

# Joint Research Centre (JRC)

**The Institute for Health and Consumer Protection (IHCP)**  
Science for a healthier life



## The HEIMTSA computational toolbox

A. Gotti (on behalf of HEIMTSA toolbox team)



1. Quantify as fully as practicable the environmental health effects of policies in various sectors
  - Policies designed to improve health
  - Health effects of policies developed for other reasons
2. Give a fair = unbiased assessment of
  - Uncertainties in what is included
3. Identify priority information/knowledge gaps
  - Priority = having a major influence on answers
4. Enable assessment of environmental health effects of future policies



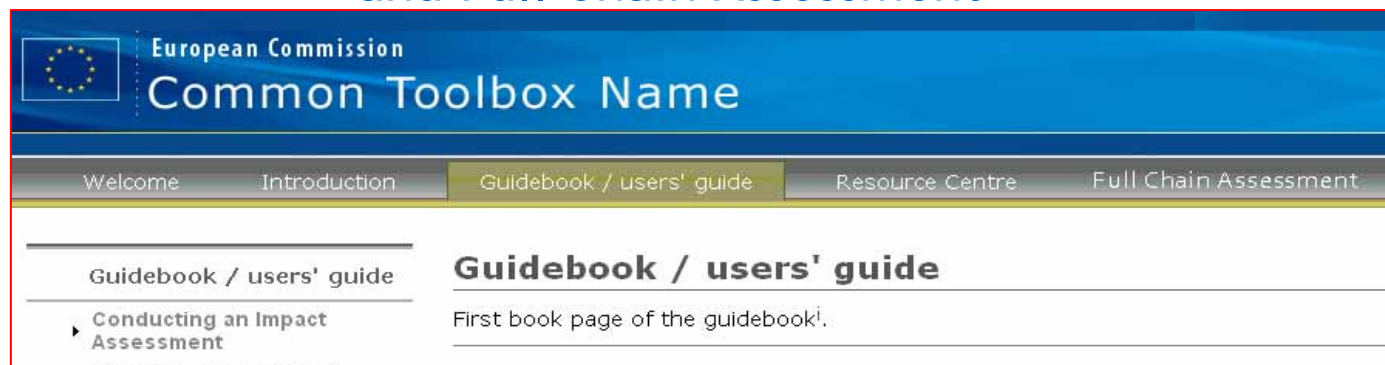
'Full chain' = 'Impact pathway'; from:

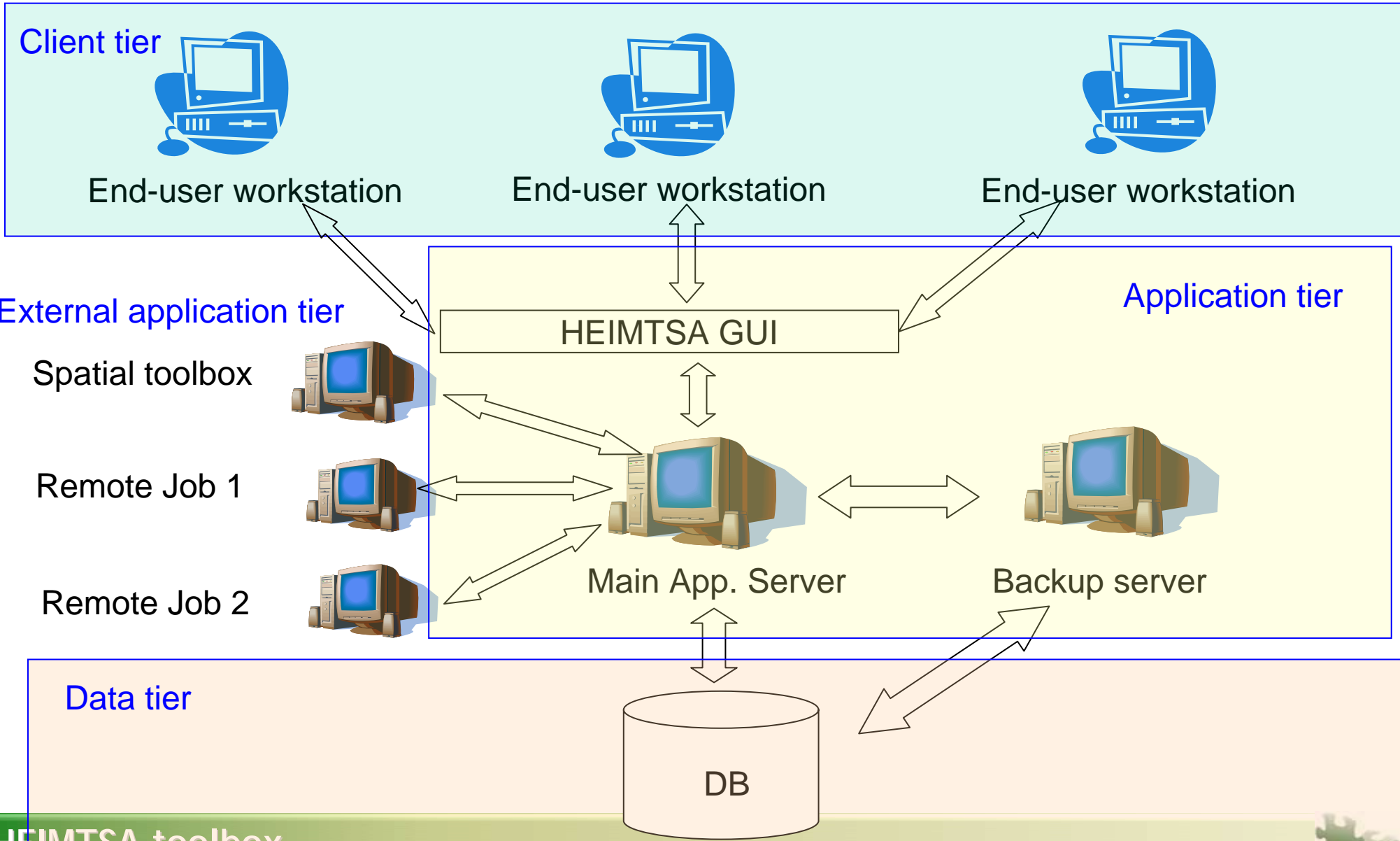
- i. (changes in) policy; to
- ii. (changes in) emissions, to air, soil and water; to
- iii. (changes in) pollutant concentrations in different environments; to
- iv. (changes in) exposures of individuals and populations (by inhalation, dermal and/or ingestion routes); to
- v. (changes in) internal dose at target organs in the body; to
- vi. (changes in) health impacts (overall and in sub-populations); to
- vii. (changes in) monetary value of health effects



- All these parts find their place in a coherent framework of a common INTARESE-HEIMTSA toolbox
- The aim is that the integrated toolbox contains:
  - a Guidebook
  - a Resource Centre
  - a Workspace to conduct full chain assessments by applying and linking ready to use models

View of an integrated toolbox with Guidebook, Resource Centre and Full Chain Assessment





Beside the HEIMTSA Db the toolbox includes five vertical computational modules:

1. Emission module (to calculate emissions)
2. Concentration module (from emission to concentration)
3. Exposure module (from concentration to exposure)
4. Health impact module (from exposure to health impacts)
5. Monetary valuation module (form health impacts to costs)

And two horizontal modules

1. Visualization module
2. Uncertainty module



> home > chains > documents  
 your are in: [home](#) > execution details

## Execution details

Chain and Stressor	Complex for arsenico
Launched by	reinavi
Start date	06-04-2009
End date	06-04-2009

## Steps

Step	Model	Details
>> 1	MSCE	URL: email: max delay:
2	WATSON	URL: email: max delay:
3	PBPK	EU Commission - JRC URL: <a href="http://www.jrc.ec.europa.eu">http://www.jrc.ec.europa.eu</a> email: <a href="mailto:vittorio.reina@ec.europa.eu">vittorio.reina@ec.europa.eu</a> max delay: 5
4	M-Val	URL: email: max delay:

- The core is represented by a geodatabase handling input and output data (incl. intermediate results) of model runs
- The models „talk“ to each other through the geodatabase
- Well-defined interfaces between the models
- Simple models are as far as possible implemented into the platform. More complex models will be run on the local servers where they reside



The HEIMTSA centralized DBMS stores:

## Dynamic data

- Input/output files of each model execution

## Supporting data

- Population data
- Land use / land cover
- Time activity pattern
- Background rate of diseases
- Exposure-response function for the health end-points of interest
- Monetary valuation functions for the health end-points of interest
- ...

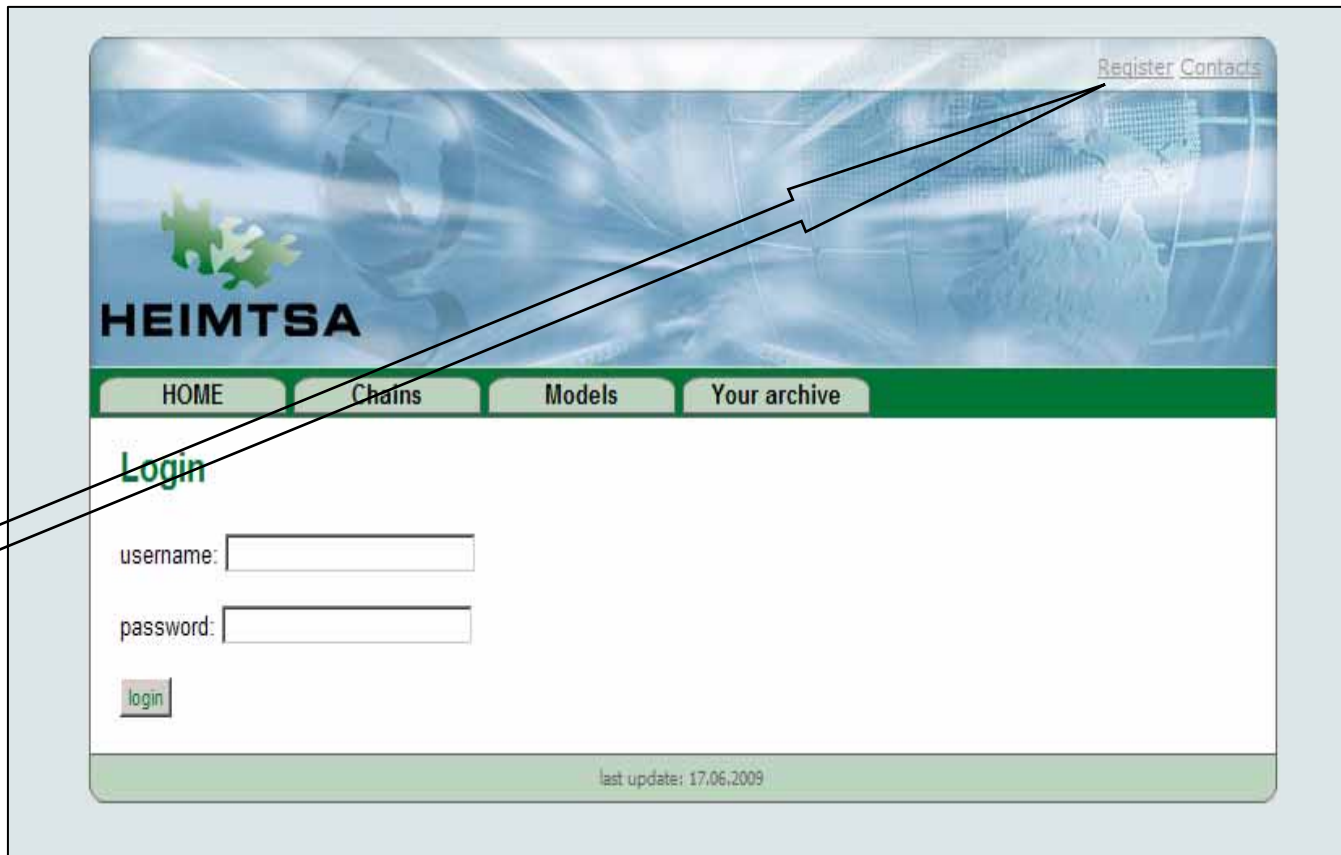




## Alpha version

The login page of the toolbox requires user registration.

Users can click *Register* in the top-right in the login page




The screenshot shows the HEIMTSA login page. At the top right, there are links for "Register" and "Contacts". Below the header, there is a navigation bar with buttons for "HOME", "Chains", "Models", and "Your archive". The main content area is titled "Login" and contains a "username:" field, a "password:" field, and a "login" button. At the bottom of the page, it says "last update: 17.06.2009". A double-headed arrow points from the "Register" link to the text "Users can click Register in the top-right in the login page".



The home page of the toolbox is composed of four main sections:

- Home
- Chains
- Models
- Your archive



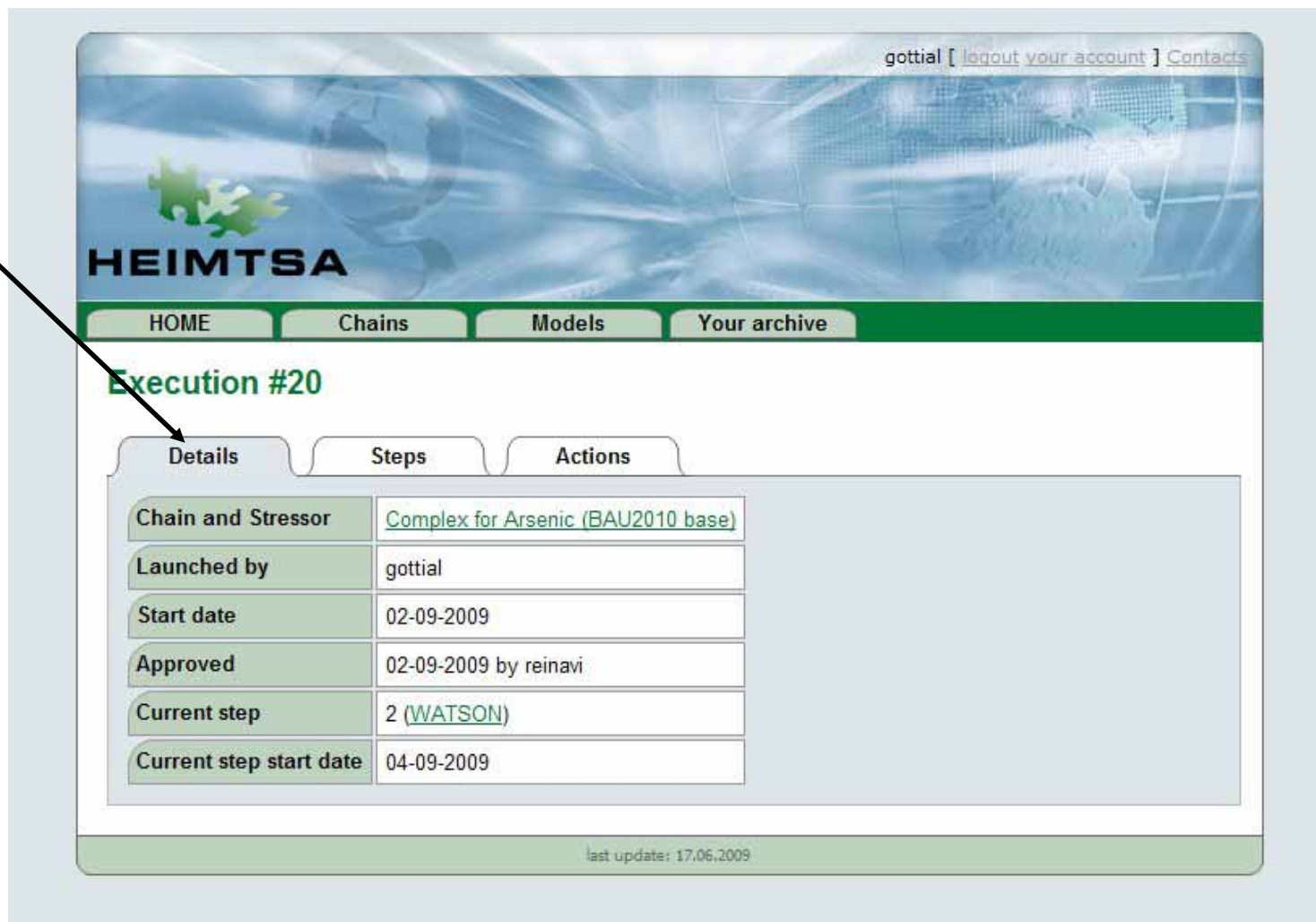
The screenshot shows the HEIMTSA Toolbox home page. At the top right, there is a user profile for 'gottial' with links for 'logout your account' and 'Contacts'. The main header features the HEIMTSA logo and a navigation bar with tabs for 'HOME', 'Chains', 'Models', and 'Your archive'. Below this, the page title is 'HEMTSA Toolbox (Alpha version)'. There are two tabs: 'Executions' (selected) and 'Help'. A 'START NEW EXECUTION' button is visible. The 'Your running executions' section contains a table with one entry:

ID	Chain name and stressor	Current step	Start date	Actions
20	Complex for Arsenic (BAU2010 base)	2 on 4	02-09-2009	<a href="#">view</a> <a href="#">stop</a>

At the bottom of the page, it says 'last update: 17.06.2009'.



*The details*  
tab displays  
more detailed  
information of  
the execution  
of the chain



The screenshot shows the HEIMTSA web application interface. At the top right, there is a user profile 'gottial' with links for 'logout your account' and 'Contacts'. The main header features the HEIMTSA logo and a navigation bar with tabs for 'HOME', 'Chains', 'Models', and 'Your archive'. Below this, the page title is 'Execution #20'. There are three tabs: 'Details', 'Steps', and 'Actions'. The 'Details' tab is active and displays a table with the following information:

Chain and Stressor	<a href="#">Complex for Arsenic (BAU2010 base)</a>
Launched by	gottial
Start date	02-09-2009
Approved	02-09-2009 by reinavi
Current step	2 ( <a href="#">WATSON</a> )
Current step start date	04-09-2009

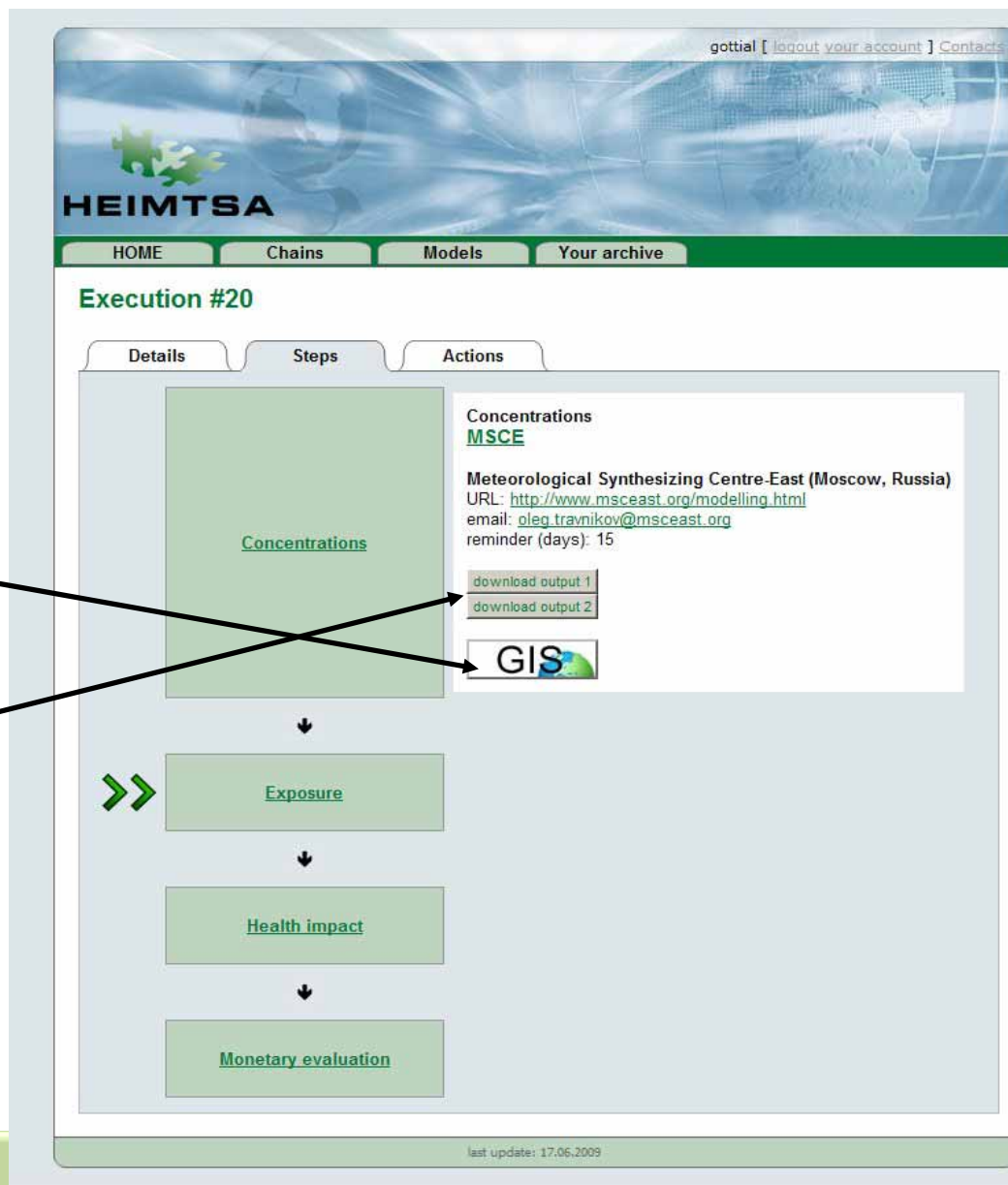
At the bottom of the page, it says 'last update: 17.06.2009'.



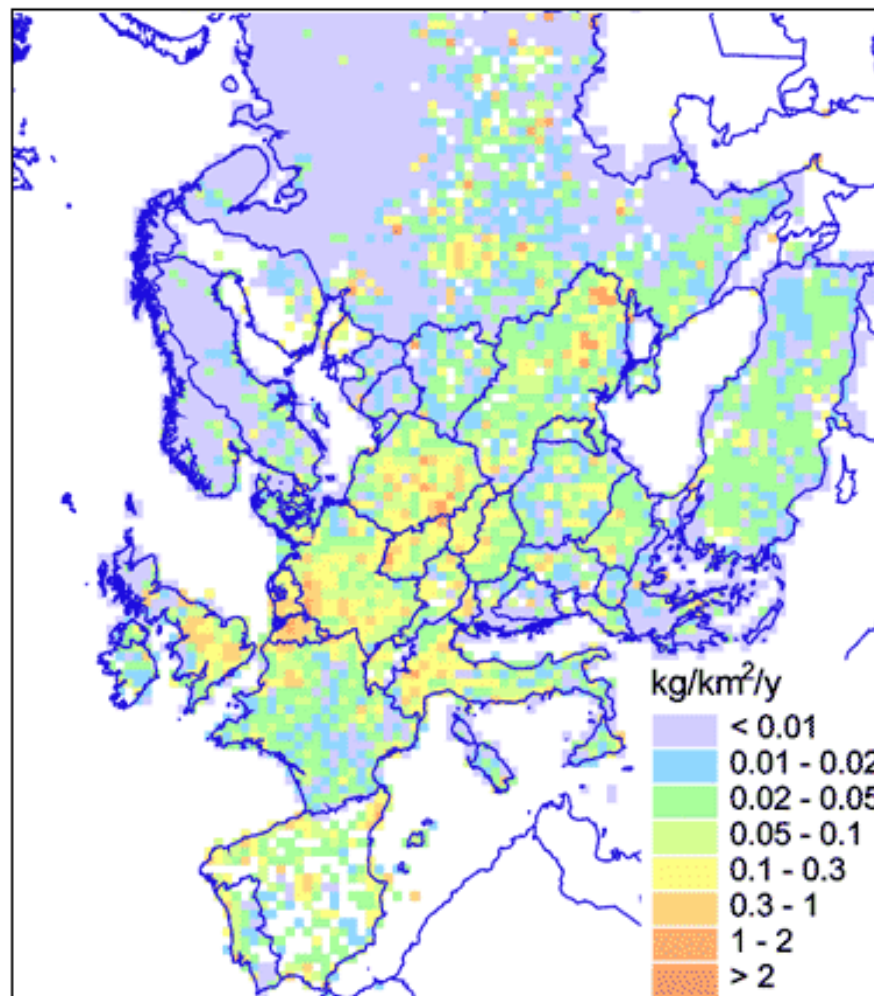
**Steps tab:** clicking here the steps of the execution are visible and users can access output data of each step

The user can invoke the visualization module by clicking the button "GIS" or he/she can download the model result selecting the "download output button"

The green arrows indicate which step is currently running

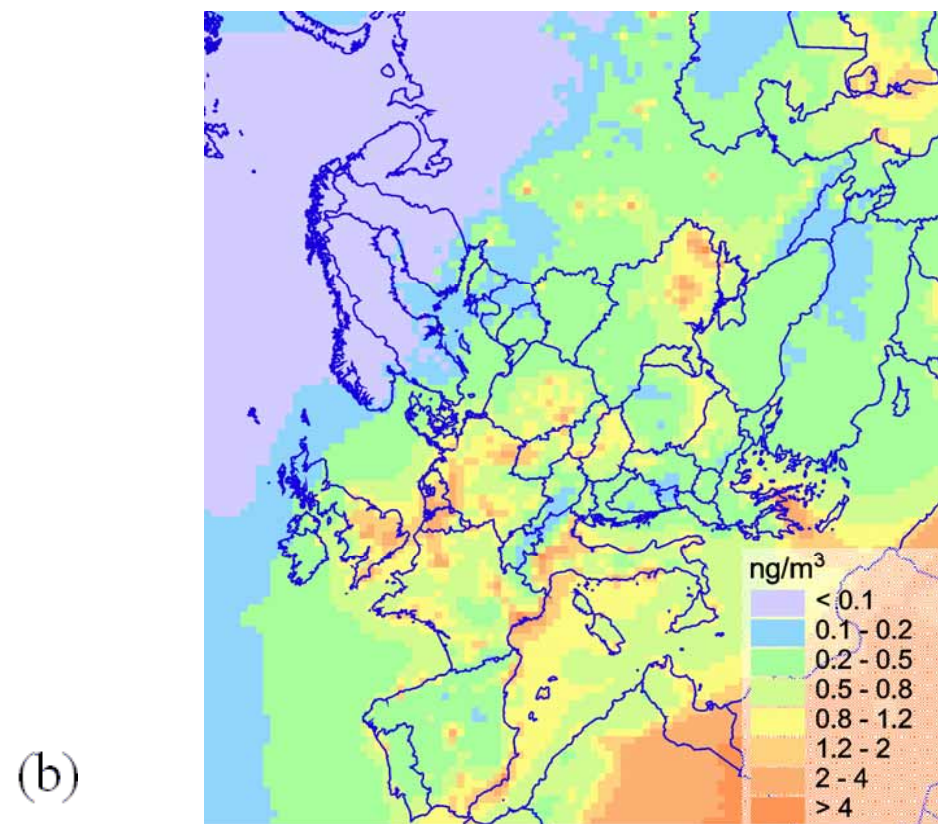
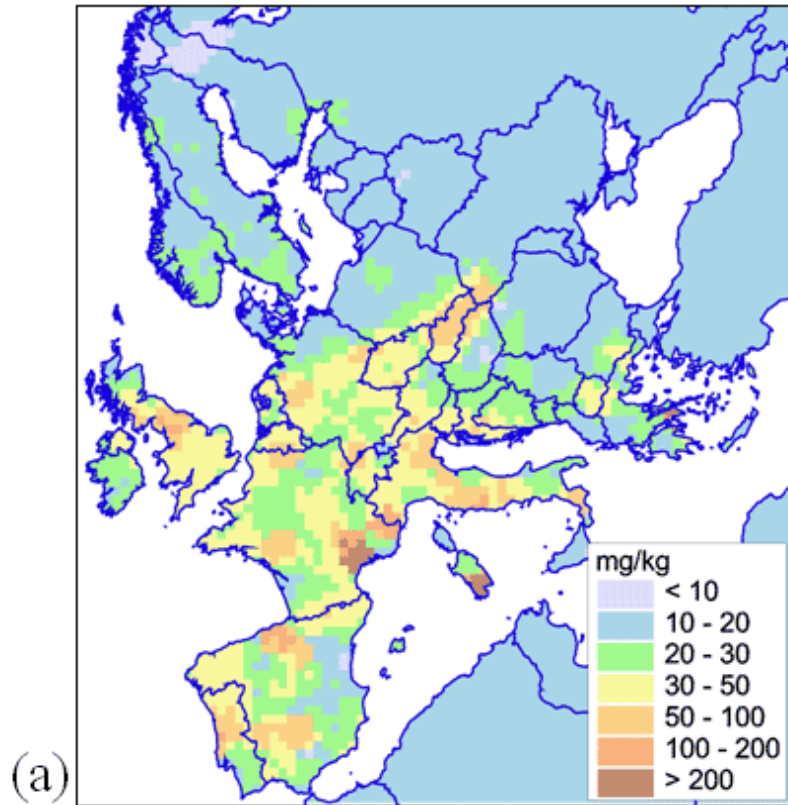


The screenshot shows the HEIMTSA web interface. At the top, there is a navigation menu with 'HOME', 'Chains', 'Models', and 'Your archive'. Below this, the page title is 'Execution #20'. There are three tabs: 'Details', 'Steps', and 'Actions'. The 'Steps' tab is active, showing a vertical flow of four steps: 'Concentrations', 'Exposure', 'Health impact', and 'Monetary evaluation'. The 'Concentrations' step is currently running, indicated by a green arrow pointing to it from the left. To the right of the 'Concentrations' step, there is a panel with the following information: 'Concentrations', 'MSCE', 'Meteorological Synthesizing Centre-East (Moscow, Russia)', 'URL: <http://www.msceast.org/modelling.htm>', 'email: [oleg.travnikov@msceast.org](mailto:oleg.travnikov@msceast.org)', and 'reminder (days): 15'. Below this information are two buttons: 'download output 1' and 'download output 2', and a 'GIS' button with a globe icon. At the bottom of the page, it says 'last update: 17.06.2009'.



Spatial distribution of anthropogenic air emissions of arsenic in Europe for the year 2000 [kg/km<sup>2</sup>/y].

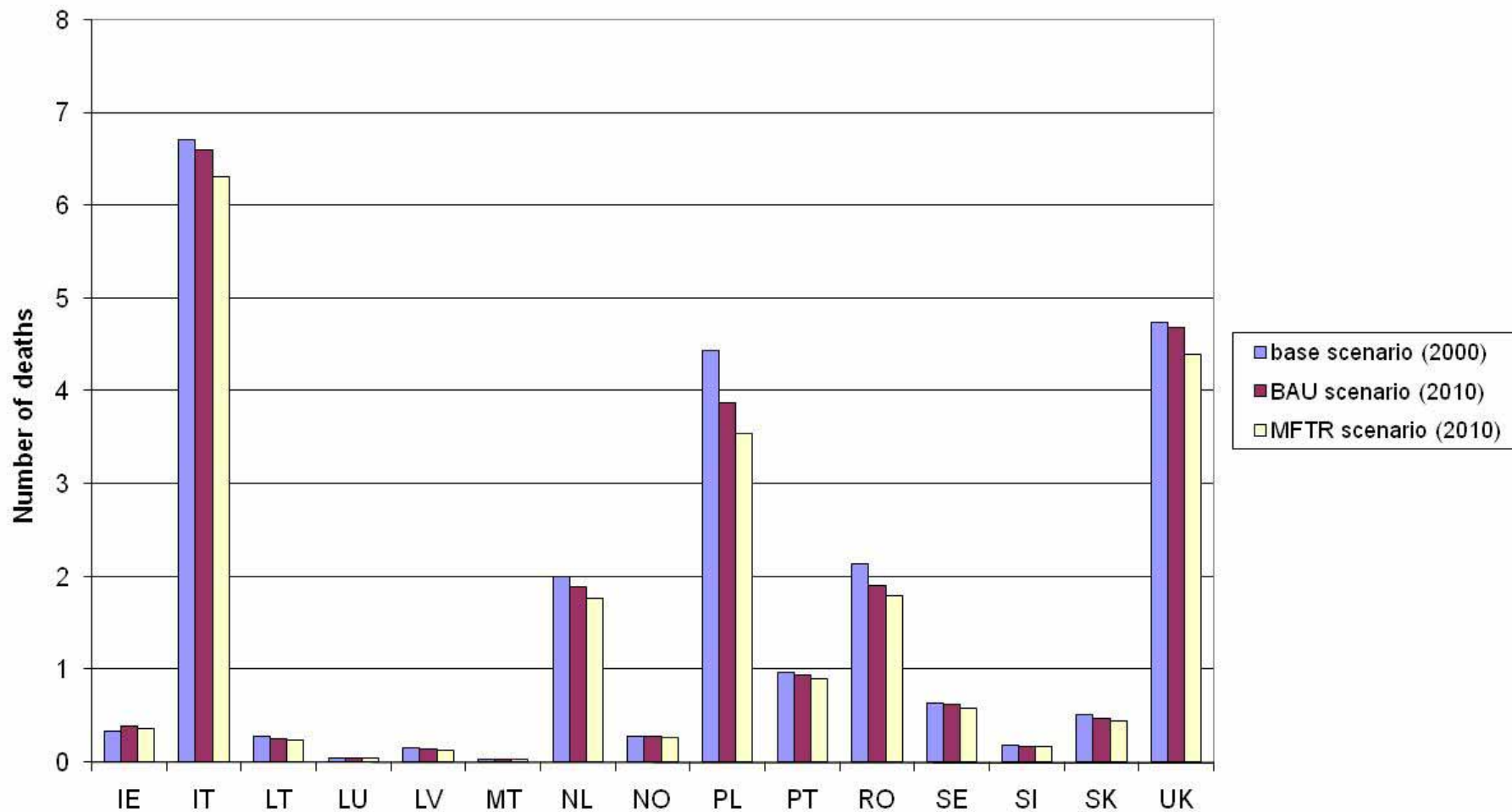




Spatial distribution of concentrations in European top-soils including adjacent territories [mg/kg] (a) and mean annual concentration in ambient air (b) for arsenic for the year 2000.



### Number of deaths due to lung cancer on country basis



- The HEIMTSA toolbox is unique in providing a comprehensive solution to integrated health impact assessment
- Its software architecture is novel, focused on a decentralised computing paradigm, which allows the parallel use of simple and more sophisticated models in different parts of the chain
- The decentralised architecture requires continuous commitment of the HEIMTSA team to maintain the operability of the toolbox
- There is a need to ensure the continuous updating of the underlying databases and the integration of new model versions