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## PaSim - Pasture Simulation Model

Katja Klumpp, Romain Lardy, Anne-Isabelle Graux, Gianni Bellocchi,  
Raphaël Martin

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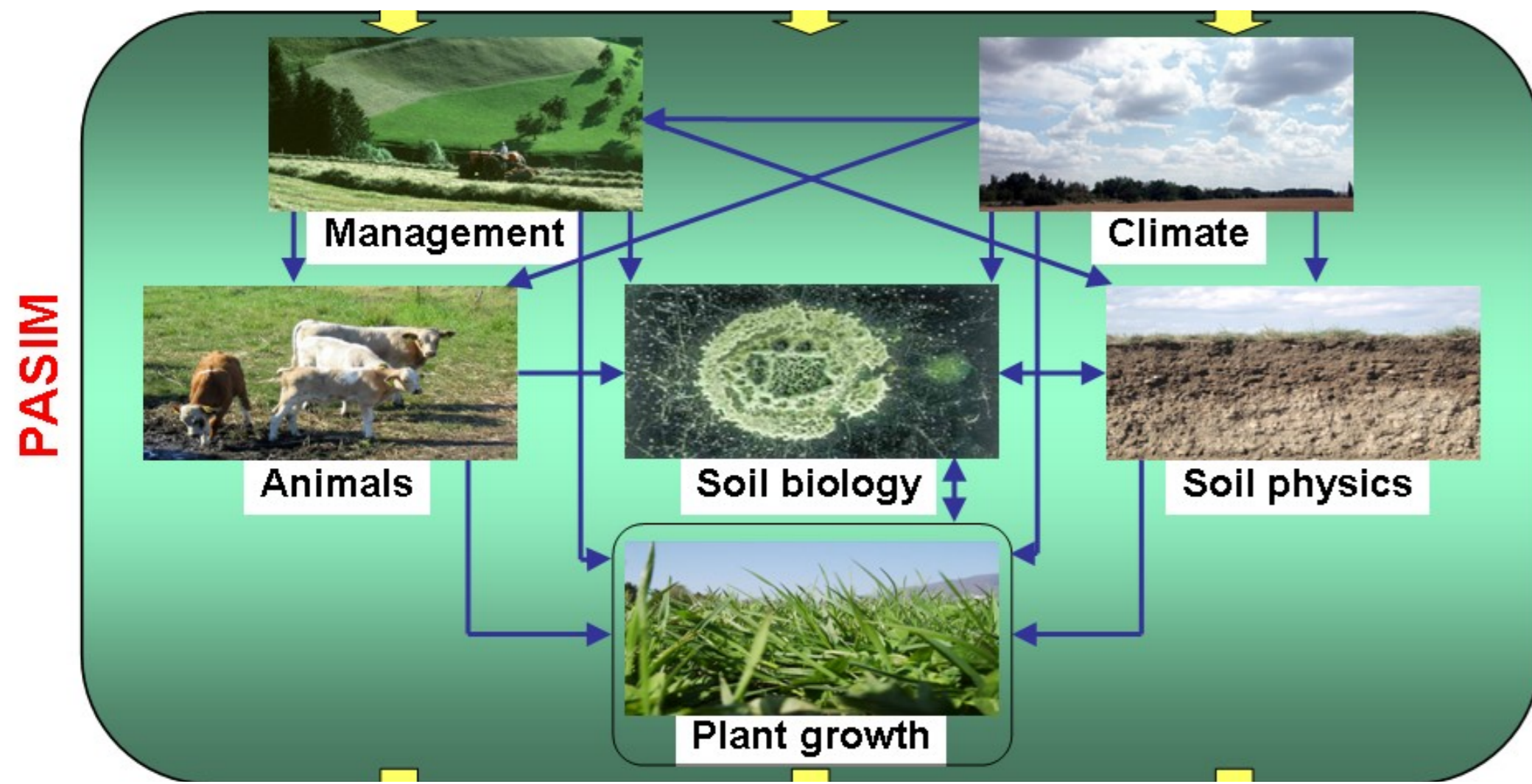
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# PaSim - Pasture Simulation Model



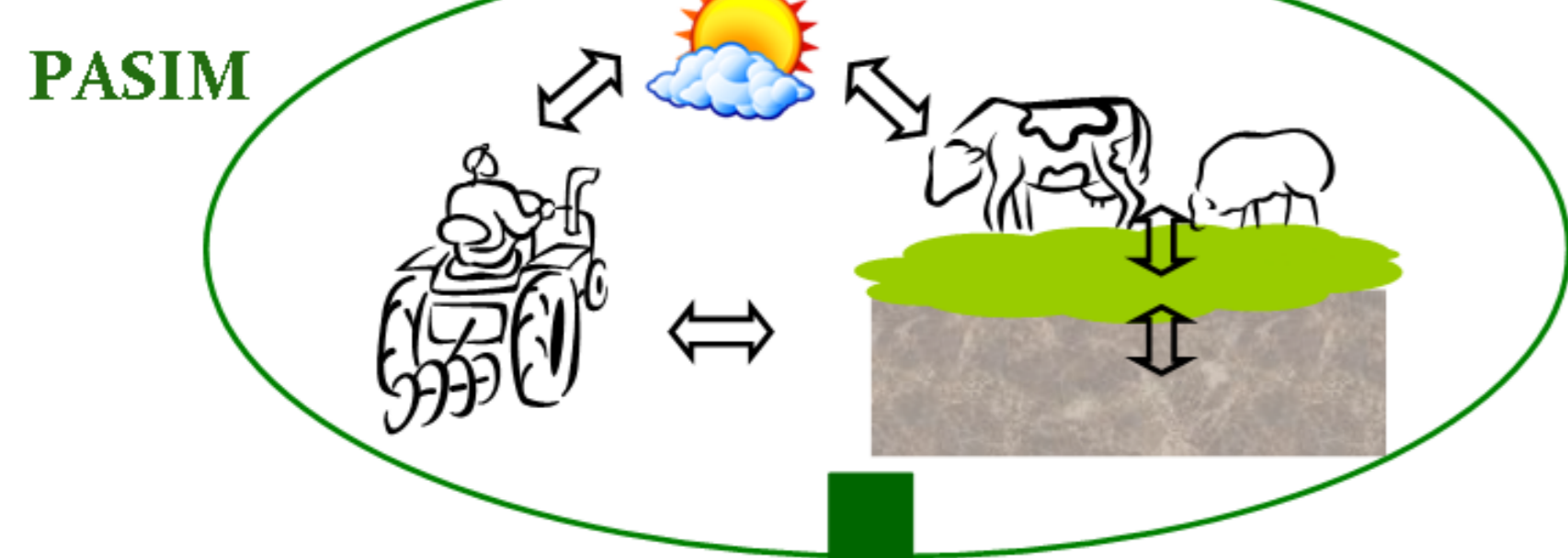
INRA, UR0874, Grassland Ecosystem Research Unit, 234 Avenue du Brézat, 63100 Clermont-Ferrand, France  
<https://www1.clermont.inra.fr/urep/modeles/pasim.htm>

## Model structure



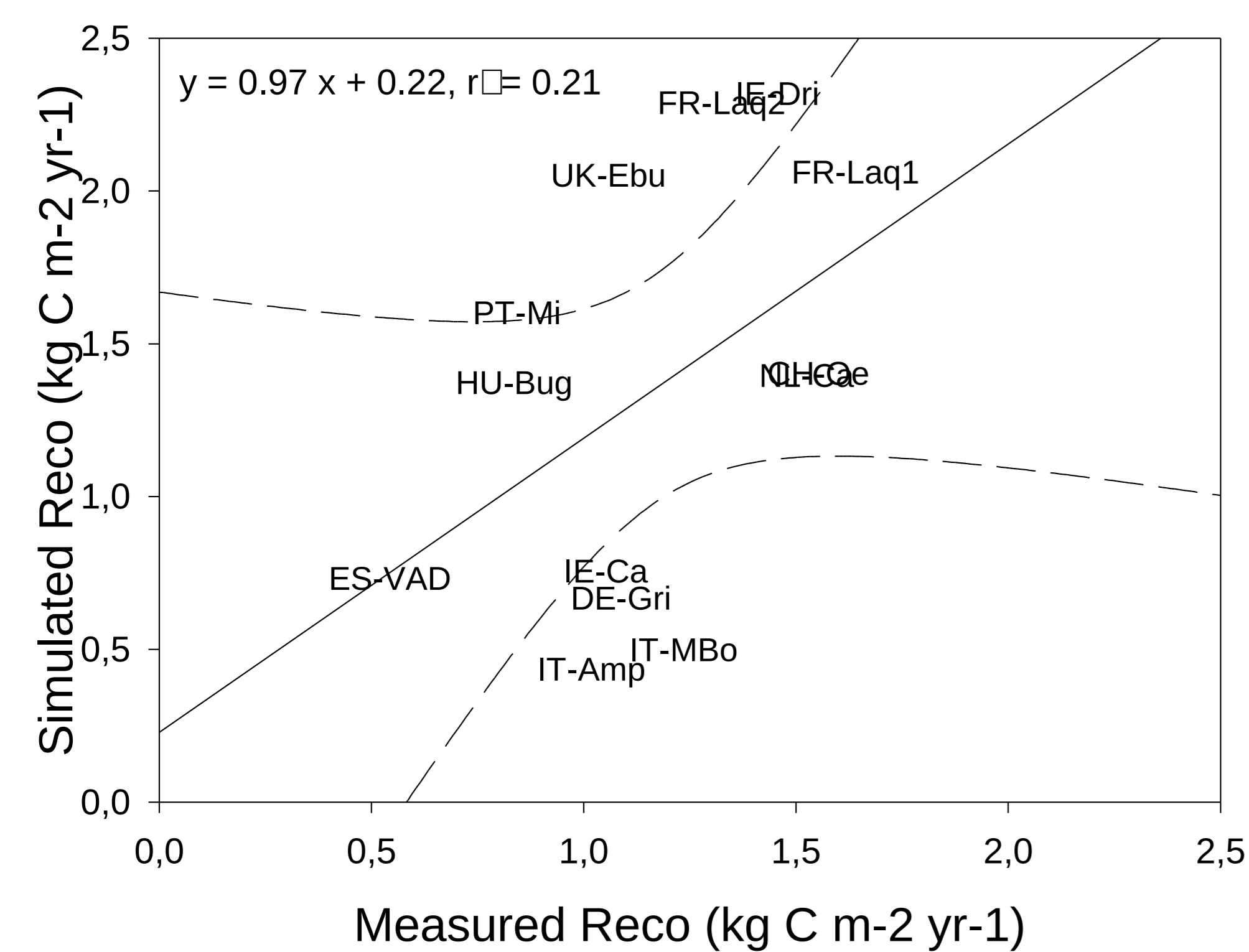
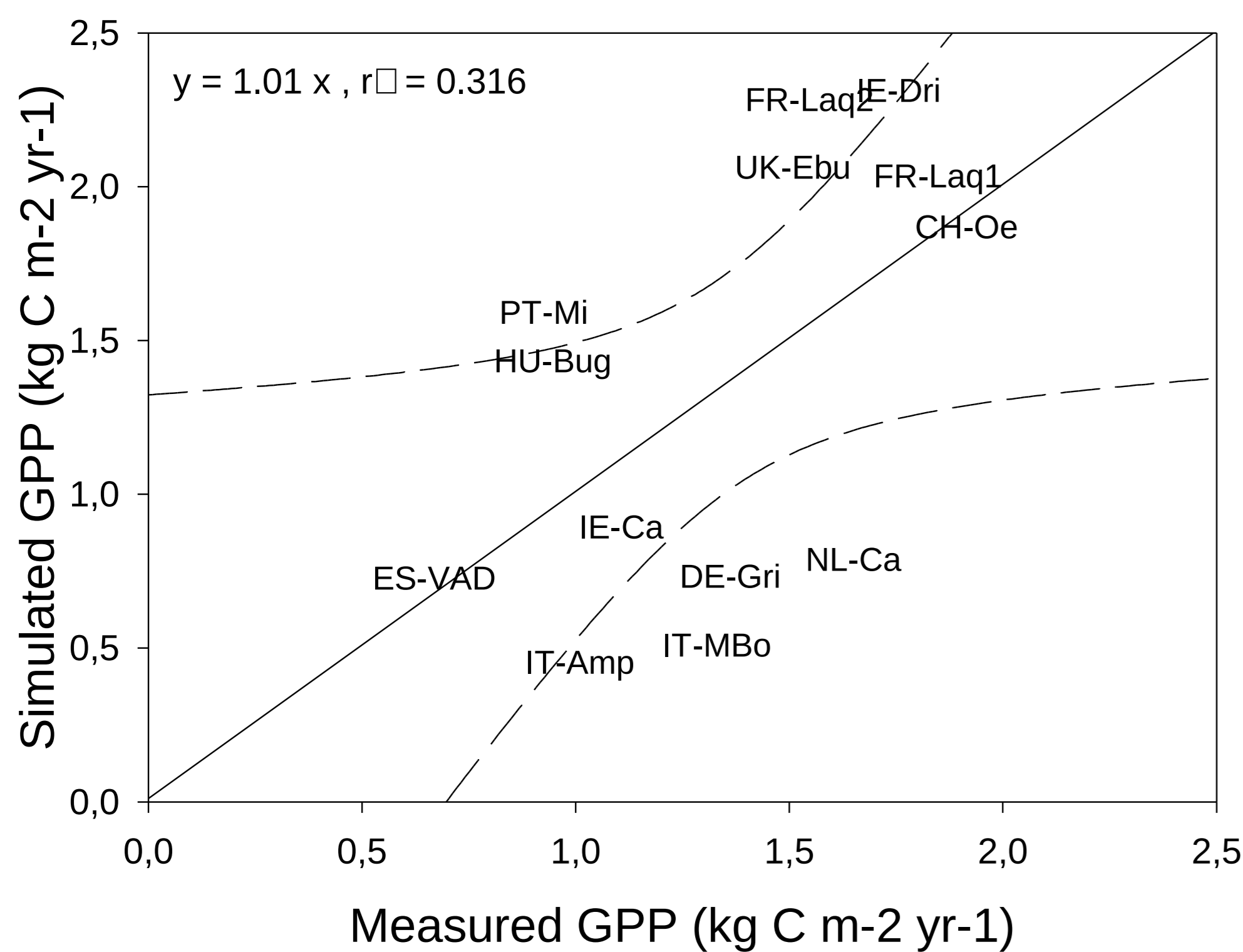
## Data in- and output

Climate	Soil	Vegetation	Herbivores	Management
<ul style="list-style-type: none"> <li>Radiation</li> <li>Precipitation</li> <li>Temperature</li> <li>Vapor pressure</li> <li>Wind speed</li> <li>CO<sub>2</sub></li> <li>NH<sub>3</sub></li> </ul>	<ul style="list-style-type: none"> <li>Texture</li> <li>Soil water content</li> <li>Conductivity</li> <li>Density</li> <li>Depth</li> </ul>	<ul style="list-style-type: none"> <li>Multi or monospecies</li> <li>With or without legumes</li> </ul>	<ul style="list-style-type: none"> <li>Type (heifers, suckler or dairy cows, sheep)</li> <li>LW, BCS, age, MP<sub>pot,max</sub> at turnout to grass</li> </ul>	<ul style="list-style-type: none"> <li>Mowing</li> <li>N fertilization</li> <li>Grazing</li> <li>Tillage</li> </ul>



Fluxes	States	Optimized management
<ul style="list-style-type: none"> <li>GHG (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>)</li> <li>C, N, H<sub>2</sub>O &amp; energy fluxes ...</li> </ul>	<ul style="list-style-type: none"> <li>Forage provision</li> <li>MP, LW and BCS</li> <li>Soil organic matter</li> <li>Soil water content...</li> </ul>	<ul style="list-style-type: none"> <li>Mowing</li> <li>N fertilization</li> <li>Grazing</li> <li>Irrigation</li> </ul>

## Model validation



Comparison of simulated vs. observed mean annual gross primary productivity (GPP) and ecosystem respiration (Reco) at 13 European grassland sites.

## Main properties

- **Process-based biogeochemical model** (H<sub>2</sub>O, C and N cycles)
- **System simulated:** soil-vegetation-animal-atmosphere
- **Short and long term simulations**
- **Subdaily (hourly) time scale** for detailed dynamics and energy budgets stability
- **Plot scale** (upscaling ability)

## Accessibility

- Used for **process understanding** rather than decision support
- **Graphical user interface**
- **Software and documentation** available for research at <https://www1.clermont.inra.fr/urep/modeles/pasim.htm>

## Evaluation/Validation

- **Variables:**
  - Forage yield and quality
  - Greenhouse gas and energy fluxes
  - Soil temperature and water content
  - Animal performance
- **Conditions:** European climate

## Usefulness and originality

Prediction of:

- **mechanistically cattle performance**
- **biogeochemical cycles** of grasslands and their interactions
- **climate changes impacts** on livestock systems, and possible **adaption options**

## Project involvement

- **National Projects**  
CLIMATOR, VALIDATE, ORACLE, EPAD
- **European projects**  
GREENGRASS (2003-2005)  
CARBOEUROPE (2005-2008)  
NITROEUROPE (2007-2011)  
CARBO-EXTREME, GHG-EUROPE, ANIMAL CHANGE

## Perspectives

to improve:

- **legume dynamics**
- **functional plant traits responses** to climate change and management
- grasslands responses to climate and management under **tropical conditions**

## PaSim references

- Riedo et al. 1998, 2002 Ecol. Model.  
 Schmid et al. 2001 Nutr. Cycl. Agroecosys.  
 Vuichard et al. 2007a,b Global Biogeochem. Cy.  
 Graux et al. 2011 (submitted to Agricultural Forest and Meteorology)  
 Graux et al. 2011 (Agr. Ecosyst. Environ., in press)  
 Lardy et al. 2011 (Environmental Modelling and Software, in press)

For further information:  
[pasim@clermont.inra.fr](mailto:pasim@clermont.inra.fr)

