





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 <u>http://ftpl.cptec.inpe.br/brams/brabu/install_pre_requisites_py2.7.sh</u>

or

→ wget http://ftpl.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: \rightarrow cd \sim/
```

```
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

\rightarrow 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://ftpl.cptec.inpe.br/brams/brabu/install_brabu_py2.7.sh

or:

→ wget http://ftpl.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.

Grid / Time Input/Output Pos-Proc Surf	Conv/Hist Difus/MicroPh	Chem/Teb/Sound	Manual Edition					
✔ Input	✔ Output for SFC and V	/file						
Topography File Prefix	Topography File Prefix							
aout/exp1_1km/2017111500/sfc/top_OQ3g	BRAMS_5.2/SURFACE_DATA/topo1km/EL Read from std							
Surface File Prefix	Soil File Prefix							
aout/exp1_1km/2017111500/sfc/sfc_OQ3g	5.2/SURFACE_DATA/GL_FAO_INPE/FAO Read from std							
SST File Prefix	SST File Prefix							
aout/exp1_1km/2017111500/sfc/sst_OQ3g	r/tempo/BRAMS/ams_	20km//sst_week/W	Read from std					
NDVI File Prefix	NDVI File Prefix							
aout/exp1_1km/2017111500/sfc/ndv_OQ3g	_5.2/SURFACE_DATA	Read from std						
Dprep File (Press) Prefix	Vegetation File Prefix							
./datain/2017111500/COND_CPT/dp	5.2/SURFACE_DATA/GL_OGE_INPE/OGE Read from std							
Isan File Prefix	In case of No file							
aout/exp1_1km/2017111500/IVAR/OPQUE	Fill in Rsurf	v Opdate	SST on run					
Varfile Initialization File Prefix								
aout/exp1_1km/2017111500/IVAR/OPQUE								
✔ Soil Moisture	✓ Model Output Initial n	node Data						
Soil Moisture File Prefix	Analisys Output Prefix		If analisys exist					
./datain/2017111500/UMID/GL_SM.GPNR.	taout/exp1_1km/20171	Overwrite -						
Soil Moisture Pre Calculated File Prefix	History File Output Pre	Action for History						
m/2017111500/soil/GL_SM.GL_SM.GPNR.	ataout/exp1_1km/2017	111500/HIS/OPQUE	Delete Previous 👻					

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

rid / Time Input/Output Pos-Proc	Surf/Conv/Hist	Difus/MicroPh	Chem/Teb/Sound	Manual Edition
List of Variables to Select (click here)		✓ Grads S	etup Info	
accon aggregates albedt aot500 aot550 apras aprgr aprmc aprst aprw cape ctxdn1 ctxup1 cine cloud CO CO_src CO2 anto CO2_bum CO2		Upleft Lat -90. Lon -180. Max Z leve 19 IP Lev.: 40 ✓ Projection ANL to GR. ONE Number of precip acccon aggregates albedt aot500	DnRight +90. 180. Lat Lon 1 Press Level In 1 . 0, 350, 300, 250, 200, on? Ascii Data ADS Mean Type VMP Vars Selected	Site -10.76 -62.36 put Levels 9 150, 100 ?
dfxdn1 dfxup1		Pos Proc F	ile Prefix	
efxdn1	Ŧ	./dataout/e	xp1_1km/2017111500	/grads/OPQUE

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

Grid / Time Input/Output	t Po	os-Proc	Surf/Conv/Hist	Difus/MicroPh		Chem/Teb/Soun	d Manua	I Edit	ion	
✓ Topgraphy			✓ Convective	Parametrization						
Topgraphy Scheme	WTSA	<u> </u>	Convective Par	ametrization Clo	su	re Type (for Grel	I)			0
Average Orography 👻 0).	70Eact	Off	▼ PE	3 - 1	Peter Betchtold		D Spr	read	
Surface Roughness M	lax Z0	201 000	0h-10 D	Sha	allo	w Update 600	G3D	Smo	othF	1 0.0
Veg., Bare Soil, Water 👻 5	5.	0.005	Shallow C. Par	ametrization Fre	eq.	[sec]	G3D	Smo	oth\	0.0
			оп	Vm Clo	oud	on .000	5 Conv Free	. Upd	late :1	600.
✓ Surface										
4 3 Sfc Layer/Soil/Veg Mod.	1. (Constant S	05 .2 Soil Type	295.	1	-12.25	0.45	u 🏝	1.	Ter≜ 0
5 JULES	-	sandy cla	y loam 👻 C	onstant	2	-7.25	0.45		2.	0
Vegetation Type	5	Soil Moistu	ire ().	3	-4.250	0.30		з.	0
Desert	•	INITIAL	C	onstant	4	-2.25	0.25		4.	0
	V	When Soil	Moisture Fail	fc ly moist grad	5	-10	0.22	•	5	0 -
		Look 5 da	iys past befc 👻 0).	•)			
✓ History Input Data										
Start Of History (Hour)	00:00		Init from analisys							
History File Input		Inpu	ut Analisys File Nar	ne						
	ad tyt be	NO	NE							
-H-2017-11-15-000000-he	au.u.									

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

Grid / Ti	ime Input/Ou	tput Pos-Proc	Surf/Conv/Hist	Difus/MicroPh	Chem/Teb/Sour	nd Manual Editio	n
✓ Micr	ophysics			✓ Microp	hysics Parameters		
Type of 2 - G. 1	Microphysics Thompson CW S	ingle	•	Cparm	.3e9		
				RParm	1.e-3		
	Mo	isture Complexity le	vel	Pparm	1.e-6		
_evel	3 0-	Bulk riming		Sparm	1.e-3 Chara	cteristic diameter,	
Irime	1 1-	bin riming Original 4.3 Power	Laws	Aparm	1.e-3 # con	centration ntercept	
IPlaws	0 1-	New Power Laws	2)	GParm	1.e-3		
	(K.)	Carver, which en 1990	5)	HDorm	3.e-3		
				nraim	1.6-5		
ICloud	5			DParm	0		
IDriz	0	Microphysics flags		GNU	Z.	m concreting with a	
ID112	2	Microphysics hags			Fill the	em separaung wun d	;ommas
Rain	5	1 - diagnostic conce	en.	✓ Difus	ion		
IPris	0	2 - specified mean 3 - specified v-inter	diameter cept	Difusion	K flag	Hor. K Deform	.32
Isnow	2	4 - specified concer	ntration	Anisotro	opic Deformation	•	
laggr	2	o - prognostic conc	entradon	Horizont	al Gradient	Vert. K Deform.	.35
IGraup	2			Tue Ho	rizontal	 Hor. Ratio def. 	3.
IHail	2						
				Ratio mi	nimum Hor. 1.	Vert. Ratio def.	3.

Grid / Time Input/Output Pos-Proc	Surf/Conv/Hist Difu	s/MicroPh	n	Chem/Teb/Soun	d N	lanual Edi	tion	
✔ Chemistry		▼ TEB						
CCATT	Aqueous Chem		Т	EB				
4dda for Chem Mocage Data			/ S	ounding				
ype of Chemistry	Timestep for Chemi	stry	Wh	at is in PS array		What is in	TS array	
•	240. H		He	eights [m]	-	Temp [C]		
Splitting operator method			Wh	at is in RTS array	/	What is in US/VS		
SYMMETRIC -	Recycle Tracers		Rel. Humidity [%] 🔹		-	u,v comp.[m/s]		Ŧ
Source File Name prefix	In case of not found	it						
NONE	Use Last Sources	-	HS	0.				
Diurnal Cycles				PS		TS	R	TS 4
1	Extra 2d vars	_	1	1010.	25.		70.	
Fill them separating with commas	Extra 3d vars 0	_	2	1000.	18.5		70.	
/ Asreal			3	2000.	12.		70.	
Aerosol			4	3000.	4.5		70.	
Aerosol	 Use plumerise 		5	4000.	-11.		20.	
	Plumerise Frequent	;y [s]	6	6000.	-24.		20.	
Aerosoi Frequency [s]			7	8000.	-37.		20.	
240.0	Volcanoes		8	11000.	-56.5		20.	
			•					Þ

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.

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File Patterns help	
Grid / Time Input/Output Pos-Proc Surf/Conv/Hist Difus/MicroPh Chem/Teb/Sound Manual Edition	
Grid / Time Input/Output Pos-Proc Surf/Conv/Hist Difus/MicroPh Chem/Teb/Sound Manual Edition Image: Start of	
Save working file Save as	
Working on file: RAMSIN.out	

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.