BRABU – BRAMS RAMSIN Builder Utility
Version 0.1 – Beta

Users Guide

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1. Introduction

The Brazilian Regional Atmospheric Modeling (BRAMS) model is a numerical time prediction model that is designed to simulate atmospheric flows ranging from hemispheric scales to LES (Large Eddy Simulations) simulations of the planetary boundary layer. Since its launch, the BRAMS model, currently in version 5.3, has an extensive list of parametrizations, such as radiation, microphysics, convection, turbulence, surface, aerosols, among others, which are stored in a single text file called RAMSIN.

To date, 274 parameters may be configured in the RAMSIN file, which makes its maintenance increasingly complex. While editing the file, some types of errors can occur, such as:

- Lack of parameters: A parameter required by the model was not filled.
- Lack of data: A value required by the model was not filled;
- Data type error: The value set does not match the type that the model expects. Example: Use a decimal number instead of an integer;
- Data value error: The value set is outside the required range, or outside the list of valid parameters. Example: A value between -90 and 90 should be used to represent latitude; The type of microphysics should be between 0 and 3.
- Configuration Consistency Error: Two or more parameters are using an unacceptable configuration by the system. Example: It is not possible to use microphysics type 2 (Greg Thompson cloud water single moment) with the parameterization type of cumulus 2 (2-Grell-Deveny scheme)
- Invalid directory or file error: A specified directory or file does not exist.

In addition to the difficulties encountered above, there are other difficulties like finding the parameters in the text file or changing them, because a small error such as a comma can invalidate the entire configuration. With as many parameters as possible, the number of rows in the file is at least 760, which can reach more than 1000, depending on the number of output variables or height levels, for example, making the usability, maintainability and system is very compromised.

Further, after a configuration of RAMSIN is finished, it is usually submitted to the execution of BRAMS in a server where the competition for its use is great. Often a configuration error is only checked after the submission of submitted work has begun, which can take up to days.

Finnally, BRABU was developed aiming to minimize the configuration problems reported above and offering more tools for configuring RAMSIN.

The brabu system are mainted by the Brams Team at CPTEC. The brabu versions are manteined in the PyPi repositories below. Please follow the Install Instructions at the 3.Installation section.

- Python 2.7 version: py2.7 - https://pypi.org/project/brabu-py2.7/
- Python 3.5 version: py3.5 - https://pypi.org/project/brabu-py3.5/

2. Structure

Brabu package has the following main directories:

a) brabu
This directory contains the python source files

b) data
Contains data files used by the brabu system, such as files for plotting maps, RAMSIN templates and RAMSIN patterns. Don't make any changes in this folder.

3. Installation

This installation procedure is also maintened in the README file of the Brabu package.

You must choose between python2.7 or python3.5.

Download and install the pre-requisites and create BRABU directories.

```
→ wget http://ftp1.cptec.inpe.br/brams/brabu/install_pre_requisites_py2.7.sh
```

or

```
→ wget http://ftp1.cptec.inpe.br/brams/brabu/install_pre_requisites_py3.5.sh
```

Check and run the lines step by step in the file install_pre_requisites_py2.7.sh or install_pre_requisites_py3.5.sh. In this files, will be defined the installation directory in environment variable $BRABU (in home directory as default -> BRABU=~/brabu-py2.7 or BRABU=~/brabu-py3.5)

Select one of install instructions mode: a) Begginers, or b) Advanced Users and follow the steps below:

a) BEGGINNERS

Install instructions for Linux Brabu pre-compiled package.

Change directory to the installation destiny, eg:

```
→ cd ~/
```

Download the file brabu1.0.0-py2.7.tgz or brabu1.0.0-py3.5.tgz from http://ftp1.cptec.inpe.br/brams/brabu/ (the versions may vary).

```
→ wget http://ftp1.cptec.inpe.br/brams/brabu/brabu-0.1.3-py2.7.tar.gz
```

or:

```
→ wget http://ftp1.cptec.inpe.br/brams/brabu/brabu-0.1.8-py3.5.tar.gz
```

extract the file:

```
→ tar -xzvf brabu-0.1.3-py2.7.tgz
```

or:

```
→ tar -xzvf brabu-0.1.8-py3.5.tgz
```

After extracting, the directory ~/brabu-py2.7 or ~/brabu-py3.5 will be created.

Create the virtual env directory. It'll overwrite the directory ~/brabu-py2.7/bin or ~/brabu-py3.5/bin

```
→ python -m virtualenv $BRABU
```

b) ADVANCED USERS

Create a Python 3 virtual environment and installing Brabu for Linux though install_brabu.sh. Download the file install_brabu_py{py-vesion}.sh

```
→ wget http://ftp1.cptec.inpe.br/brams/brabu/install_brabu_py2.7.sh
```

or:

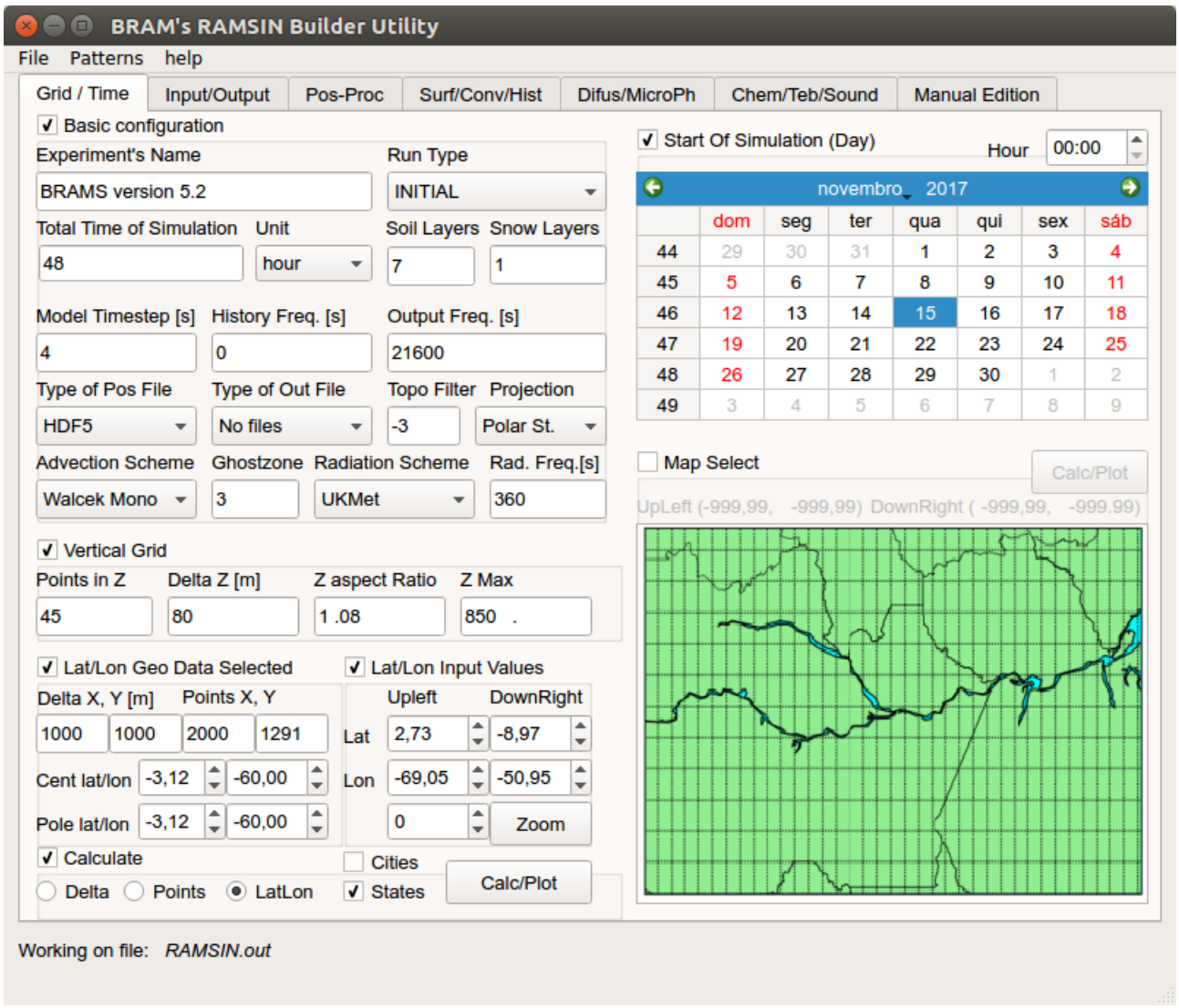
```
→ wget http://ftp1.cptec.inpe.br/brams/brabu/install_brabu_py3.5.sh
```

Check install_brabu_{py-version}.sh and execute the commands line by line.

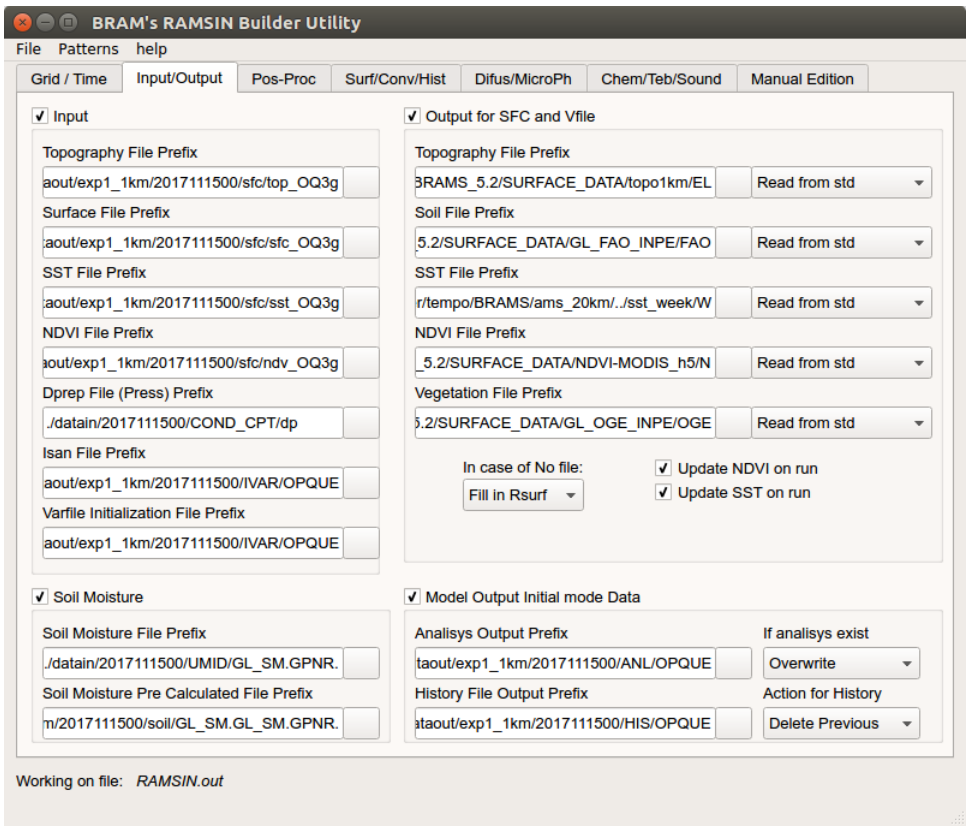
4. Basic Operation

BRABU is a software tool that has a visual interface for loading a RAMSIN file to the visual format, that is, a screen, writing RAMSIN from the screen configuration and performing configurations validations. Each RAMSIN parameter is represented by a control item, which can be used to store a parameter of type text, integer, decimal, a list of variables, or can be controlled graphically as in a combo of options, calendar, a control where you can select files or directories or even manipulate a map to determine geographic coordinates.

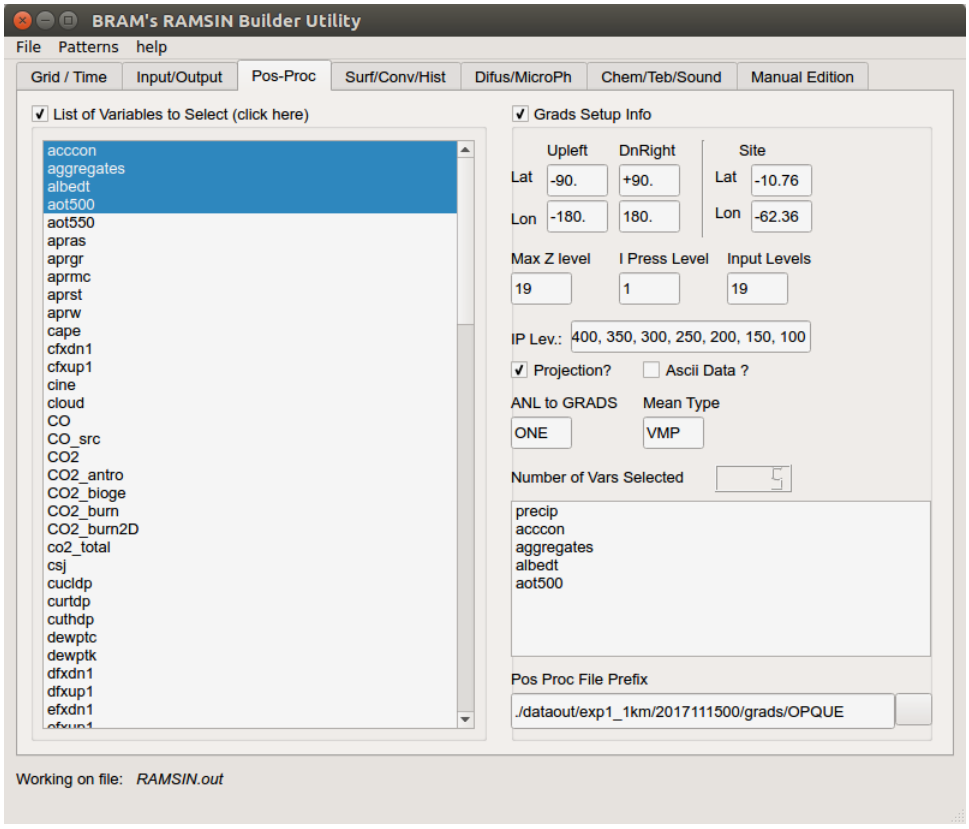
The BRABU main screen can be seen in the first tab, called "Grid / Time". In this screen you can change the most used settings such as the simulation period, through the calendar, the total simulation time, the type of round, among others. The functionality that most adds value in this tab is the option to be able to visualize and / or determine the geographic area that will be used in the execution. One of the difficulties in the composition of RAMSIN is the map visualization, determined by the CENTLAT / CENTLON parameters, which determine the center of the grid, DELTAX / DELTAY, which determines the resolution, and NNXP / NNYP, which determine the number of points. Using the "Calculate Lat / Lon" option, when clicking the "Calc / Plot" Button, the map is generated as in the figure below. In this case, the values of Delta, Cent Lat/Lon and number of Points are used to calculate Lat/Lon . It is also possible to determine Latitude and Longitude through the map, by choosing “Map Select” and dragging the mouse from top left to bottom right while the mouse left button is pressed. To zoom in or to zoom out, user must enable “Lat/Lon Input Values” and the type the number of points in Lat/Lon to zoom in (positive number) or to zoom out (negative number) in the field at the left size of button “Zoom’, the press the buttom “Zoom” to generate new values of Lat/Lon. After that, just press “Calc/Plot” to see map again.



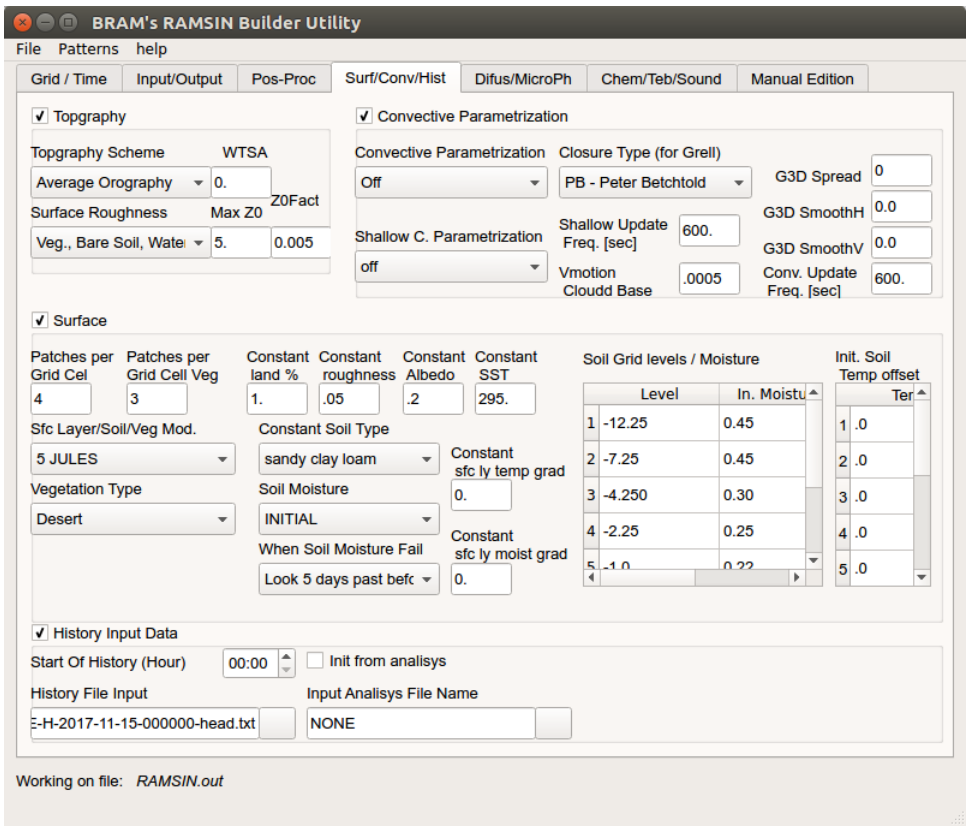
In the next screen, you may configure the model's input and output files and directories by typing the path directly or choosing it from a screen where you can navigate between directories.



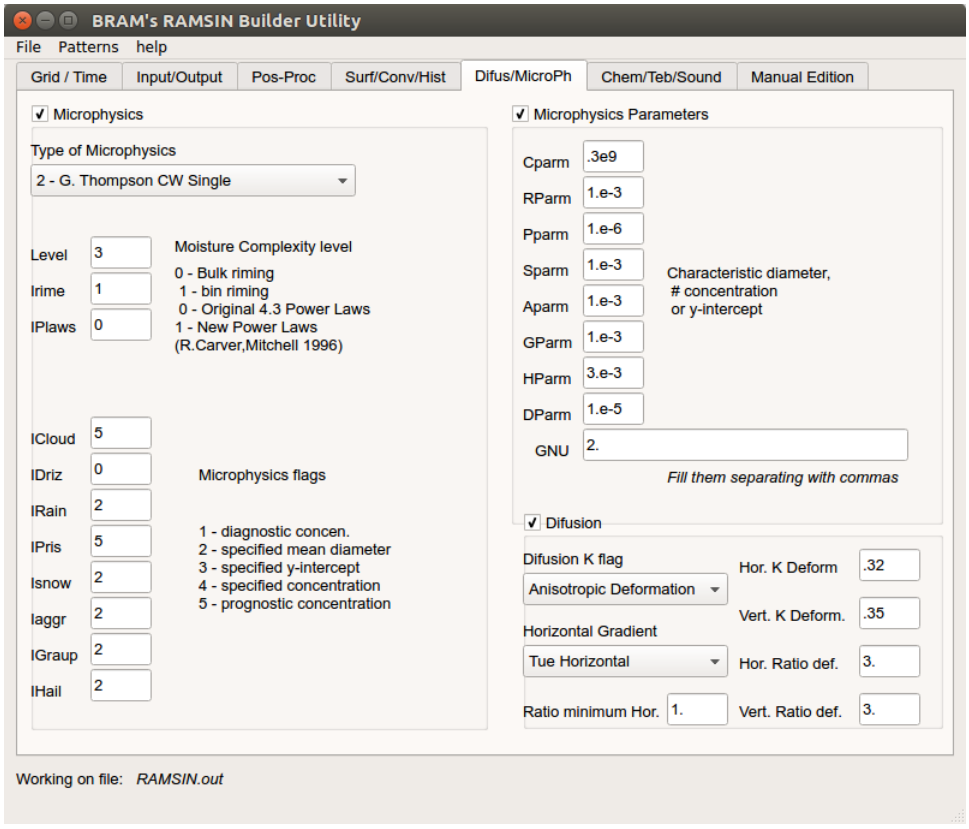
The parameters of post-processing of BRAMS are defined, such as the selection of variables, grid data and output file in the screen below.

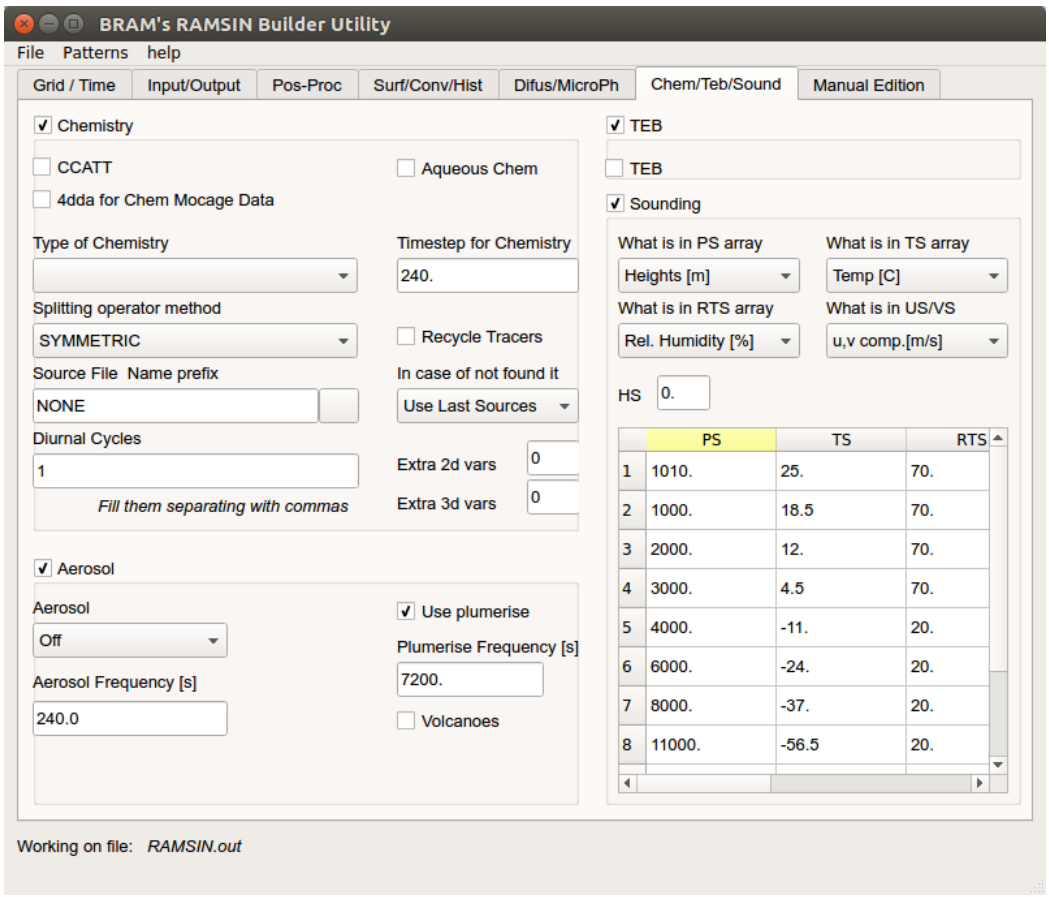


The parameters of topography, surface, convective parameterization, and model reset (history) may be configured in the next screen.

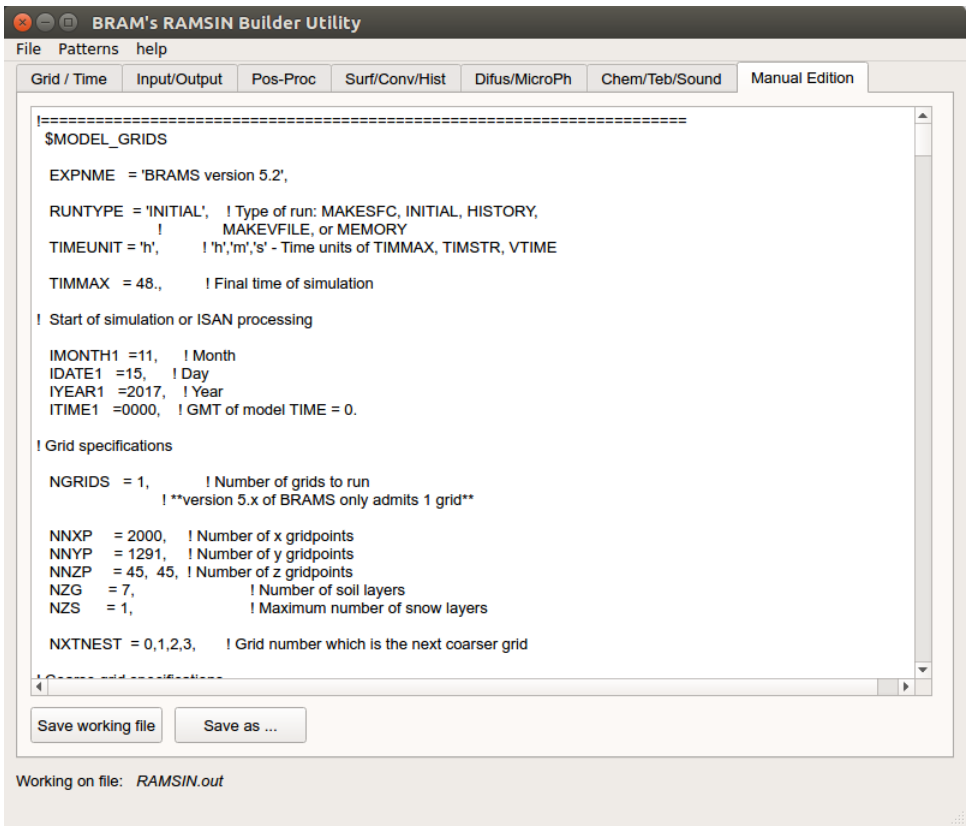


In the next two screens are defined the parameters of microphysics and diffusion, chemistry, aerosols and acoustics.





After the settings are completed, RAMSIN can be saved with a user-defined name via the "File / Save as" menu. You can also load a pre-existing RAMSIN via the "File / Open" menu. Some RAMSIN's patterns can be found in the "Patterns" menu, such as "South America", "Africa", "Southeast Brazil", etc. Finnally, the entire generated RAMSIN configuration can be viewed or edited manually in the "Manual Edition" screen. The "Expert Area" screen is still in development.



CONCLUSIONS AND FUTURE WORK

BRABU can be used as a tool that assists the user in the management of BRAMS model configurations and avoids errors that are made to the RAMSIN configuration.

In the future, the configuration consistency validation logic will be developed, which will check the possible errors of configuration combinations. Another expected functionality is a new tab where it will be possible to launch the model and manage the executions or a set of executions, as in an Ensemble, or the submission of only one work in a server, being able to be configured items like number of processors, queue , user, etc.