Guidelines

ARISE to new machine

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How to install step by step

ARISE is developed in a **KNIME analytics platform**[1] environment which is an open-source software for creating data science. ARISE also uses Python programming language that requires an **Anaconda**[2] environment. The ARISE code can be downloaded from **GitHub** (provider of internet hosting for software development). Finally, the free version of **Microsoft Power-BI** software is used to run the pathway explorer, as an interactive data visualization software. The present document presents how to install and use the ARISE model step by step:

Software

Anaconda (latest version)

Anaconda enables KNIME to benefit from a Python environment:
1. Download the Anaconda
2. Install Anaconda (requires at least 3.5Go free space)

KNIME (version 4.6)

Fig. 1. KNIME download

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[1] Link for download: https://www.knime.com/downloads; Be careful to download the suitable version for your operating system (e.g., Windows, Mac OS, Linux, etc.)

[2] Link for download: https://www.anaconda.com/; Be careful to download the suitable version for your operating system (e.g., Windows, Mac OS, Linux, etc.)

Download the KNIME version that correspond to your OS (i.e., Windows, Linux, Mac. See **Fig. 1**). The version 4.6.1 is recommended. Once downloaded, execute the KNIME installer as shown in **Fig. 2**:
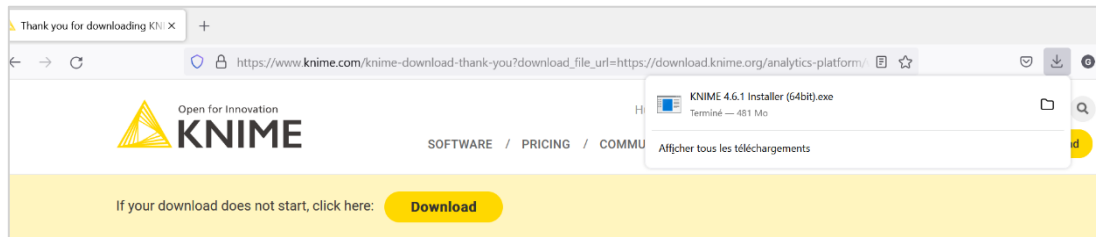

Fig. 2. KNIME download

While installing the software, you are to set a memory setting, i.e., the heap space that you allocate to KNIME. We recommend allocating as much space as you can while saving 2Go for your system at least. As a minimum setting, we recommend 4 Go.
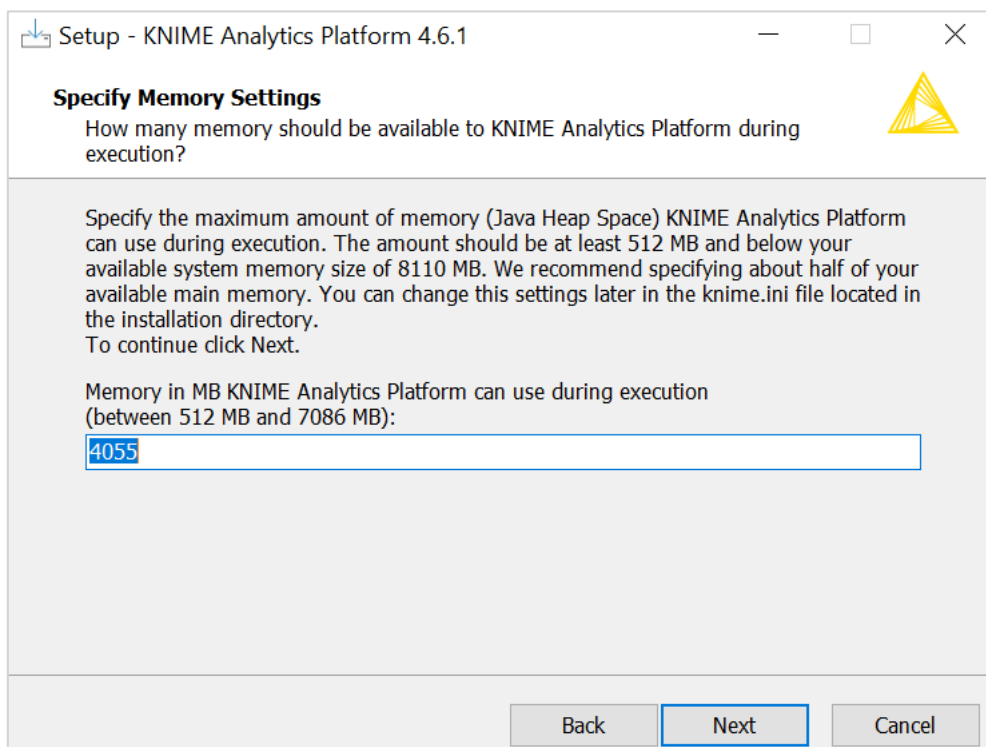

Fig. 3. KNIME heap space setting

Finally, you will have to set a workspace, i.e., a virtual environment in which KNIME can operate. You can set it as you please, but you will have to put the ARISE source code in the root of this workspace.
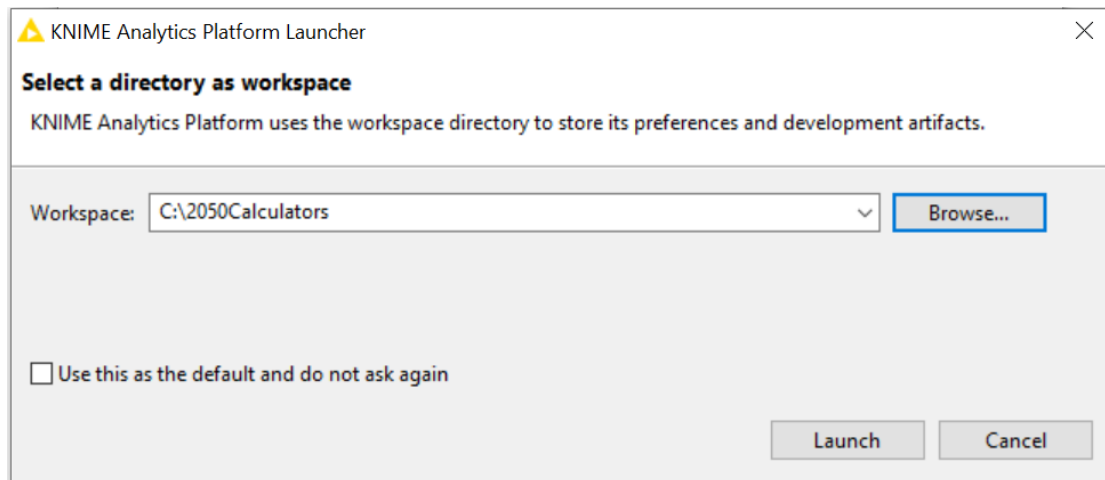
Fig. 4. KNIME work environment

By default, KNIME will set a Python environment thanks to the prior installation of Anaconda. If any issue, go to the KNIME preferences (file/preferences) and check the python options:
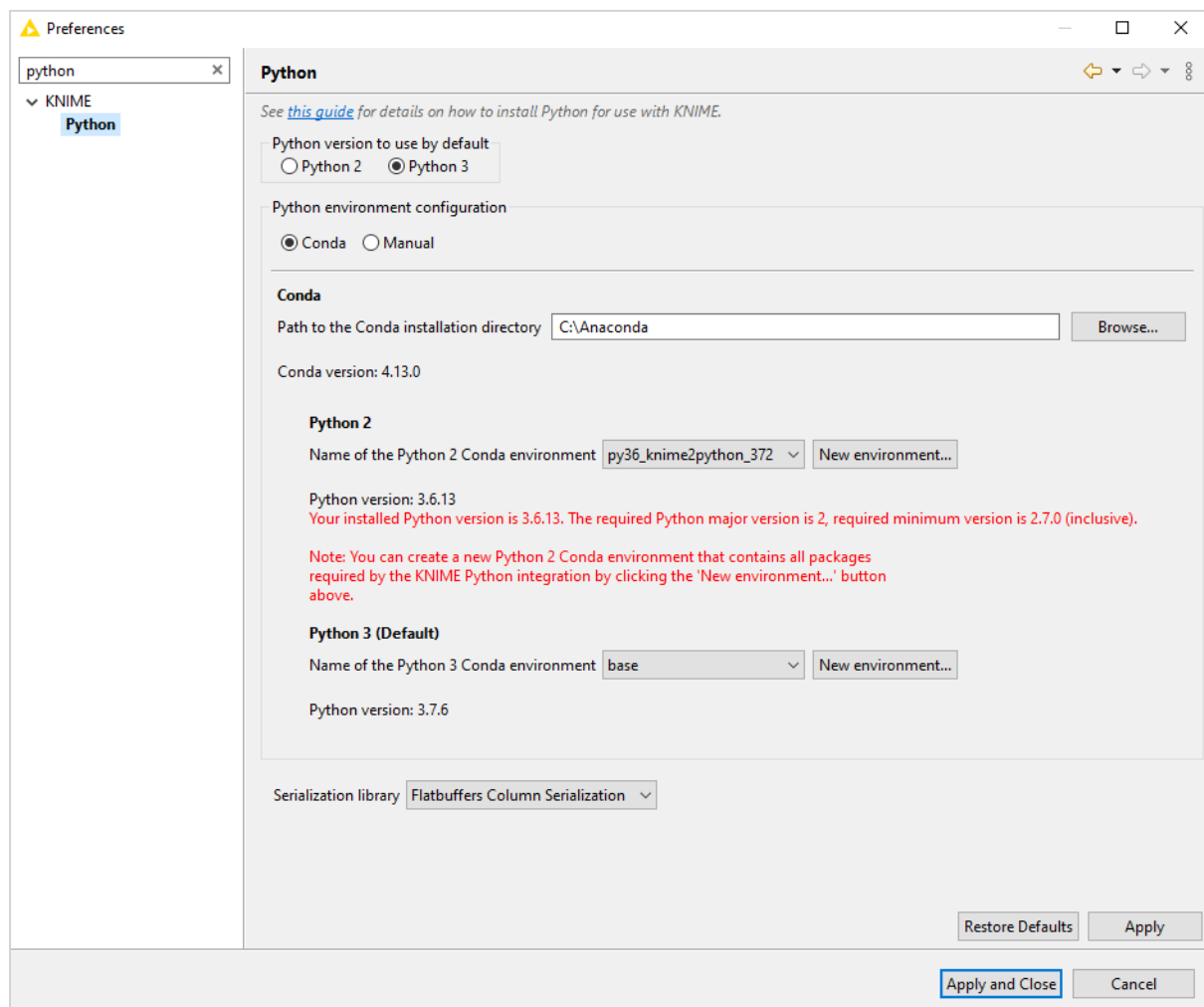

Fig. 5. KNIME python environment

Do select **base** and **Python 3** by default, or your own python environment if you already have one.

Optional: Install the KNIME extension (file/install knime extensions) that are required to run ARISE, namely: python integration & text processing. These extensions will be automatically installed in the next steps anyway.

Power BI (latest version)

Power-BI enables ARISE to provide the users with a friendly environment to explore and compare the pathways that have been saved in real time.
1. Download the Microsoft Power BI[3]
2. Install Microsoft Power BI

ARISE

Download the ARISE code[4] either using GitHub (pull) or a direct download if you are not familiar with GitHub. In both cases, please ensure that the knime-arise file is at the root of your KNIME working environment (e.g., extract the ARISE code in "C:\2050Calculators").
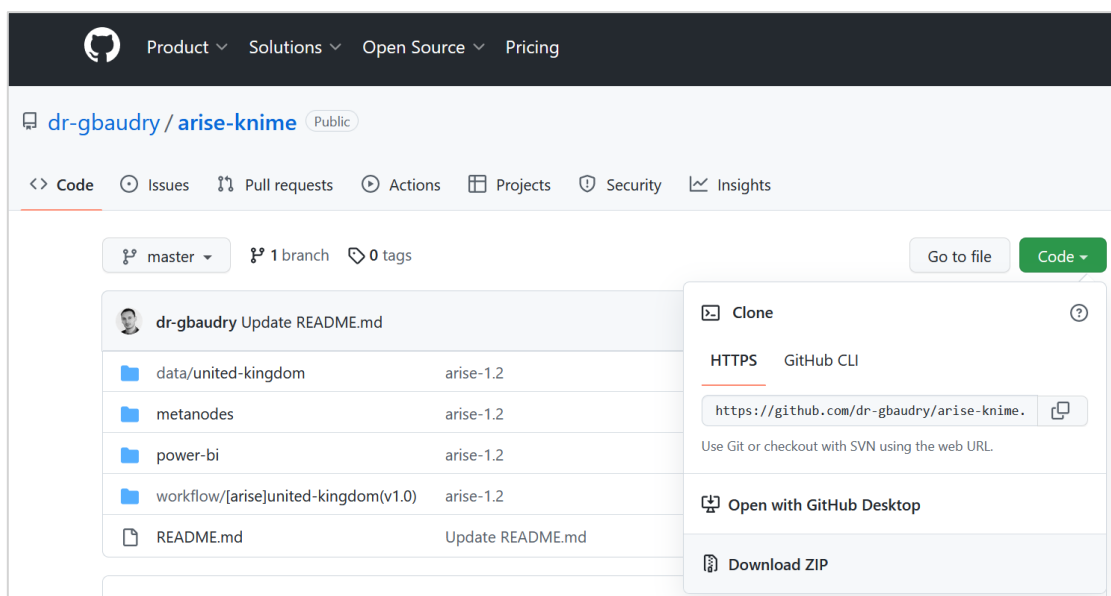

Fig. 6. ARISE GitHub repository: *(1) use the git clone command and copy-paste the Git link – OR – (2) Download the code as a ZIP file to unzip in your KNIME workspace (850Mo). Unzipping the code takes up to 20 minutes.*

ARISE requires 9Go of free space. Once unzipped or pulled from GitHub in your workspace, ensure that the ARISE folder is called: "arise-knime" rename it this way otherwise (e.g., if unzipped renamed from arise-knime- master to arise-knime). Run KNIME and browse to ARISE to open it:

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[3] Link for download: https://www.microsoft.com/en-us/download/details.aspx?id=58494;

[4] Link for download: https://github.com/dr-gbaudry?tab=repositories; For non-GitHub users, please go to arise-knime, code (green box), and download as a ZIP. When extracting, do control that the file is actually named "arise-knime"
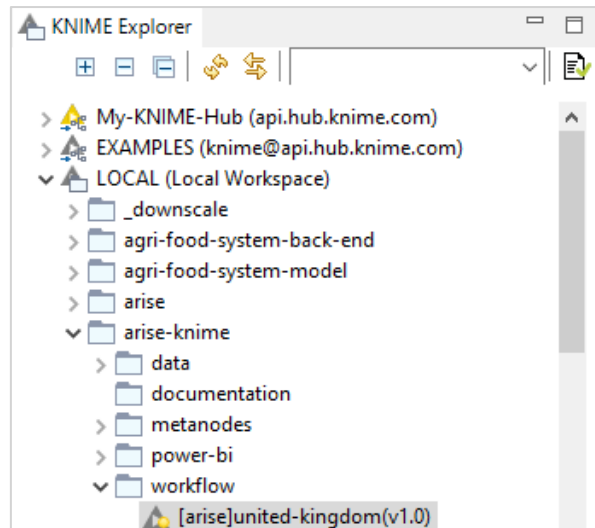
Fig. 7. ARISE workflow

At the first opening of ARISE workflow, KNIME will inform you about missing extensions. Accept the installation of these extensions and reset the software. Everything is now set up to use the ARISE model.

ARISE

The model is divided in 3 main parts: (1) the user form; (2) the calculation tree; (3) the export to Power-BI (i.e., transition pathway explorer). Lunching KNIME and ARISE workflow can take up to 10 minutes.

User Form

The user can name the pathway and choose to (1) save (write if non-existing or overwrite if already existing) the pathway; (2) Load an existing pathway (requires the pathway to exist already); (3) only explore pathways without saving (Read). By default, a user will overwrite the "Your Path" pathway and the username will remain anonymous.
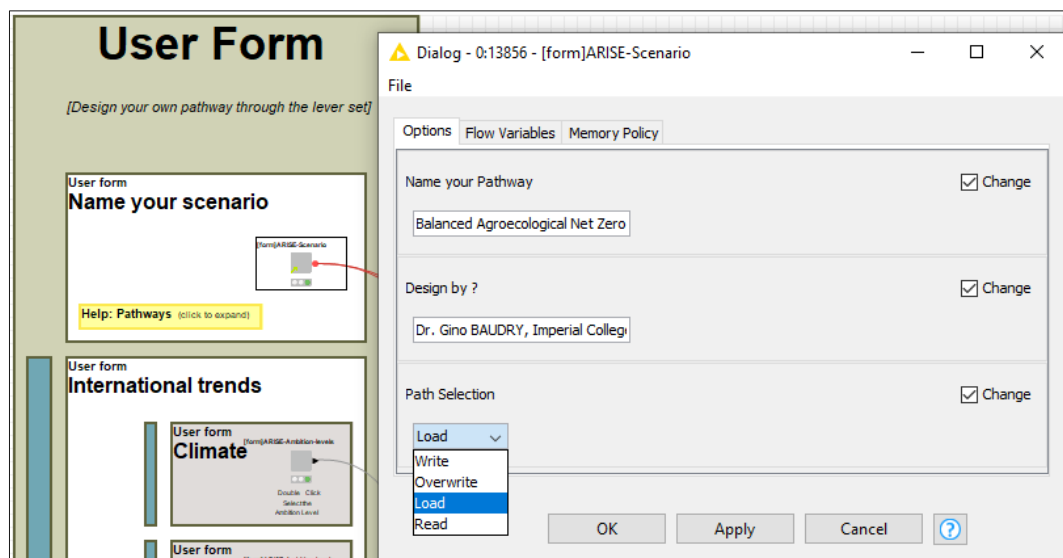

Fig. 8. User form in the ARISE model: *The first step consists in naming the pathway, possibly the user (not mandatory), and to choose whether the user wants to (1) save (write or overwrite) a pathway; (2) Load an existing pathway; (3) only explore the pathways but without saving (Read).*
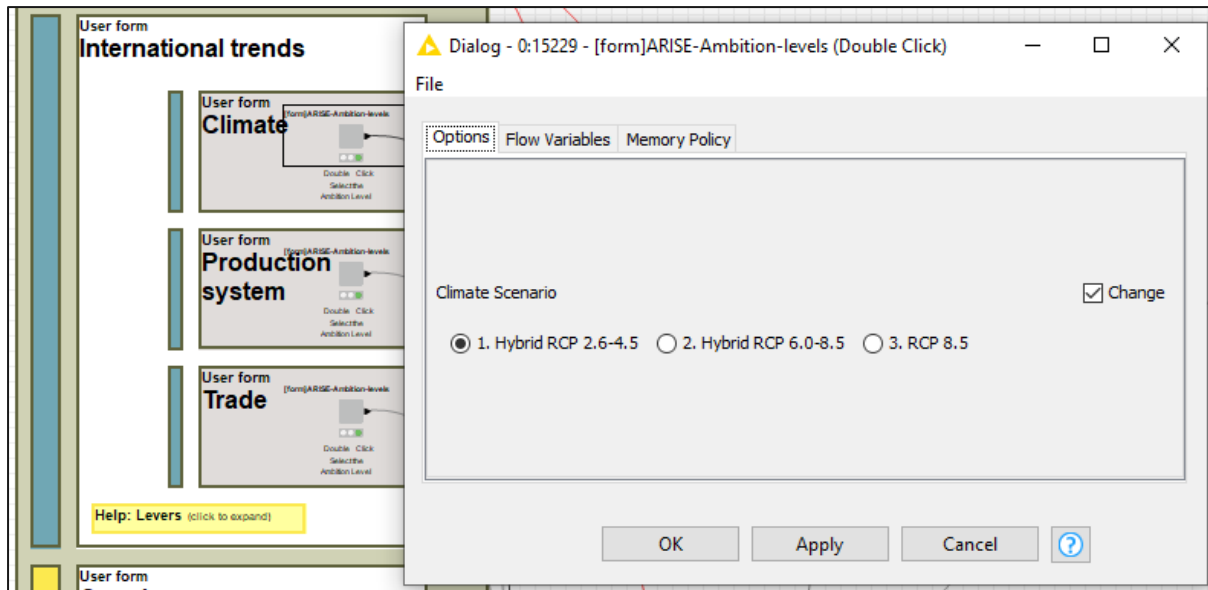
Fig. 9. Lever set: *The second step consists of setting the levers.*

The user can set the levers towards various ambition levels (metanodes: [form] Ambition-level selection), either using the levers individually or by group (i.e., metalever). The metalevers have been developed to ease the exploration and to avoid the information overload. For example, one can set the self-sufficiency for all crop-based commodity at once or do it crop by crop.
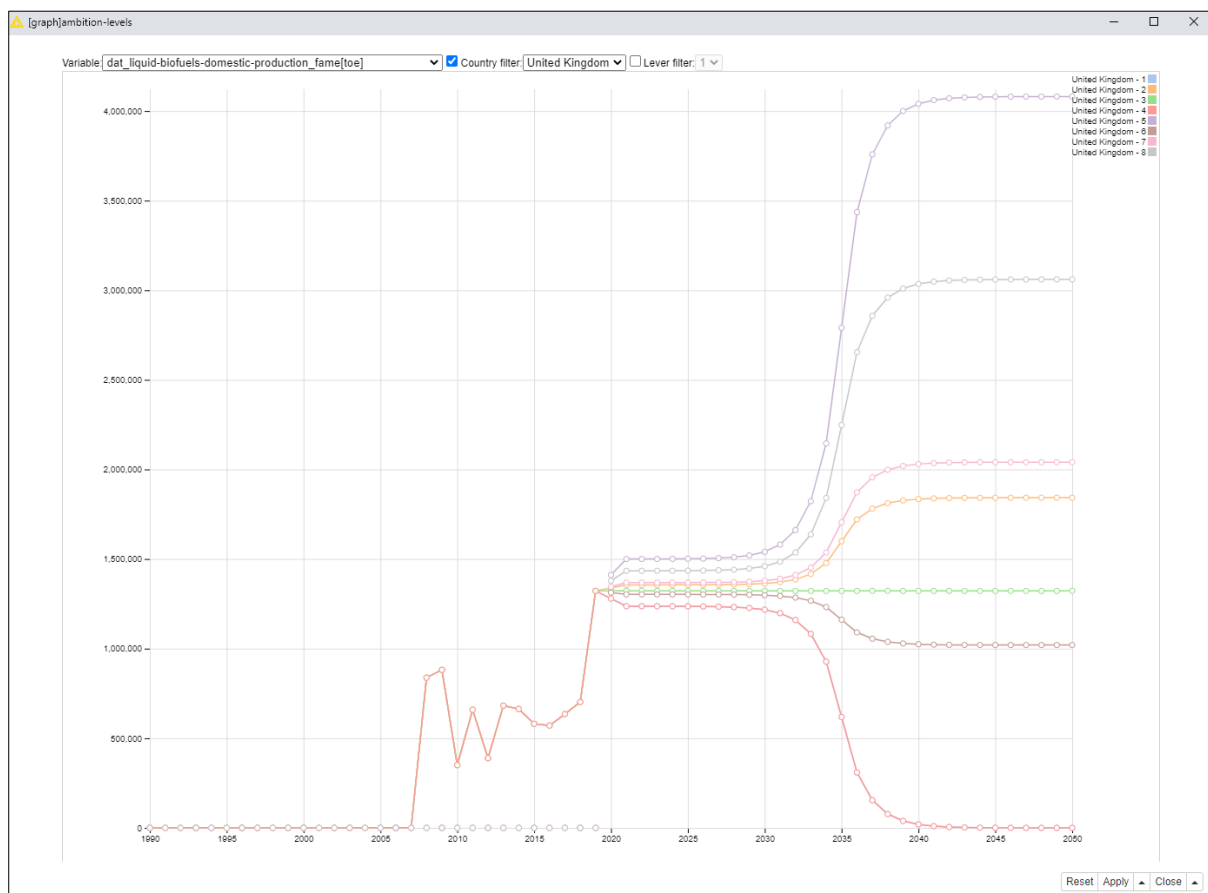
Ambition levels

Fig. 10. Illustration of ambition levels: *one can for example investigate the impact of developing FAME biodiesels, ranging from a full phase out (as stakeholders ask to have as a setting) and an increase corresponding to the most ambitious we found in the literature.*

Ambition levels express the extent for which each lever can be set. Usually, the ambition levels cover a wide range of possible options from the least to the highest ambition we could find in the literature. It is worth mentioning that the pathway updates the bibliography automatically (i.e., computed for each pathway given the lever setting).

Runs

Once the lever setting and pathway's name chosen, the user only has to execute the code using the execute all command or shift+F7. Alternatively, the user can execute the very last node (right, ARISE to Excel node) in order to gain computation speed. Doing so, only the data computation nodes will run.
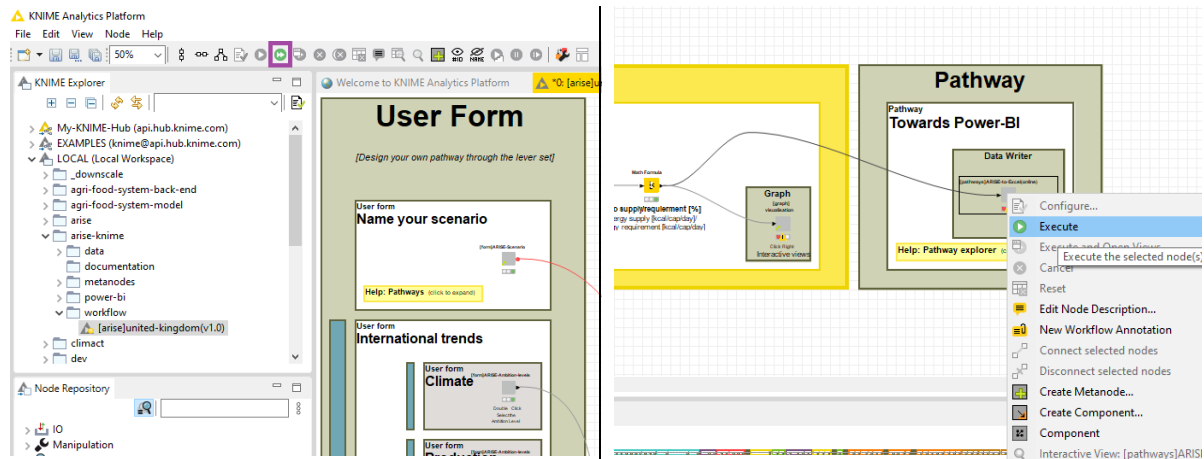

Fig. 11. Running a pathway: *(1) execute all (left figure); (2) Execute the TPE node (right figure); (3) shift+F7.*

Running a pathway takes about 6 minutes which can widely vary depending on your computer specifications and KNIME memory allocation. Execute all nodes (1) and (3) leads to run all the code, that includes all the graphs for each computation stage. Running (2) only computes the math and not the visuals, which saves time. Nevertheless, each visual can be executed individually on will.

Warning: ensure that the setting is set on the good setting i.e., load, save, overwrite.
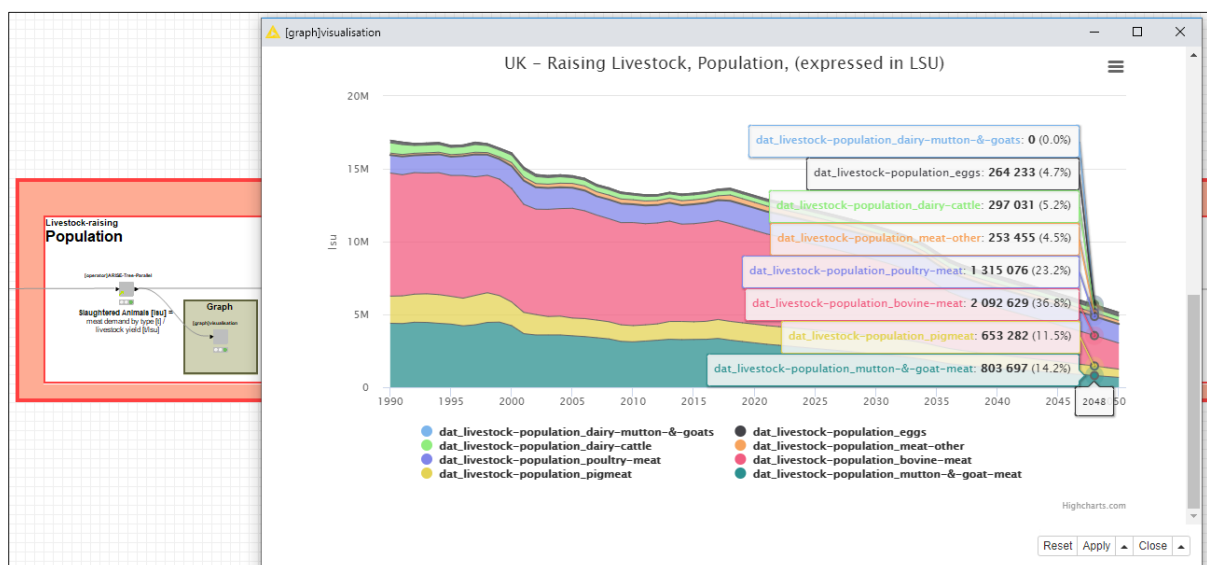
Visuals

The user can explore the pathways in KNIME, for each step of the computation using the graph nodes (Fig. 12) or using the pathway explorer that offers a better user friendliness as well as a way to share the pathway easily without requiring to install ARISE or KNIME.

Calibration

The ARISE model is calibrated against UNFCCC[21], FAOSTAT[1,4,9,10] and Eurostat[17] datasets for historical data. The calibration enables the model to by adjusted for some selected key variables. Nevertheless, the user can easily enable or disable the calibration by modifying the so called "workflow variables" as: (1) right click on the workflow's name, (2) select workflow variables, (3) modify the calibration variable (either enabled or disabled).

The model is calibrated over the 1990-2017 time period. The domestic supply (food, feed, domestic), production, and emissions are calibrated against the FAOSTAT database[1]. The energy-use is calibrated against the Eurostat and FAOSTAT, and accounts for 14 energy carriers[1,17]. The land-use, land-use change, and associated carbon dynamics are calibrated against the official UNFCCC inventories (1990-2017)[21]: it includes cropland, grassland, forest land, artificial land, wetland, and other-lands dynamics.

As shown by Fig. 13, the calibration is transparent and allows the user to check the calibration factors and to compare the model outputs with and without the calibration process (KNIME workflow, calibration nodes, right click, interactive visualisation).
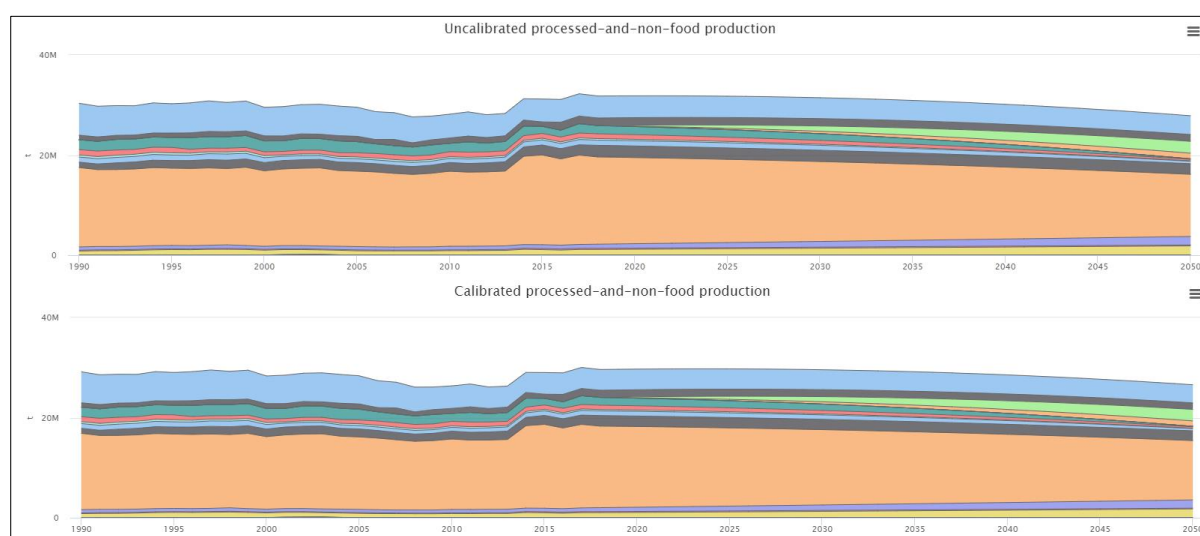

Fig. 13. ARISE calibration: The user can visualise the calibration factors and compare the model outputs with and without calibration. The user can also disable/enable the calibration of the model on will.

Fig. 13 presents the food production in the UK as computed by the model (top: uncalibrated), and as parameterized using the calibration factors (i.e., average gap between the model and original datasets).

Pathway Explorer

Each run that is saved (see How to use -Step1) in ARISE can be explored in real time in the pathway explorer (Fig. 14 and Fig. 15). The home page allows the users to navigate easily from a tab to another (press ctrl + icon). All tabs also include the same quick access menu on the left. Please do refresh the outputs and references fields to ensure the dataset is up do date (field tab on the right, right click, refresh).
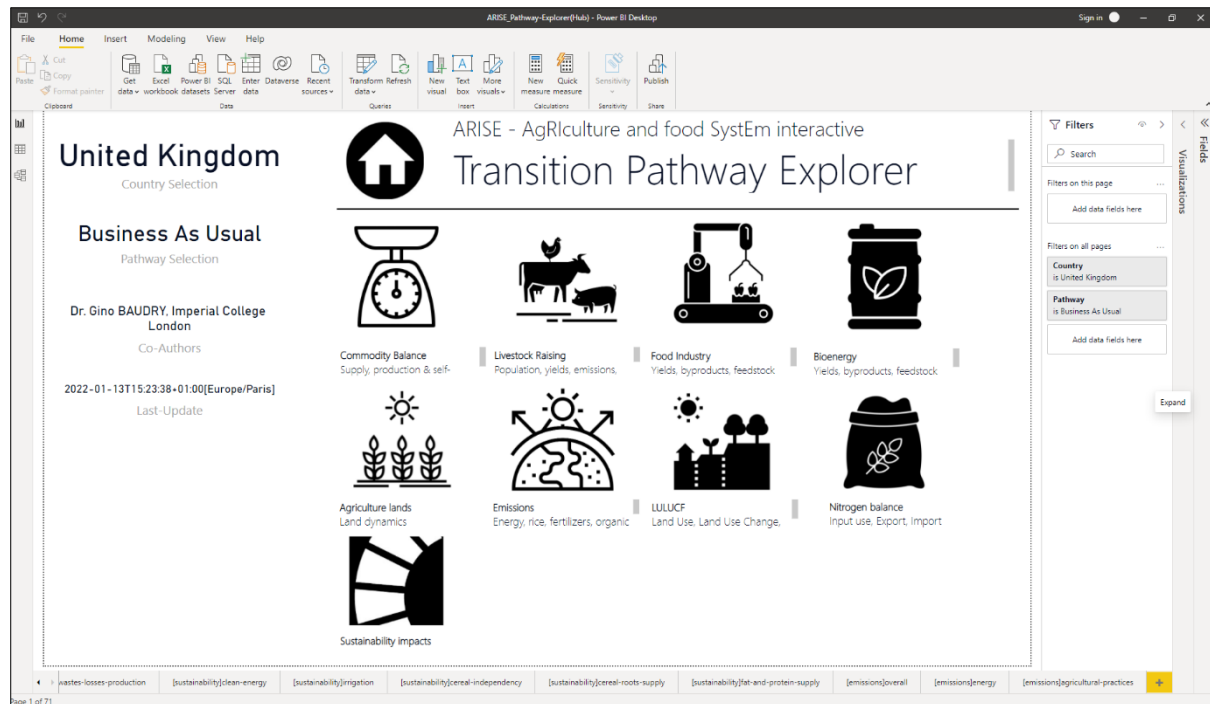
Fig. 14. ARISE pathway explorer – home page: *The user can easily navigate from tab to tab to explore the saved pathways*

The main tabs include the commodity balance, the livestock raising, the food industry, the bioenergy, the agriculture lands, the emissions, LULUCF, the nitrogen balance, and other sustainability impacts. Each of these elements includes sub-tabs (e.g., commodity balance includes self-sufficiency, supply, production, etc.).
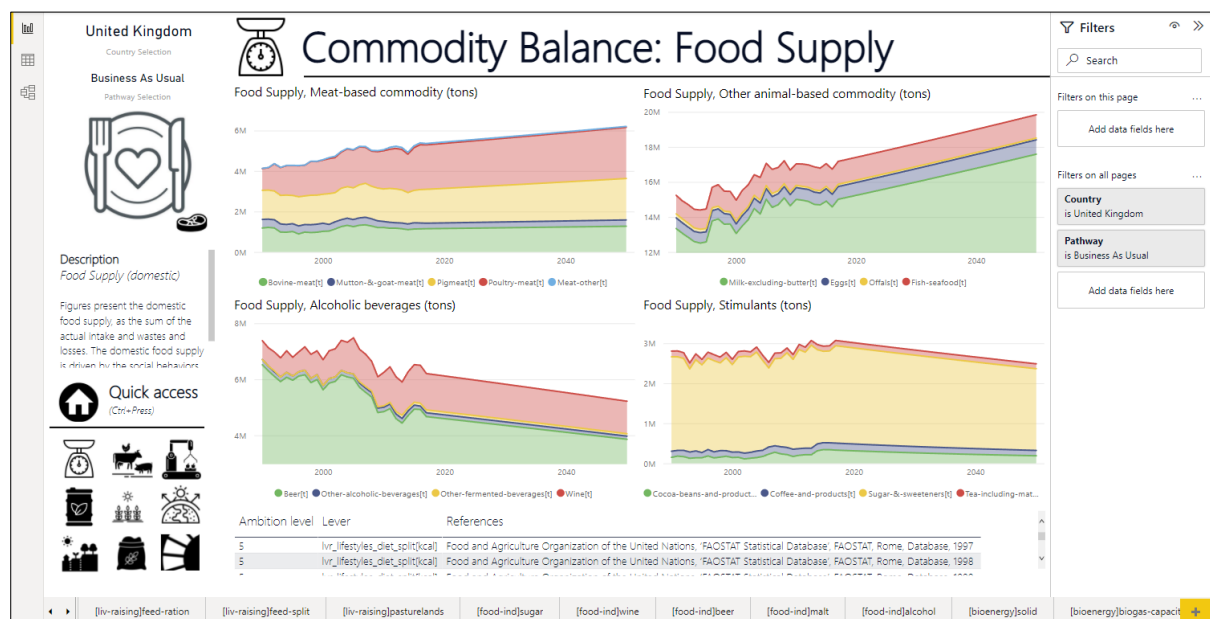

Fig. 15. ARISE pathway explorer – a tab example: *The user can easily navigate from tab to tab to explore the saved pathways*

As shown in Fig. 15, the left part of the tab (from top to bottom) informs about the country and pathway that is being displayed, as well as short description of the context and variables. On the right side, the navigation tab allows one to explore various country and pathways in real time. For now, only the UK is calibrated but other countries will be added in the future. References from which the graphs are computed for both historical and future time series (ambition levels) can be found on the bottom. Finally, the core of the tab presents visuals for the key variables.

Contact

Please do send an email detailing the unclear steps or new issue to report gino.baudry[a]epfl.ch.