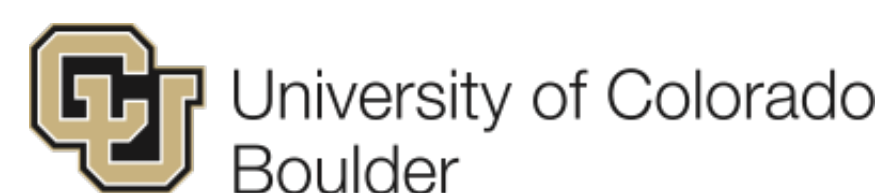


Landlab: A Python library for building and coupling 2D numerical models

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ABSTRACT

Landlab is a Python-language library that speeds the building and coupling of 2D numerical models, with a primary focus on models of earth-surface processes. Landlab's capabilities include: (1) create and configure a grid with one or a few lines of code; (2) choose from a variety of grid types, either structured and unstructured; (3) connect data arrays directly to the grid, where they can be accessed and shared; (4) assemble integrated models from reusable components, each of which models a particular process; (5) perform input and output using standardized data formats; and (6) design continuous-time stochastic cellular automaton models by specifying cell states and a set of transition rules. More information about Landlab is available at <http://landlab.github.io>.

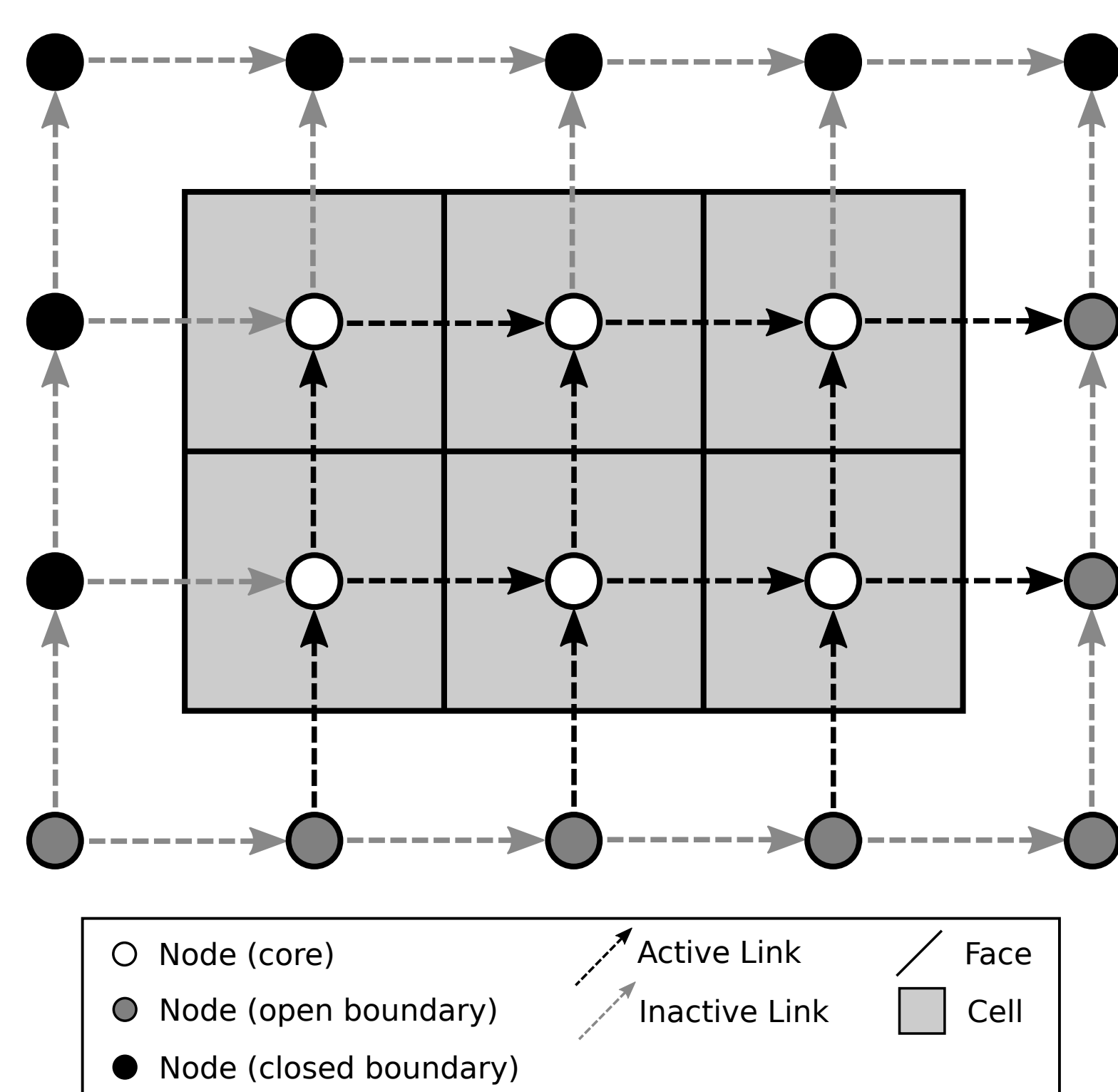


What is Landlab?

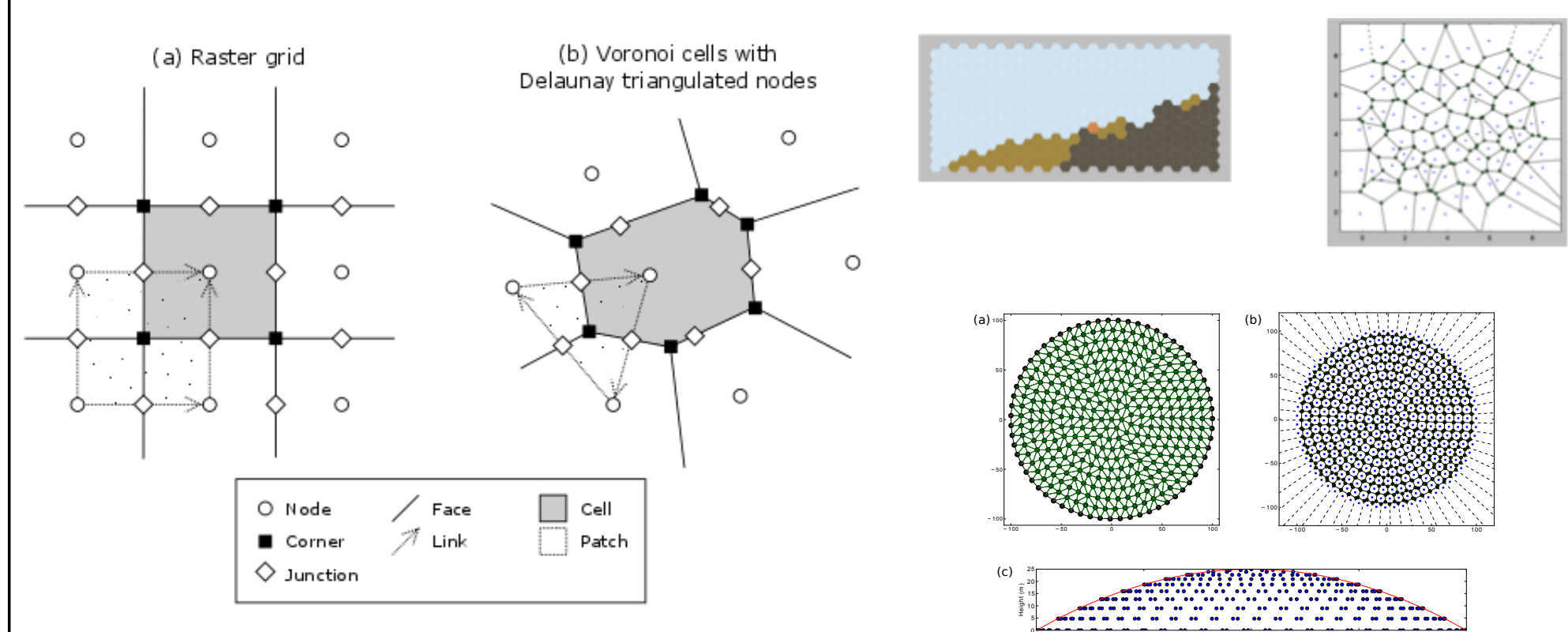
- An open-source, Python-language library that helps geoscience researchers efficiently develop 2D grid-based numerical models
- A set of pre-built model *components*, each of which models a particular landscape process (see examples below)
- A framework for combining components into multi-process models
- Learn more at <http://landlab.github.io>

GRIDS

Grids are built from primitives such as *nodes*, *links*, and *cells*

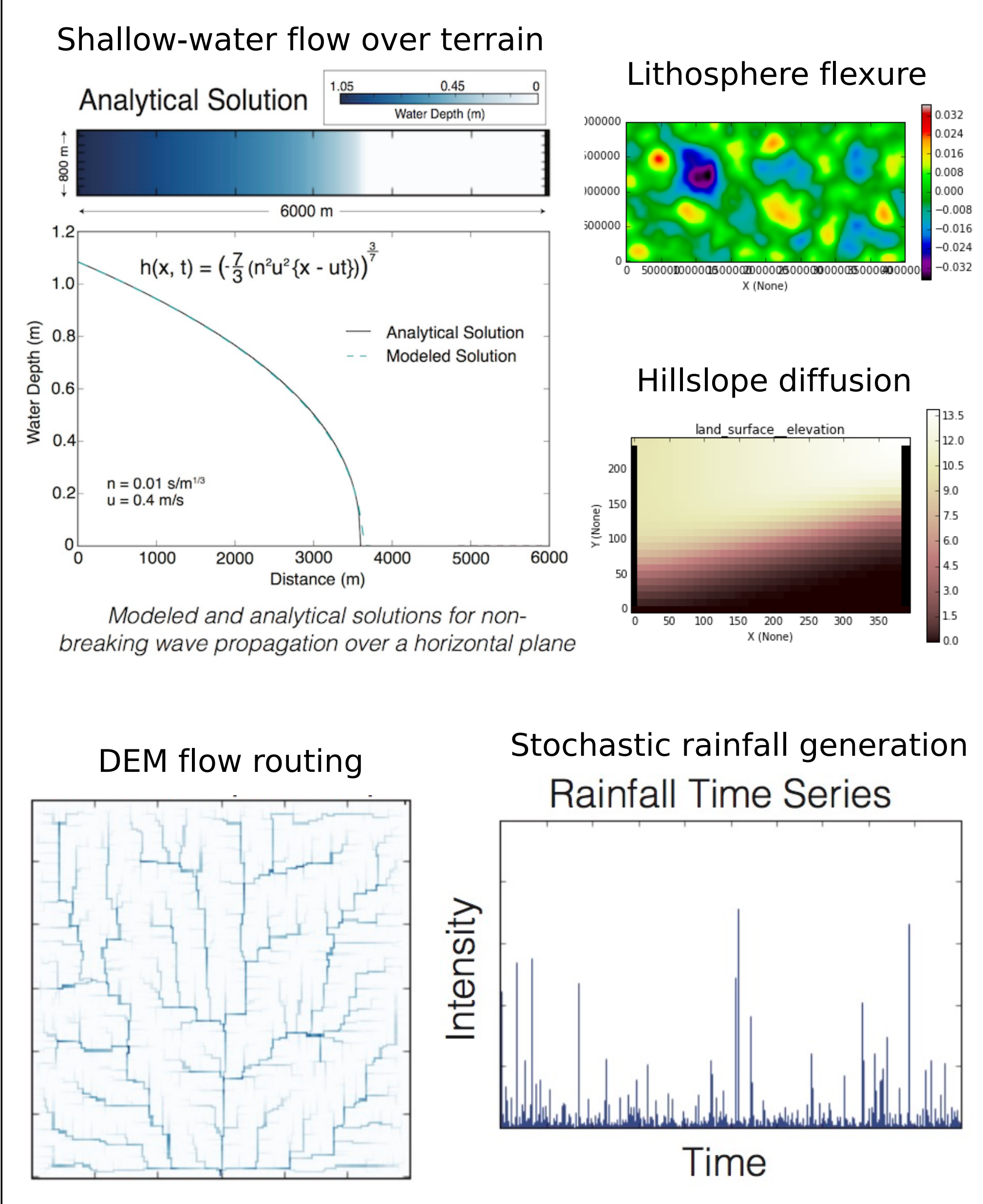


Different grid types



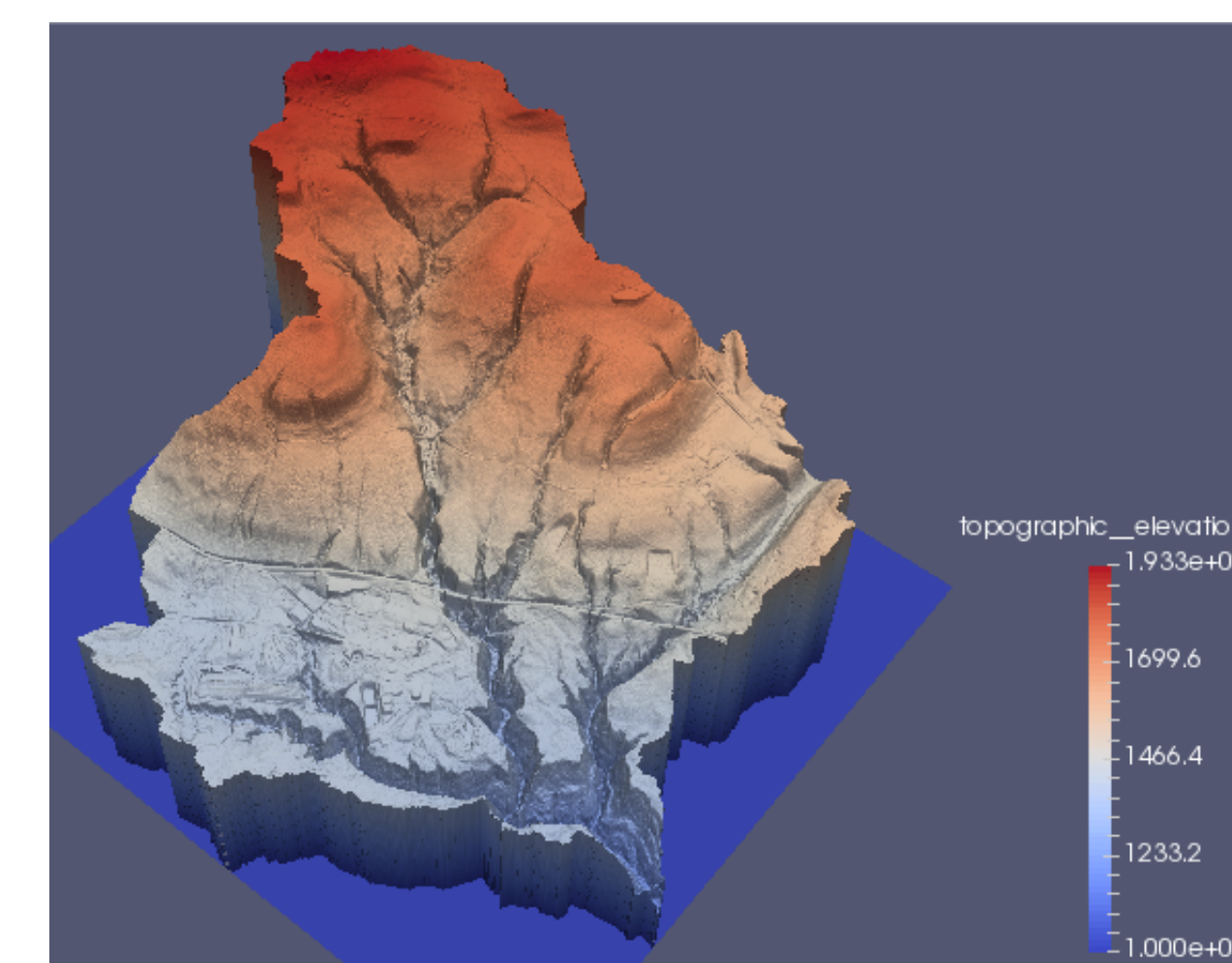
COMPONENTS

- o Standard design
- o Sharing data through grid object
- o Coupling with driver script



UTILITIES

- o Import ESRI Arc AsciiGrid format digital elevation data
- o Read and write netCDF files
- o Read model parameters from formatted text files



SCRIPTING

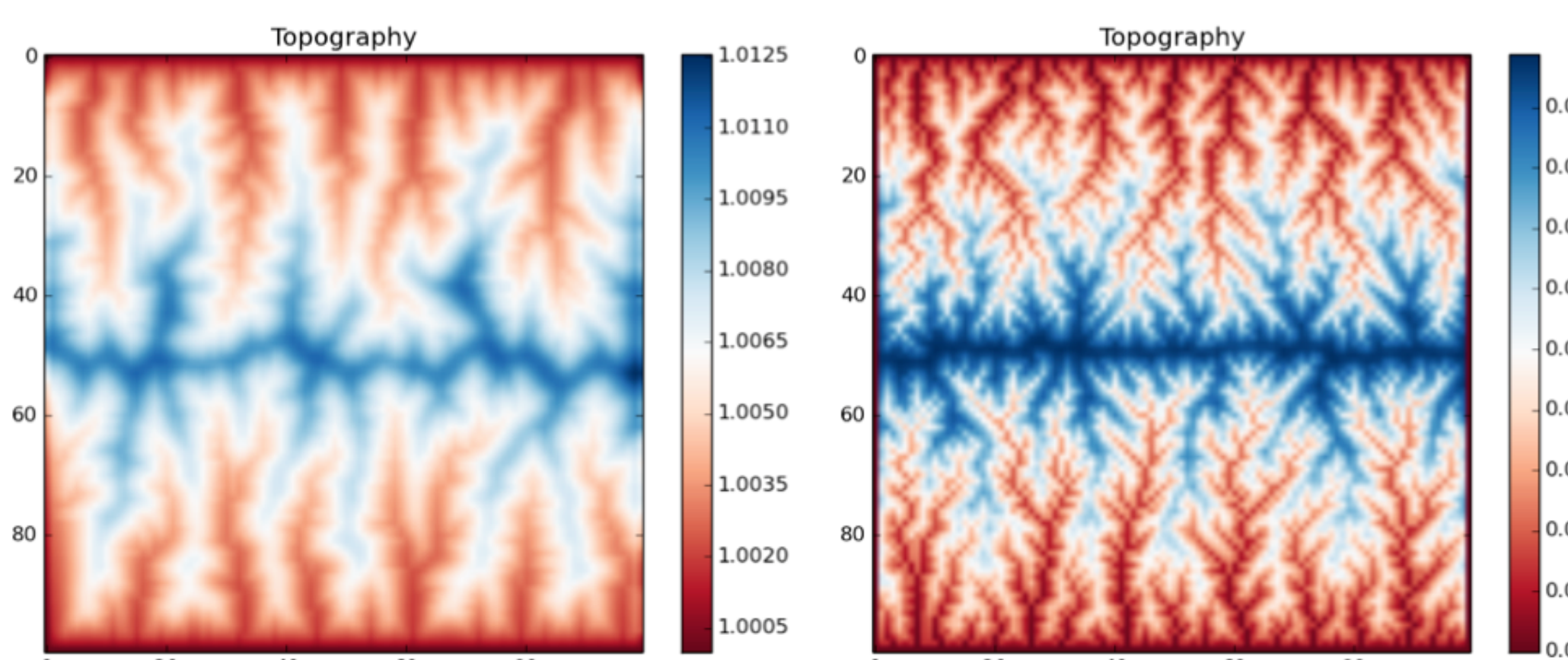
Example: a nine-line diffusion model

```
mg = landlab.RasterModelGrid(numrows, numcols, dx)
z = mg.add_zeros('node', 'land_surface_elevation')
core_nodes = mg.core_nodes()

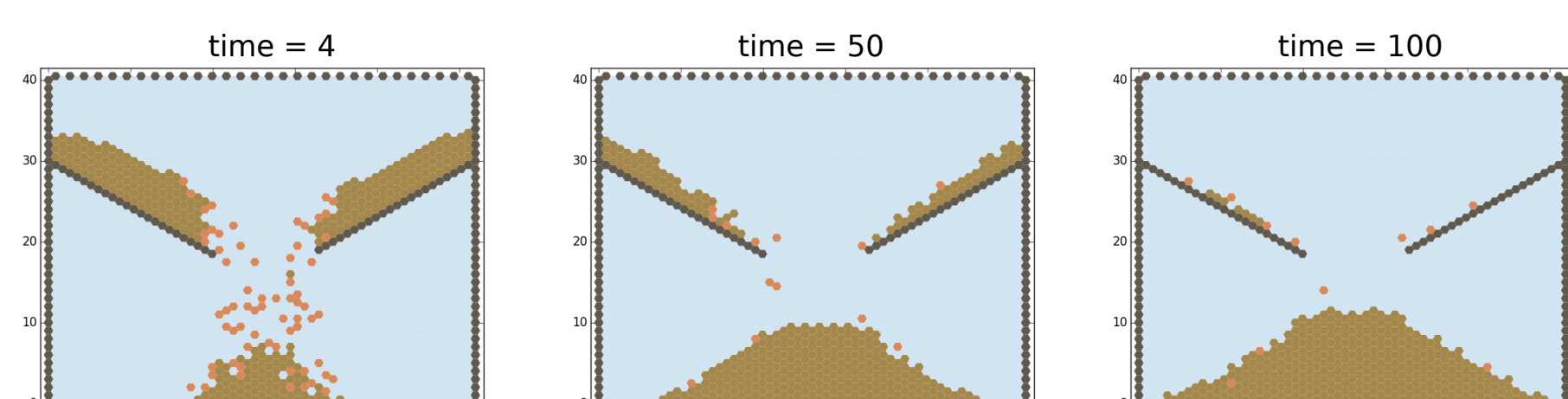
for i in range(0, num_time_steps): # main loop
    g = mg.calculate_gradients_at_active_links(z) # slope
    qs = -kd*g # sediment flux
    dqds = mg.calculate_flux_divergence_at_nodes(qs)
    dzdt = uplift_rate - dqds
    z[core_nodes] += dzdt[core_nodes] * dt
```

EXAMPLES

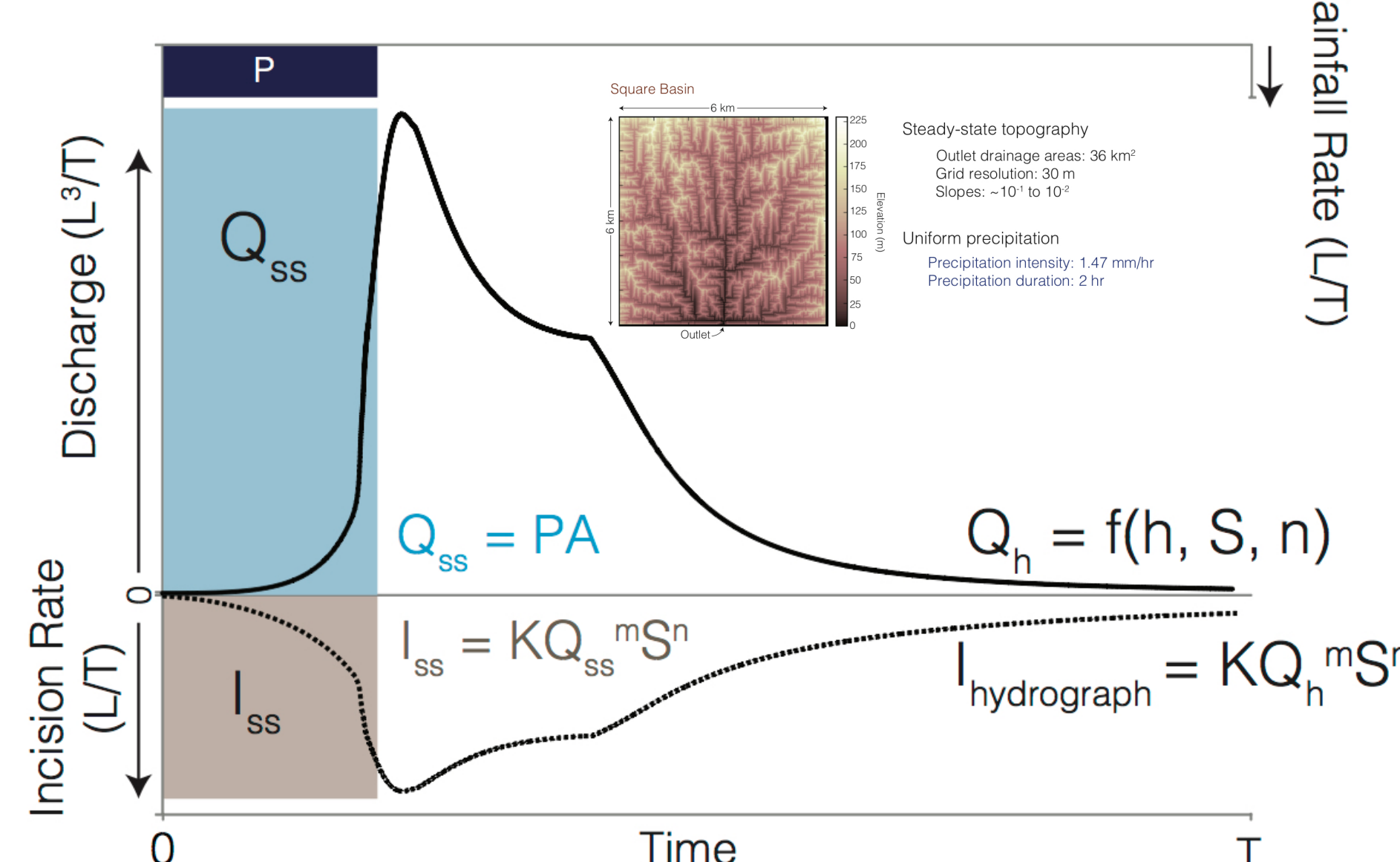
Landform Evolution



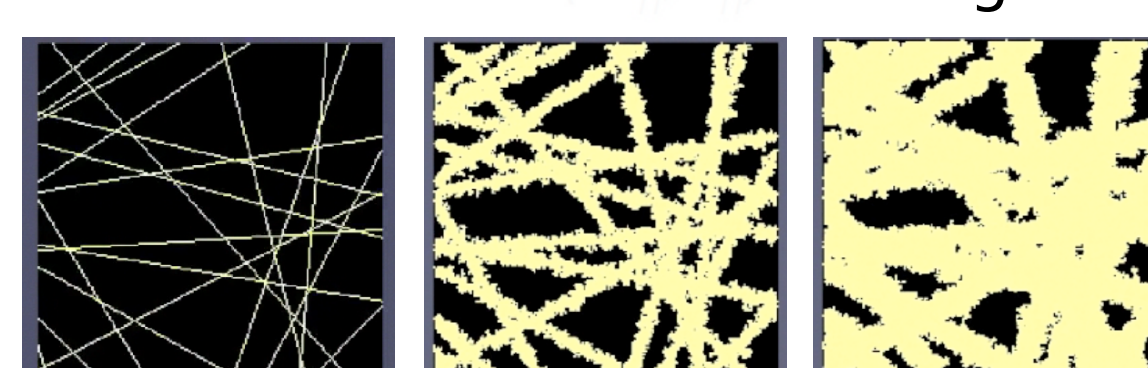
Granular mechanics (lattice-grain model)



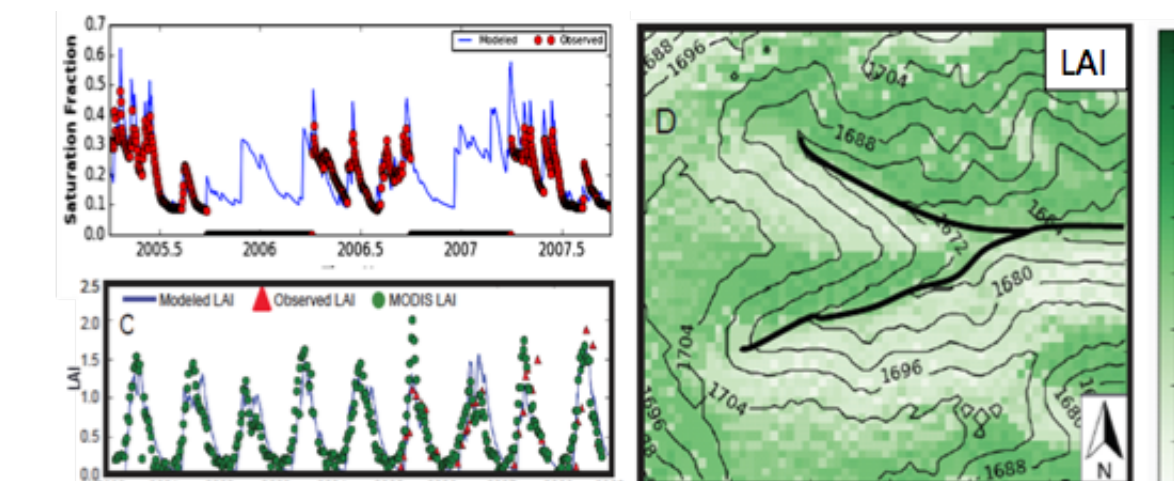
Rainfall, runoff, and erosion



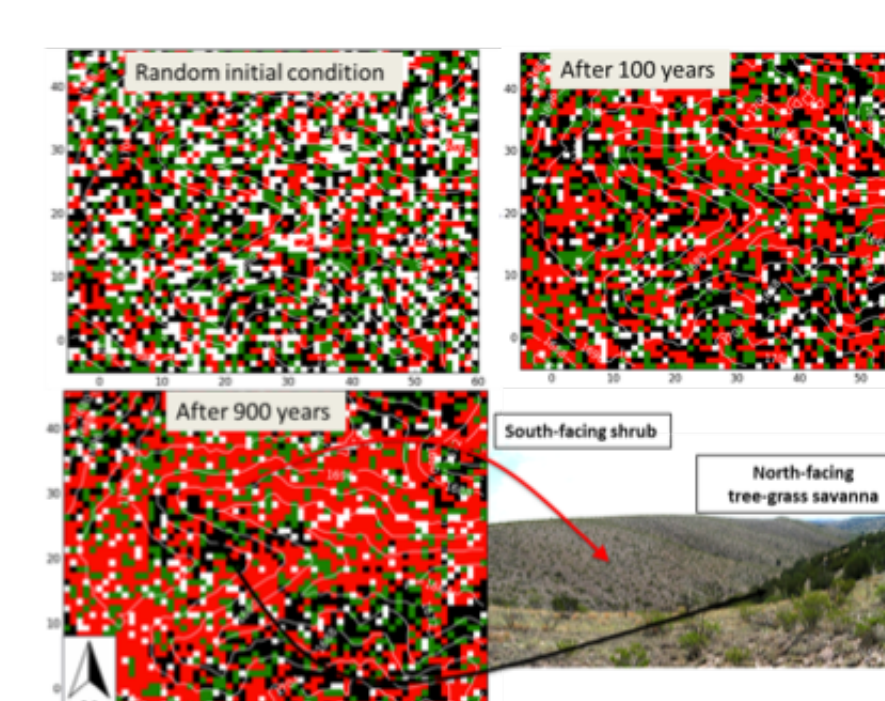
Fractured rock weathering



Soil moisture and leaf-area index (LAI)



Vegetation dynamics



Acknowledgments:
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