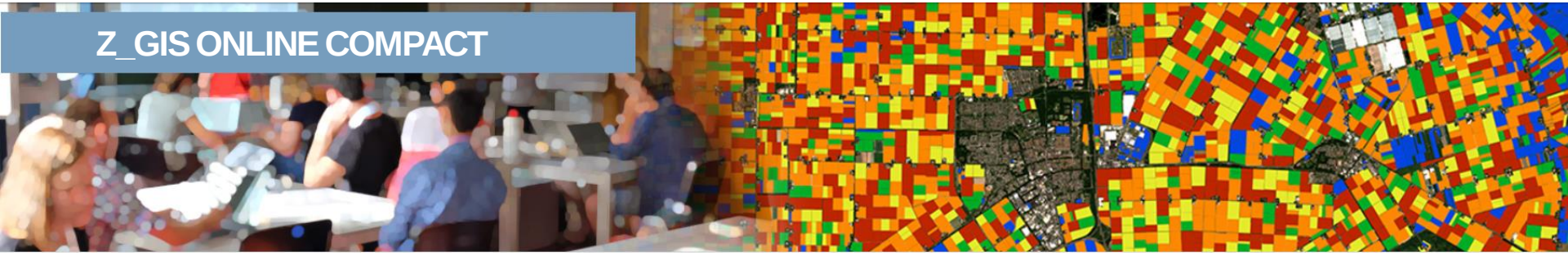

Spatial Simulation

UNIGIS Salzburg provides materials for the **Z_GIS online compact** courses and is responsible for the tutoring.

Communication and course materials are in English language.

Instructor: Gudrun Wallentin

Spatial Simulation

Everything is related to everything else… This core principle of spatial analysis is equally true for the temporal domain: history matters! Together, the two dimensions of space and time build the spatio-temporal context of our environment. Spatial simulation models are fundamentally new tools to study systems from a truly spatio-temporal perspective.
Topics that have been successfully addressed with spatial simulation models include biological and geomorphological applications heuristic algorithms and transport models.

Learning Objectives

The module will provide a broad overview on existing theories and methods in the domain of spatio-temporal models. The focus is given to hands-on experience with adapting, designing and coding agent-based simulation models. Upon successful completion of this module, you will be equipped with the competences to design, implement, analyse and valdiate your own models to solve applied problems and conduct research with simulation models.

Course Content I

Lesson 1 — Simulation Modelling
This lesson introduces to Simulation Modelling, for which type of problems it can be used, common application areas and different methodological approaches.

Lesson 2 — Theory of (complex) systems
This lesson provides the theory-based background of systems sciences: the nature of systems and how systems have been conceptualised in science from the General System Theory to Complex Systems.

Lesson 3 — Thinking in systems
This lesson discusses the core properties of systems: its structure made of elements and connections, and its behaviour that is governed by flows, feedback and equilibria.

Lesson 4 — System Dynamics
This lesson guides through the workflow of modelling simple systems in a way that it can be implemented in System Dynamics software.

Lesson 5 — Models of spatial systems
This lesson focuses on the spatial perspective of simulation models. Several way of how to include the spatial dimension are discussed, including Spatial System Dynamics, Finite Elements, probability-based spatial models and bottom-up models of Complex Systems.

Lesson 6 — Cellular Automata
This lesson introduces Cellular Automata as a commonly used method to model (continuous) spatial processes.

Lesson 7 — Agent-based models
This lesson focuses on Agent-based models, their distinct characteristics and typical problems that can be addressed by ABMs.

UNIGIS Salzburg

UNIVERSITÄT SALZBURG

Course Content II

Lesson 8 — Spatial processes
This lesson presents a number of alternative algorithms how to model the three spatial processes with which are the building blocks of virtually any spatial process: diffusion & growth, movement, and aggregation / segregation.

Lesson 9 — Space and Time
This lesson gives an integrated overview of the spatial and the temporal dimension in simulation modelling, with respect of scale and resolution, hierarchy, neighbourhood, topology / scheduling and system boundaries.

Lesson 10 — Developing a model
This lesson presents the workflow of designing and building (or modifying) a simulation model.

Lesson 11 — Parameterisation
This lesson is dedicated to input parameters of a model: how they are assigned (parameterisation), assessed (calibration) and analysed with respect to their impact on the uncertainty of a model.

Lesson 12 — Validation and POM
This lesson links back from the 'model world' to the 'real world'. Different levels and strategies of validation are discussed to assess whether a model is an adequate tool for its purpose.

Lesson 13 — Reporting a model -ODD protocol
This lesson presents the ODD strategy of reporting a model. The added value of following the ODD protocol lies in a structured way to write about – and above all to think about – a model.

Lesson 14 — Scenario-based research
This lesson draws everything together and walks the reader through the steps of a 'doing research' by means of simulation modelling by the example of a run-off model.

Z GIS