic: data for temperature, air humidity and precipitation collected from a file in the directory where ENSIS is installed

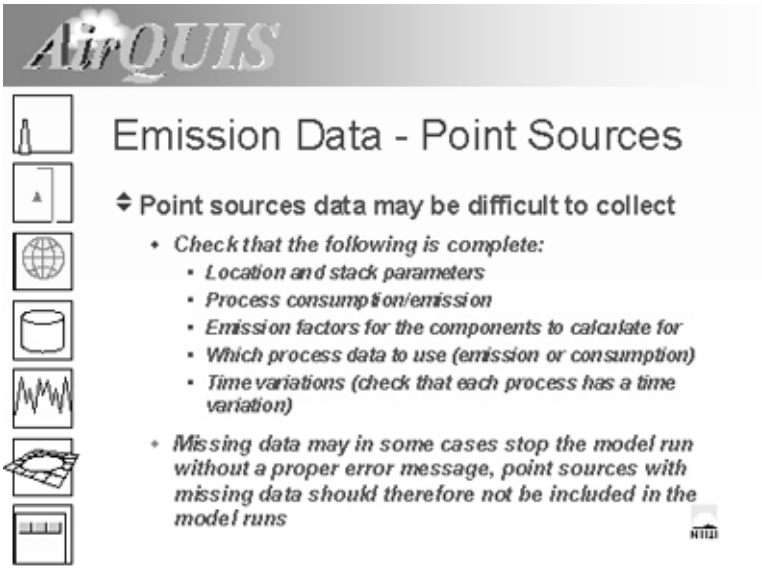

AirQUIS
Wind Model MATHEW
Measured meteorology in one or more points
Wind speed
Wind direction
Temperature
Vertical temperature difference in two heights
Topography field
Surface roughness field (or single value)
Minimum sigma values and minimum wind speed
Define calculation grid

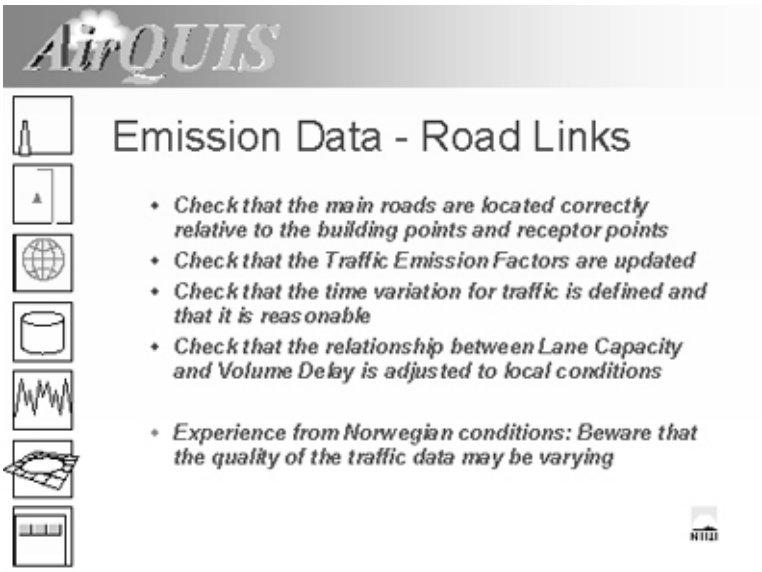

AirQUIS
Dispersion Model EPISODE
Define emission scenario
Define meteorology scenario
Define meteorology run scenario
Define calculation grid
Define background concentrations
Define data set for storing results in the database
For the research version:
Define building height field
Define surface roughness field (or value)
Define meteorology data for PM10 calculations

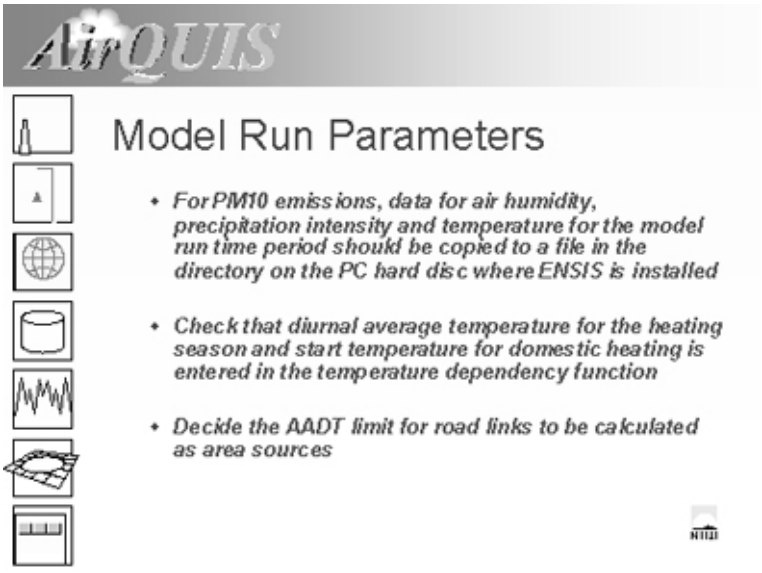

AirQUIS
Population Exposure
Population exposure hours
Number of hours a number of persons are exposed to pollution in user defined concentration intervals
Person dose
Accumulated exposure to pollution concentrations above a selected level per person
Population load
Accumulated exposure to pollution concentrations above a selected level for all persons within a grid square

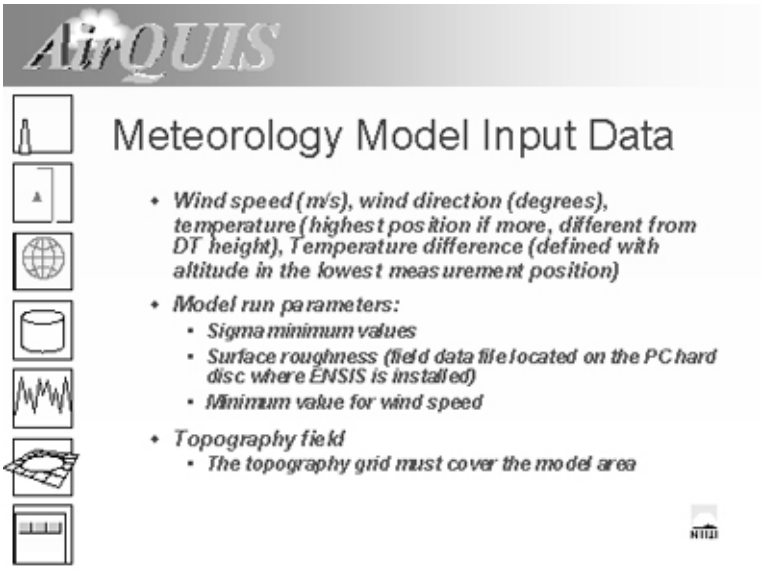

AirQUIS
Summary of input data
Emission data
Time variations
Emission factors and traffic factors
Meteorology data
Temperature correction data
Building points
Receptor points (measurement stations)
Population in buildings and fields
Topography
Background concentrations
Building height field
Surface roughness field (or value)

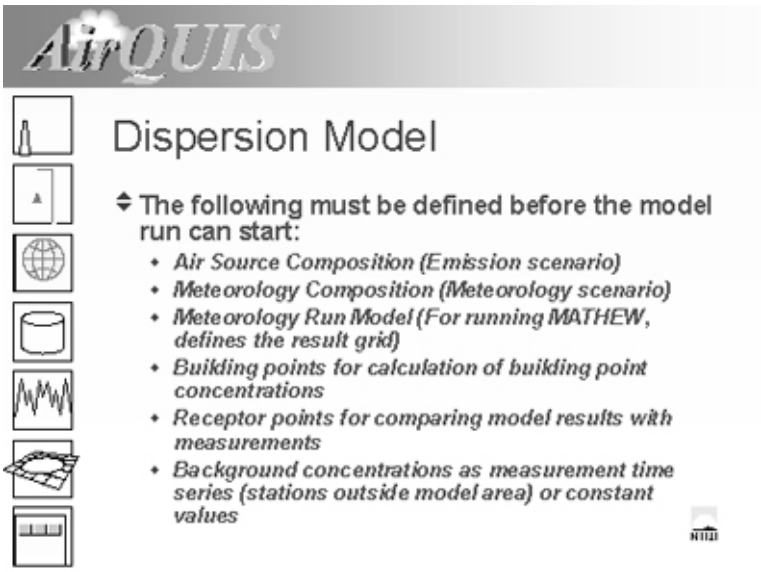

AirQUIS
Emission Data - Area Sources
Consumption data is recalculated to emissions and summarised in 7 categories:
Wood
Industry
Railroad and ships
Motorised equipment
Domestic heating except wood
Primary industries/private business and public administration
Air traffic
Time variation for each category is chosen as the TV of the dominating emission for the category

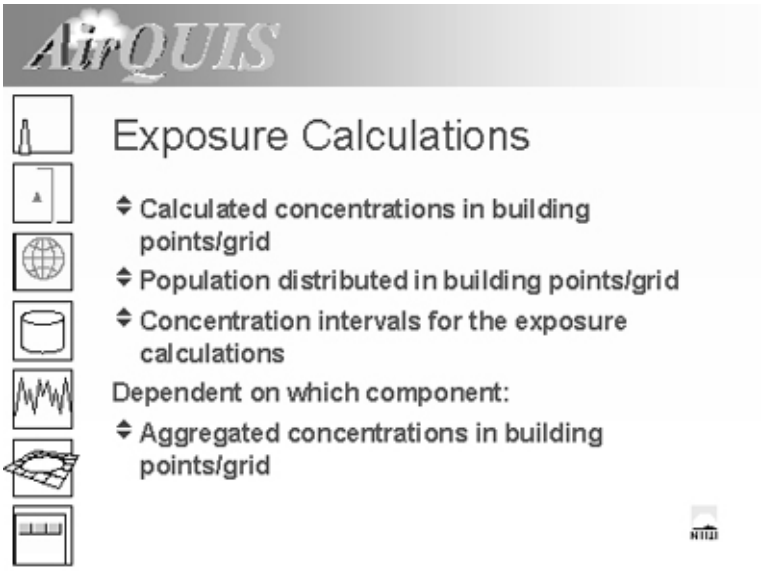

AirQUIS
Emission Data - Point Sources
Point sources data may be difficult to collect
Check that the following is complete:
Location and stack parameters
Process consumption/emission
Emission factors for the components to calculate for
Which process data to use (emission or consumption)
Time variations (check that each process has a time variation)
Missing data may in some cases stop the model run without a proper error message, point sources with missing data should therefore not be included in the model runs


AirQUIS
Emission Data - Road Links
Check that the main roads are located correctly relative to the building points and receptor points
Check that the Traffic Emission Factors are updated
Check that the time variation for traffic is defined and that it is reasonable
Check that the relationship between Lane Capacity and Volume Delay is adjusted to local conditions
Experience from Norwegian conditions: Beware that the quality of the traffic data may be varying


AirQUIS
Model Run Parameters
For PM10 emissions, data for air humidity, precipitation intensity and temperature for the model run time period should be copied to a file in the directory on the PC hard disc where ENSIS is installed
Check that diurnal average temperature for the heating season and start temperature for domestic heating is entered in the temperature dependency function
Decide the AADT limit for road links to be calculated as area sources


AirQUIS
Meteorology Model Input Data
Wind speed (m/s), wind direction (degrees), temperature (highest position if more, different from DT height), Temperature difference (defined with altitude in the lowest measurement position)
Model run parameters:
Sigma minimum values
Surface roughness (field data file located on the PC hard disc where ENSIS is installed)
Minimum value for wind speed
Topography field
The topography grid must cover the model area


AirQUIS
Dispersion Model
The following must be defined before the model run can start:
Air Source Composition (Emission scenario)
Meteorology Composition (Meteorology scenario)
Meteorology Run Model (For running MATHEW, defines the result grid)
Building points for calculation of building point concentrations
Receptor points for comparing model results with measurements
Background concentrations as measurement time series (stations outside model area) or constant values


AirQUIS
Exposure Calculations
Calculated concentrations in building points/grid
Population distributed in building points/grid
Concentration intervals for the exposure calculations
Dependent on which component:
Aggregated concentrations in building points/grid

Norwegian Institute for Air Research (NILU)
P.O. Box 100, N-2027 Kjeller, Norway

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ABSTRACT

A training workshop for introducing the AirQUIS database and planning tool for the IDAQ consultant and for the NERI modelling expert was arranged at NILU from 4 to 7 September 2001. The report summerises the workshop and presents a selection of slides that was used in the presentations. Most of the work, however, was based on hand-on training.

NORWEGIAN TITLE

KEYWORDS		
Air quality	EU directives	Romania

ABSTRACT (in Norwegian)

* *Classification*
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