Multi-platform Training Sessions to Teach Agent-Based Simulation

MISS-ABMS
2-week Summer Schools
organized every year since 2011 in Montpellier (France)

Christophe Le Page, CIRAD, France
Géraldine Abrami, IRSTEA, France
Nicolas Becu, CNRS, France
Pierre Bommel, CIRAD, France
Bruno Bonté, IRSTEA, France
François Bousquet, CIRAD, France
Benoît Gaudou, Toulouse University, France
Jean-Pierre Müller, CIRAD, France
Patrick Taillandier, Rouen University, France
MISS-ABMS
Multi-platform International Summer School on Agent-Based Modelling & Simulation for Renewable Resources Management

http://cormas.cirad.fr

http://cormas.cirad.fr

3 platforms

https://code.google.com/p/gama-platform/

https://ccl.northwestern.edu/netlogo/
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Multi-platform International Summer School on Agent-Based Modelling & Simulation for Renewable Resources Management

- Principles, methods and technics of the various stages of ABMS (design, implementation and exploration)

- Focus on a participatory use of models and simulation (in relation to the Companion Modelling approach that was initiated in Montpellier in the 90’s)

- Participants are requested to organize themselves into small groups of 2-4 to develop prototypes: the design stage can only be collaborative
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**Group work: setup during 1st week...**

<table>
<thead>
<tr>
<th>Day 1</th>
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<td>ReHab Ice-breaking role-playing game</td>
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<td>Benchmark Model UML Class diagram</td>
<td>Benchmark Model Participants' Prototype Models (PPMs) Presentation and discussion</td>
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- **Plenary session**
- **Tools demo**
- **Plenary lecture (methodology)**
- **Individual exercise**
- **Group work**
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**Group work: main activity during 2\textsuperscript{nd} week**

<table>
<thead>
<tr>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
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<td><strong>Case Study</strong>: a project with a conceptual model</td>
<td><strong>Case Study</strong>: a project with CORMAS platform</td>
<td><strong>Case Study</strong>: a project with GAMA platform</td>
<td><strong>Case Study</strong>: Wat-A-Game + a project with Netlogo platform</td>
<td><strong>Preparation of PPMs presentation &amp; demo</strong></td>
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| *Participants’ Prototype Models (PPMs)*  
Class diagram, structure and initialisation | *Participants’ Prototype Models (PPMs)*  
Sequence diagram and global dynamics | *Participants’ Prototype Models (PPMs)*  
Activity diagrams and agents behaviours | *Participants’ Prototype Models (PPMs)*  
Indicators, visualisation and analysis | **Presentation and demo of PPMs** |
| **Documentation of ABMs** | **Validation of models** | **Final debriefing** |
| *Participants’ Prototype Models (PPMs)*  
Class diagram, structure and initialisation | *Validation of models*  
General discussion on validation | | |
| *PPMs - static*  
Presentation to another group | *Participants’ Prototype Models (PPMs)*  
Activity diagrams and agents behaviours | *Participants’ Prototype Models (PPMs)*  
Indicators, visualisation and analysis | |
| *PPMs - global dynamics*  
Presentation to another group | | | |
| *PPMs - agents behaviours*  
Presentation to another group | | | |
| *PPMs - visualisation*  
Presentation to another group | | | |

**Summer School Diner**
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Group work

Reference system

Domain model

Design model
(conceptual model)

Simulation model in Cormas
Simulation model in Gama
Simulation model in Netlogo
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Setting-up a worldwide network
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Diversity of participants

Disciplines
- Agriculture: 22
- Geography: 14
- Environmental studies: 16
- Economics: 12
- Computer Sciences: 7
- Ecology: 10
- Social Sciences: 8
- Water management: 9

Positions
- Researcher: 33
- PhD student: 47
- Master student: 5
- Professor-Lecturer: 8
- Post-doc fellow: 5
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## Triplication of a benchmark model

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Legend:
- Plenary session
- Tools demo
- Plenary lecture (methodology)
- Individual exercise
- Group work
Implementing the same benchmark model with various ABM platforms

When the implementations are performed by the same computer scientists, there is a bias due to the unequal command of the different platforms.
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Triplication of a benchmark model by experts of the 3 platforms

Domain model
Implicit assumptions
Design model 1
Design model 2
Design model 3
Implementation biased by built-in scheduling control

Simulation model in Cormas
Simulation model in Gama
Simulation model in Netlogo
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Benchmark model: verbal description

• A landscape displays a random pattern with half forested plots and half cleared plots. The area represents 900 Ha of a fire-prone monospecific open forest that is divided in plots of 1 Ha. When a fire breaks out, it spreads swiftly around the landscape by setting ablaze all neighboring forested plots.
• A voluntary forest fire-fighting brigade made of 10 firefighters is monitoring the forest. Each firefighter patrols the forest by moving randomly from one plot to a surrounding plot. When detecting a burning plot around its location, a firefighter goes to the fire site to extinguish it.
• In a first scenario, firefighters act independently: they have no mean to know where the other fighters are located and what they are currently doing.
• In a second scenario, the location and the status (fighting a fire or patrolling) of each firefighter are known to all. When a firefighter does not detect any fire around his/her own location, he/she moves towards the closest fire fought by one the other firefighters if any, else he/she continues patrolling
• Compare the two scenarios when initially a fire breaks out in a forested plot randomly picked.
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Benchmark model: verbal description

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Benchmark model: differences in design

- Implicit assumptions about time
  - Speed of fire spreading relative to duration of firefighters’ activities

- Implicit assumptions about space
  - Neighborhood: 4-6-8 ????
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Benchmark model: a unified design (UML)
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Benchmark model: simulation outputs

- The importance of observation
  - Running simulations to figure out if the model is right (verifying that what is exhibited corresponds to what was supposed to be coded)
  - Running simulations to identify meaningful indicators
    - Time to extinguish the fire
    - Size of the remaining forest

- Mastering the dimensions of stochasticity
  - Specifying an initial landscape?

- Comparison of the 3 implementations still to be carefully conducted
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Take-home messages

- With their unexpected behavior, trainees are gifted for tracking down highly unlikely bugs... Training sessions help enhancing the robustness of platforms!

- Trainers are also learning!
  - new ideas for improving the platforms from deeper look into other platforms,
  - detection and specification of agent-based modeling primitives (AMPs)* usable in the various platforms

- 2016 edition: http://www.agropolis.org/miss-abms/

*Bell et al, 2015