

# Global Simulator 0.01

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Authorship Note . . . . .	1
1.2	Version Note . . . . .	1
1.3	Licence Note . . . . .	1
1.4	Terms Definition . . . . .	1
<b>2</b>	<b>Data: Tables and Maps</b>	<b>3</b>
2.1	Frozen Tables (FT) . . . . .	3
2.1.1	Config Frozen Table . . . . .	3
2.1.2	Force Frozen Table . . . . .	4
2.1.3	Action Frozen Table . . . . .	4
2.1.4	Building Frozen Table . . . . .	6
2.1.5	Stock Frozen Table . . . . .	6
2.2	Constant Tables . . . . .	6
2.2.1	Terrain Constant Table . . . . .	6
2.2.2	Stock Constant Table . . . . .	7
2.2.3	Process Constant Table . . . . .	7
2.3	Static Tables (ST) . . . . .	7
2.3.1	Control Static Table . . . . .	7
2.3.2	Nation Static Table . . . . .	8
2.3.3	Swap Static Table . . . . .	8
2.4	Dynamic Tables (DT) . . . . .	8
2.4.1	Action Dynamic Table . . . . .	8
2.4.2	Force Dynamic Table . . . . .	8
2.4.3	Stock Dynamic Table . . . . .	9
2.4.4	Stream Dynamic Table . . . . .	9
2.4.5	Market Dynamic Table . . . . .	9
2.5	Constant Maps (CM) . . . . .	9
2.5.1	Diagram Constant Map . . . . .	10
2.5.2	Source Constant Map . . . . .	10
2.6	Static Maps (SM) . . . . .	10
2.6.1	Nation Static Map . . . . .	10
2.6.2	Building Static Map . . . . .	10
2.6.3	Noosphere Static Map . . . . .	11
2.6.4	Stock Static Map . . . . .	11
<b>3</b>	<b>Mechanisms</b>	<b>12</b>
3.1	Event Order . . . . .	12
3.2	Node Control . . . . .	12
3.3	Actions . . . . .	12
3.4	Map Projection . . . . .	12
3.4.1	Cylinder Projection . . . . .	12
3.5	Transport . . . . .	12
3.5.1	Stock Transport . . . . .	13

3.5.2	Force Transport . . . . .	13
3.6	Population . . . . .	13
3.6.1	Employment . . . . .	13
3.6.2	Birth Rate . . . . .	13
3.6.3	Migration . . . . .	13
3.7	Production . . . . .	13
3.7.1	Stock Production . . . . .	13
3.7.2	Force Production . . . . .	13
3.7.3	Development . . . . .	13
3.8	Maintenance . . . . .	13
3.8.1	Force Maintenance . . . . .	13
3.8.2	Building Maintenance . . . . .	13
3.8.3	Stream Maintenance . . . . .	13
3.9	Stock Exchange . . . . .	13
3.9.1	Swap Ratio . . . . .	13
3.9.2	Local Exchange . . . . .	13
3.9.3	Inter-Controller Trade . . . . .	13

# Chapter 1

## Introduction

### 1.1 Authorship Note

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### 1.2 Version Note

Version of this document: 0.01

### 1.3 Licence Note

1. The authors of this document do not provide any guarantee of using the presented model or any part of this model.
2. All authors of this document should be efficiently informed about any use (especially commercial and public) of the presented model or any part of this model.
3. Scientific and other publications, which provide results obtained by using the presented model or any part of this model, should have an appropriate note (including all authors names and surnames) about this fact at least in bibliography.

### 1.4 Terms Definition

1. **model** – a set of configurations, a specific instance of world/map
2. **node** – limited area, territorial administration unit
3. **nation** – an ethnically homogeneous group of people
4. **stock** – a type of good which can be controlled, transported and processed
5. **stream** – a pipe between 2 adjacent nodes for stock transport
6. **population** – sum of all people (over nations) in a node
7. **process** – a defined way to process an combination of stocks to:
  - another combination of stocks (stock process)
  - any selected force (force process)
8. **action** – a type of acting, it gives possibility to impact on a model
9. **controller** – an object giving access for human player or controlled by AI
10. **force** – a type of power which represents quantitative impact on a node
11. **attitude** – quantitative representation of sympathies or dislikes from a nation to a controller
12. **noosphere** – sphere of human thought, it represents control of population using media

13. **current** – this quantity characterizes strength (steepness) and direction of:
- surface slope
  - sea currents
  - rivers

# Chapter 2

## Data: Tables and Maps

All data, including maps, shall be organized in tables. Each table has to contain at least a single key (column of the table). Division between keys and values are defined by "role" column in a corresponding table header definition. Each key has to be unique in a table.

### 2.1 Frozen Tables (FT)

**Frozen Tables** are tables which are defined for a specific simulator version. They have fixed size and constant keys defined by this document. The column configuration is also constant or depends on other constant or static tables. Selected values can be set only before simulating. During the simulation, they are always read only.

#### 2.1.1 Config Frozen Table

- table name: config\_ft
- table type: frozen table
- brief: a list of predefined global parameters

Tab. 2.1.1 Header

column title	column type	column role	column brief
name	string	key	parameter name
value	float	value	parameter value

Tab. 2.1.1 Content

name	parameter brief
map_scale	map scale
map_width	map width (rounded to int)
map_height	map height (rounded to int)
map_project	code of map projection (rounded to int, only 0)
transship_fee	cost metric for land-see/see-land transport
transport_fee	cost metric for civilian transport
fortress_fee	cost metric for units moving during a battle
base_fee	base cost metric for moving
current_base	base of current
transship_gain	building gain for land-see/see-land transport
transport_gain	building gain for civilian transport
product_gain	building gain for production
market_gain	reduction of distribution cost from infrastructure
house_gain	house capacity (mean number of people per house)
build_staff	mean number of people needed to building maintenance
build_cost	amount of building stock needed to building

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name	parameter brief
offensive_cost	cost of offensive as factor
defensive_cost	cost of defensive as factor
barrack_cost	cost of barrack as factor
media_attitude	impact on noosphere from infrastructure
capitol_attitude	impact on noosphere from capitol
leader_attitude	impact on nation from leadership
nation_attitude	impact on noosphere from nation
human_living	amount of living stock needed for people
employ_impact	employ impact on birth rate
attitude_impact	attitude impact on birth rate
birth_rate	base birth rate
swap_tollerance	swap tollerance
swap_dynamic	swap dynamic
employ_dynamic	employ dynamic
attitude_dynamic	attitude dynamic
emigration_dynamic	emigration dynamic
land_range	land trade/civil range
see_range	see trade/civil range
air_range	air force range
navy_range	navy warfare range
light_range	land light range
heavy_range	land heavy range

### 2.1.2 Force Frozen Table

- table name: force\_ft
- table type: frozen table
- brief: a list of predefined military processes

**Tab. 2.1.2 Header**

column title	column type	column role	column brief
name	string	key	force name
code	char	key	force code
offensive	float	value	offensive power $(0, \infty)$
defensive	float	value	defensive power $(0, \infty)$
civil	float	value	civil power $(0, \infty)$
$\forall \text{ name} \in \text{stock\_ft}$	float	value	stocks needed to work
$\forall \text{ name} \in \text{stock\_ct}$	float	value	stocks needed to work
<i>Each unit needs stocks to work.</i>			

**Tab. 2.1.2 Content**

name	code	force brief
civil	C	civil service (diplomats, intelligence, corporations)
light	L	land light army (mainly infantry)
heavy	H	land heavy army (mechanized, artillery)
navy	N	naval warfare (selected actions on adjacent land allowed)
air	A	air force (selected remote actions allowed)

### 2.1.3 Action Frozen Table

- table name: action\_ft
- table type: frozen table
- brief: a list of predefined action types

**Tab. 2.1.3 Header**

column title	column type	column role	column brief
name	string	key	action name
type	string	value	types are defined by Tab. 2.1.3 Coding
factor	float	value	factor ( $0, \infty$ ) expresses efficient of the action
target	string	value	target type (controller, nation, process, ...)
attitude	float	value	attitude $(-\infty, \infty)$ on population

**Tab. 2.1.3 Coding**

type code	code brief
C	can be realized by civil service
L	can be realized by light forces
H	can be realized by heavy forces
N	can be realized by naval forces
A	can be realized by air forces
1	can be realized if defence of population will be overcome
2	can be realized if defence of action target (including population support) will be overcome
3	can be realized if defence of all enemies and population will be overcome
X	civil power using
D	defencive power using
O	offencive power using

**Tab. 2.1.3 Content**

action	type	target	brief
A0	CLHN-3-X	stock	apply input duty
A1	CLHN-3-X	stock	apply output duty
A2	CLHN-3-X	stock	apply transit duty
A3	CLH-1-X	stock	get taxes
B0	CLHA-1-O	process	block stock process
B1	CLHA-2-O	controller	block force processes
B2	CLHA-1-X	—	control force processes
B3	C-1-X	—	realize stock processes
C0	C-1-X	—	get economy info
C1	C-2-X	controller	get military info
C2	C-2-X	controller	get service info
D0	CLHNA-1-D	—	block X2 and X3 actions (default)
D1	CLHNA-2-O	controller	remove service
E0	C-1-X	nation	spreading positive propaganda
E1	C-2-X	controller	spreading negative propaganda
F0	CVMNA-1-X	stock	create stream
F1	CVMNA-2-O	controller	block/destroy stream
F2	CVMNA-2-O	controller	confiscate/destroy stock (remote only A)
G0	C-1-X	node	move civil force
G0	LHNA-3-O	node	move non civil force
G1	CLHNA-2-O	controller	strike militarily (remote only A)
H0	CL-1-X	building	develope selected building
H1	CLH-1-O	building	destroy selected non-critical building
H2	CLHAN-3-O	—	destroy critical building (remote only AN)
H3	CLHAN-3-O	—	destroy all building (remote only AN)
I0	CLH-3-O	nation	persecute selected nation
I1	CLH-3-O	—	persecute all nations
J0	CLHAN-1-X	nation	change leader nation (only in capitol)
J1	CLHAN-1-X	node	change capital node (only in capitol)
J2	CLHAN-1-X	controller	peace declare (only in capitol)
J3	CLHAN-1-X	controller	war declare (only in capitol)

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action	type	target	brief
K0	CLHN-1-X	stock	declare stock buy
K1	CLHN-1-X	stock	declare stock sell
K2	CLHN-1-X	stock	declare stock distribution

#### 2.1.4 Building Frozen Table

- table name: building\_ft
- table type: frozen table
- brief: a set of predefined buildings

Tab. 2.1.4 Header

column title	column type	column role	column brief
name	string	key	name of building

Tab. 2.1.4 Content

name	building brief
fortress	fortress used for defence during battle (critical)
transship	transship infrastructure (critical)
transport	transport infrastructure (critical)
market	trade infrastructure (allows stock distribution)
media	information infrastructure (permanent impact)
house	housing infrastructure (capacity)

#### 2.1.5 Stock Frozen Table

- table name: stock\_ft
- table type: frozen table
- brief: a list of predefined stocks

Tab. 2.1.5 Header

column title	column type	column role	column brief
name	string	key	stock name
decay	float	value	decay (0, 1] of the stock per each round
toll	float	value	toll (0, $\infty$ ) for stock transport

Tab. 2.1.5 Content

name	decay range	toll range	stock brief
energy	1	(0, $\infty$ )	energy which can be consumed in the current round
building	1	$\infty$	building possible to develop in the current round
living	1	$\infty$	living represents consumption in the current round

## 2.2 Constant Tables

**Constant Tables** are tables which are defined for a specific model. Their sizes, column configuration, and content (keys and values) have to be set before simulating. During the simulation, their are always read only.

### 2.2.1 Terrain Constant Table

- table name: terrain\_ct
- table type: constant table
- brief: a list of terrains

**Tab. 2.2.1 Header**

column title	column type	role	brief
name	string	key	terrain name
color	string	key	RGB in HEX
drag	float	value	resistance $(0, \infty)$
charge	float	value	building maintenance charge $(0, \infty)$

### 2.2.2 Stock Constant Table

- table name: stock\_ct
- table type: constant table
- brief: a list of stocks

**Tab. 2.2.2 Header**

column title	column type	column role	column brief
name	string	key	stock name
decay	float $(0, 1]$	value	decay in each round
toll	float $(0, \infty)$	value	toll for transport

### 2.2.3 Process Constant Table

- table name: process\_ct
- table type: constant table
- brief: a list of processes

**Tab. 2.2.3 Header**

column title	column type	column role	column brief
name	string	key	process name
energy	float $(-\infty, \infty)$	value	energy amount
living	float $[0, \infty)$	value	living amount
building	float $[0, \infty)$	value	building amount
$\forall \text{ name} \in \text{stock\_ct}$	float $(-\infty, \infty)$	value	stock amount

*Each process can have any combinations of stocks.*

## 2.3 Static Tables (ST)

**Static Tables** are tables which are defined for a specific model. Their sizes and column configuration have to be set before simulating and are read only. However, during the simulation, their content (values only) can freely be modified.

### 2.3.1 Control Static Table

- table name: control\_st
- table type: static table
- brief: a list of controllers

**Tab. 2.3.1 Header**

column title	column type	column role	column brief
name	string	key	controller name
nation	string	value	nation of leader
capitol	string	value	base node name of the controller
employment	float	value	model of employment $(0, 1]$
$\forall \text{ name} \in \text{control\_st}$	bool	value	war declaration

*Each controller can declare war for any other controller.*

### 2.3.2 Nation Static Table

- table name: nation\_st
- table type: static table
- brief: a list of nations with their attitude to controllers

**Tab. 2.3.2 Header**

column title	column type	column role	column brief
name	string	key	nation name
employment	float	value	fraction of employment
$\forall \text{ name} \in \text{control\_st}$	float $[-1, 1]$	value	attitude
<i>Each nation has specified attitude to all controllers.</i>			

### 2.3.3 Swap Static Table

- table name: swap\_st
- table type: static table
- brief: a list of stocks with their mean prices expressed in amount of different stocks

**Tab. 2.3.3 Header**

column title	column type	column role	column brief
name	string	key	stock name
volume	float	value	stock volume exchanged
offer	float	value	total stock offer
need	float	value	total stock need
$\forall \text{ name} \in \text{stock\_ft}$	float $(0, \infty)$	value	mean ratio/price
$\forall \text{ name} \in \text{stock\_ct}$	float $(0, \infty)$	value	mean ratio/price
<i>Each stock has specified prices expressed by all stocks.</i>			

## 2.4 Dynamic Tables (DT)

**Dynamic Tables** are used as buffers for data which can be modified during simulating. Their sizes can be freely changed (even to 0 rows). Only the column configuration has to be set before the simulation but later it is read only.

### 2.4.1 Action Dynamic Table

- table name: action\_dt
- table type: dynamic table
- brief: a list of actions to process

**Tab. 2.4.1 Header**

column title	column type	column role	column brief
owner	string	value	controller name
action	string	value	action name
force	char	value	force code – defined by Tab. 2.1.2
share	float	value	share/fraction of available impact
start	string	value	starting node name
stop	string	value	destination node name
target	string	value	controller/nation/stock/process

### 2.4.2 Force Dynamic Table

- table name: force\_dt
- table type: dynamic table
- brief: a list of forces over controllers

**Tab. 2.4.2 Header**

column title	column type	column role	column brief
owner	string	value	controller name
node	string	value	node name
force	char	value	force code – defined by Tab. 2.1.2
amount	float	value	force amount

### 2.4.3 Stock Dynamic Table

- table name: stock\_dt
- table type: dynamic table
- brief: a list of stocks over controllers

**Tab. 2.4.3 Header**

column title	column type	column role	column brief
owner	string	value	controller name
node	string	value	node name
stock	string	value	stock name
amount	float	value	stock amount

### 2.4.4 Stream Dynamic Table

- table name: stream\_dt
- table type: dynamic table
- brief: a list of streams over nodes

**Tab. 2.4.4 Header**

column title	column type	column role	column brief
owner	string	value	controller name
stock	string	value	stock name
start	string	value	starting node name
stop	string	value	destination node name
amount	float	value	stock amount

### 2.4.5 Market Dynamic Table

- table name: market\_dt
- table type: dynamic table
- brief: a list of offered stock transactions over nodes

**Tab. 2.4.5 Header**

column title	column type	column role	column brief
owner	string	value	controller name
node	string	value	node name
stock	string	value	stock name
amount	float	value	stock amount

## 2.5 Constant Maps (CM)

**Constant Maps** are tables which are defined for a specific model with the geographical context. Their sizes, column configuration, and content have to be set before simulating. During the simulation, their are always read only.

### 2.5.1 Diagram Constant Map

- table name: diagram\_cm
- table type: constant map
- brief: a list of atoms with terrain and node characterization over the geographical context

Tab. 2.5.1 Header

column title	column type	column role	column brief
x	int	part of key	x coordinate $[0, \infty)$
y	int	part of key	y coordinate $[0, \infty)$
terrain	string	value	terrain name
node	string	value	node name
dx	float	value	vector x component $(-\infty, \infty)$
dy	float	value	vector y component $(-\infty, \infty)$

### 2.5.2 Source Constant Map

- table name: source\_cm
- table type: constant map
- brief: a list of natural stock source over the geographical context

Tab. 2.5.2 Header

column title	column type	column role	column brief
node $\forall \text{ name} \in \text{stock\_ct}$	string float	key value	node name yield of stock $[0, \infty)$
<i>Each node can be a source of any stock from stock_ct.</i>			

## 2.6 Static Maps (SM)

**Static Maps** are tables which are defined for a specific model with the geographical context. Their sizes and column configuration have to be set before simulating and are read only. However, during the simulation, their content (values) can freely be modified.

### 2.6.1 Nation Static Map

- table name: nation\_sm
- table type: static map
- brief: a list of nation over the geographical context

Tab. 2.6.1 Header

column title	column type	column role	column brief
node $\forall \text{ name} \in \text{nation\_st}$	string int	key value	node name number of people $[0, \infty)$
<i>Each nation has a specific distribution over nodes.</i>			

### 2.6.2 Building Static Map

- table name: building\_sm
- table type: static map
- brief: a list of building over the geographical context

**Tab. 2.6.2 Header**

<b>column title</b>	<b>column type</b>	<b>column role</b>	<b>column brief</b>
node	string	key	node name
$\forall \text{ name} \in \text{building\_ft}$	int	value	number of buildings $[0, \infty)$
$\forall \text{ name} \in \text{process\_ct}$	int	value	number of buildings $[0, \infty)$
$\forall \text{ name} \in \text{force\_ft}$	int	value	number of buildings $[0, \infty)$
$\forall \text{ name} \in \text{stock\_ct}$	int	value	number of buildings $[0, \infty)$

*Each building has a specific distribution over nodes.*

### 2.6.3 Noosphere Static Map

- table name: noosphere\_sm
- table type: static map
- brief: a list of controller share of information media over the geographical context

**Tab. 2.6.3 Header**

<b>column title</b>	<b>column type</b>	<b>column role</b>	<b>column brief</b>
node	string	key	node name
$\forall \text{ name} \in \text{control\_st}$	float	value	share $[0, 1]$

*Each controller can have a specific distribution of impact over nodes.*

### 2.6.4 Stock Static Map

- table name: stock\_sm
- table type: static map
- brief: a list of gathered stock over the geographical context

**Tab. 2.6.4 Header**

<b>column title</b>	<b>column type</b>	<b>column role</b>	<b>column brief</b>
node	string	key	node name
$\forall \text{ name} \in \text{stock\_ft}$	float	value	amount $[0, \infty)$
$\forall \text{ name} \in \text{stock\_ct}$	float	value	amount $[0, \infty)$

*Each stock can have a specific distribution over nodes.*

# Chapter 3

## Mechanisms

3.1 Event Order

3.2 Node Control

3.3 Actions

3.4 Map Projection

3.4.1 Cylinder Projection

3.5 Transport

$$R_{\text{next}} = R_{\text{curr}} + R_{\text{atom}} X^{-S_{\text{stream}}}$$

**3.5.1 Stock Transport**

**3.5.2 Force Transport**

## **3.6 Population**

**3.6.1 Employment**

**3.6.2 Birth Rate**

**3.6.3 Migration**

## **3.7 Production**

**3.7.1 Stock Production**

**3.7.2 Force Production**

**3.7.3 Development**

## **3.8 Maintenance**

**3.8.1 Force Maintenance**

**3.8.2 Building Maintenance**

**3.8.3 Stream Maintenance**

## **3.9 Stock Exchange**

**3.9.1 Swap Ratio**

**3.9.2 Local Exchange**

**3.9.3 Inter-Controller Trade**