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Water balance model mGROWA outputs as water scarcity indicators

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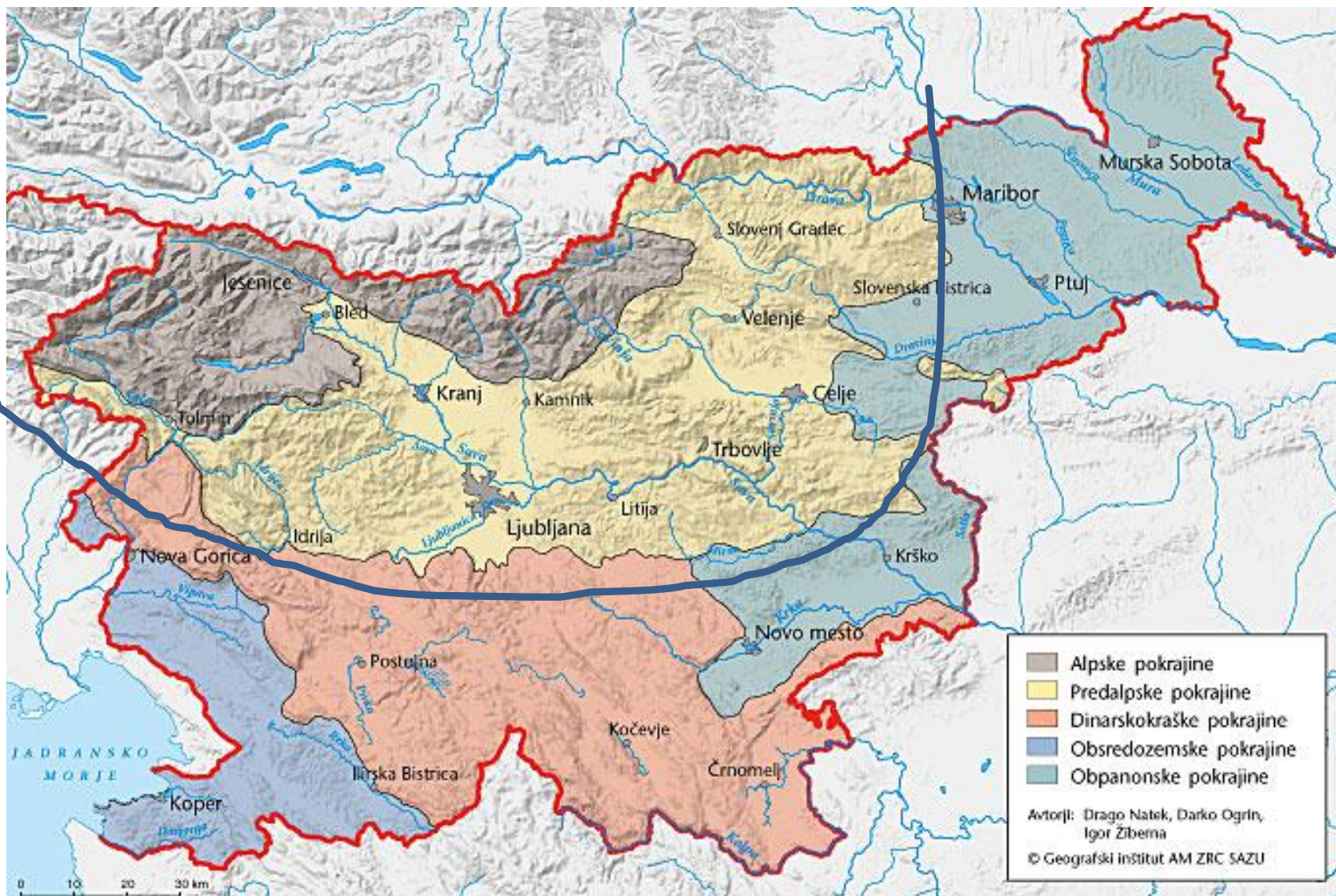
dr. Frank Herrmann

Alps



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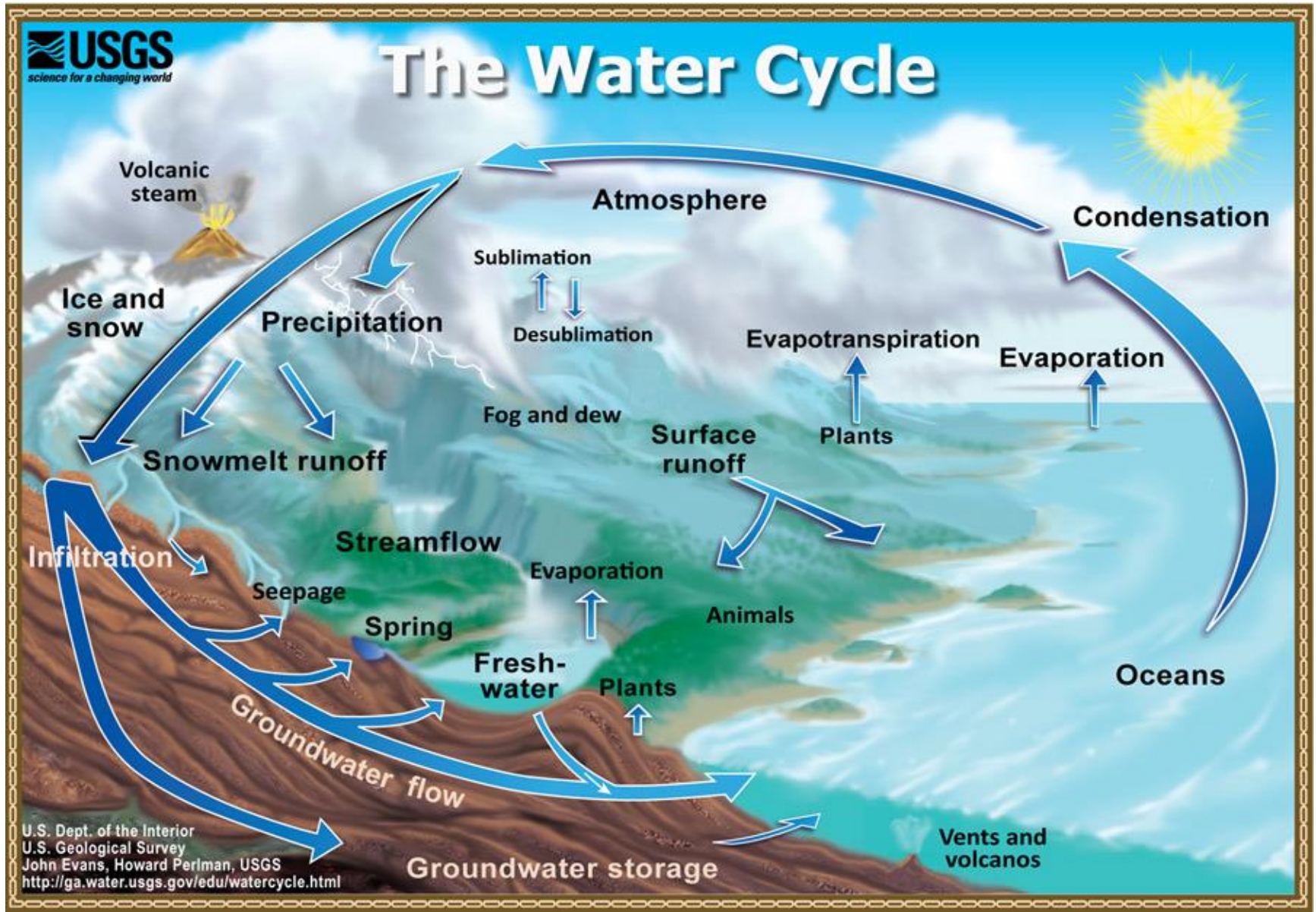


Water cycle



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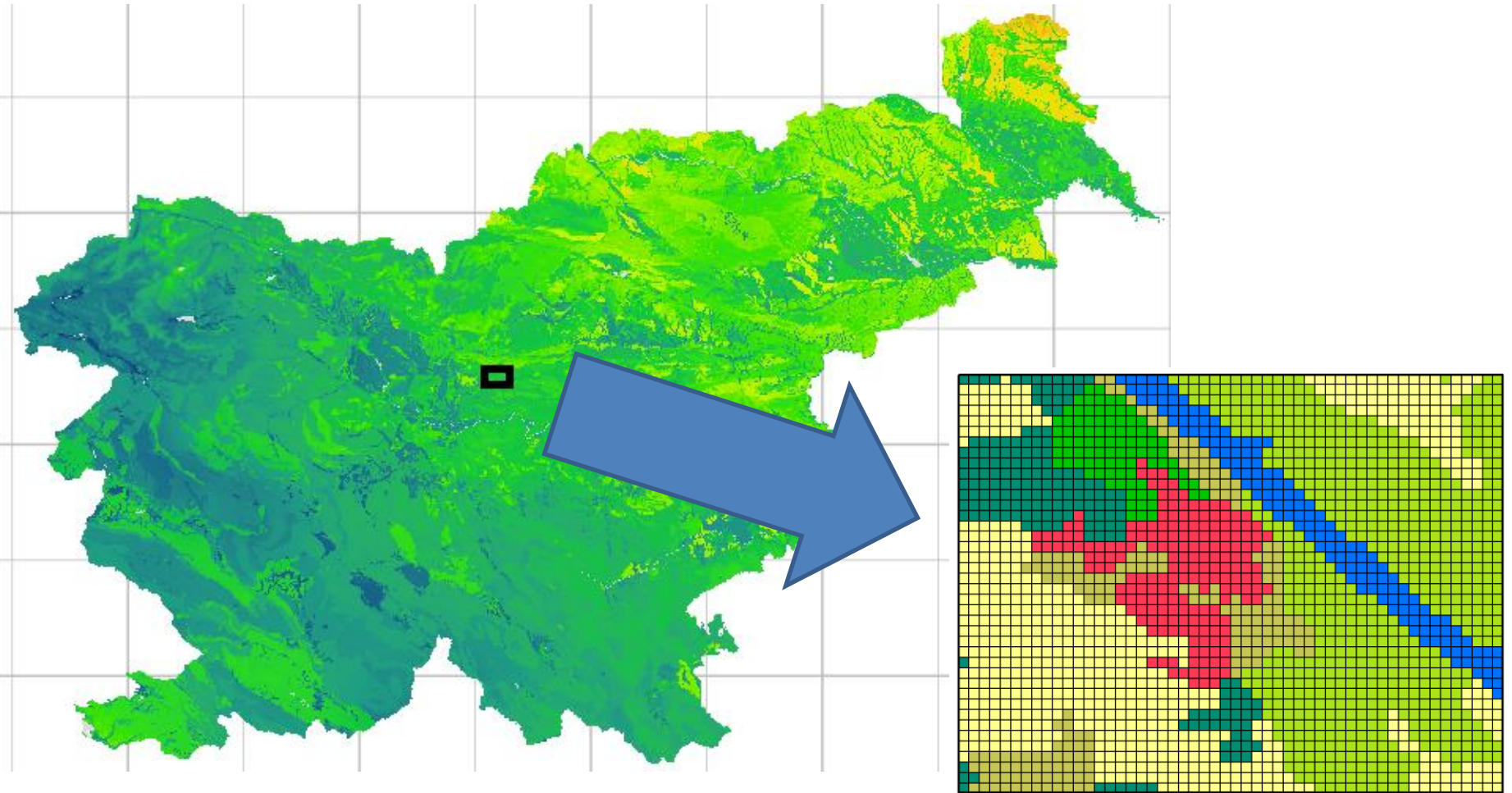


Water balance model mGROWA



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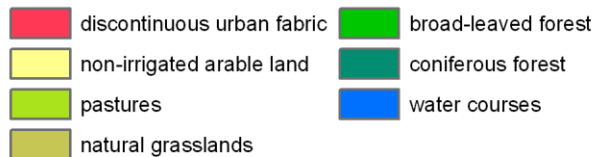
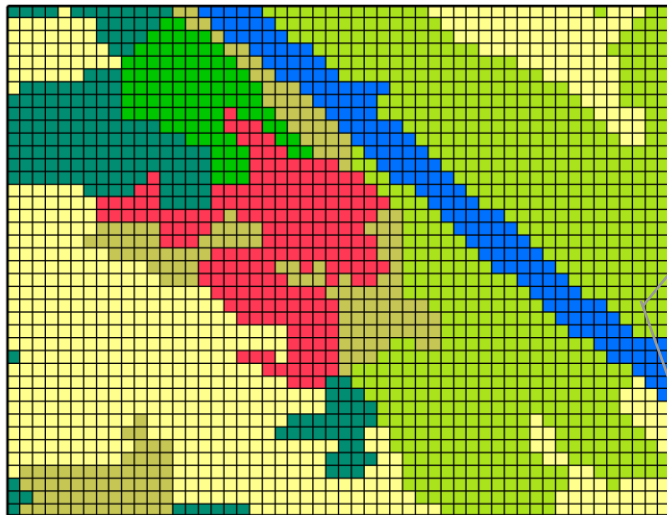


Water balance model mGROWA



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Balancing the amount of water for every grid cell based on the water balance equation:

$$p + q_{in} = et_a + q_t + (s_2 - s_1)$$

Calculation of the actual evapotranspiration based on the Penman-Monteith-equation, **site-specific parameters and site-specific functions:**

$$et_a = et_0 \cdot k_{LN} \cdot f(\beta, \gamma) \cdot f(s)$$

BOWAB

for sites with
vegetation

impervious
surface

...
expandable

function $f(s)$ is defined differently for
different sites

Water balance model mGROWA

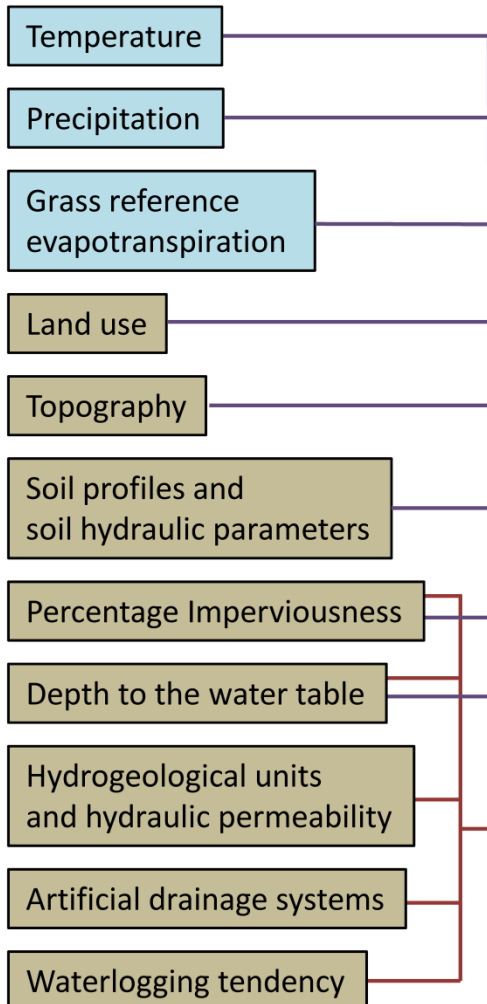


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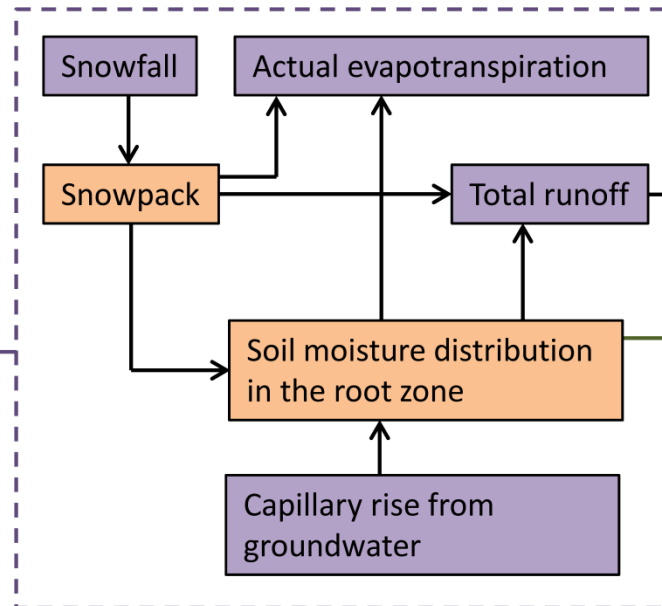


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MINISTRSTVO ZA OKOLJE IN PROSTOR
AGENCIJA REPUBLIKE SLOVENIJE ZA OKOLJE

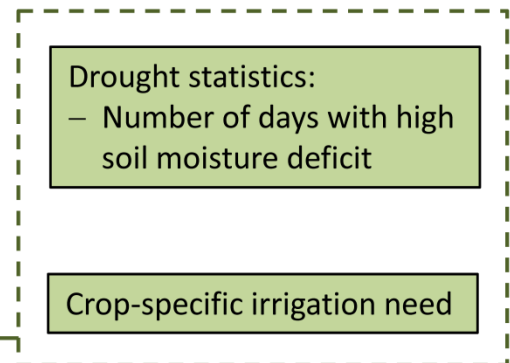
Climatic data basis & site conditions



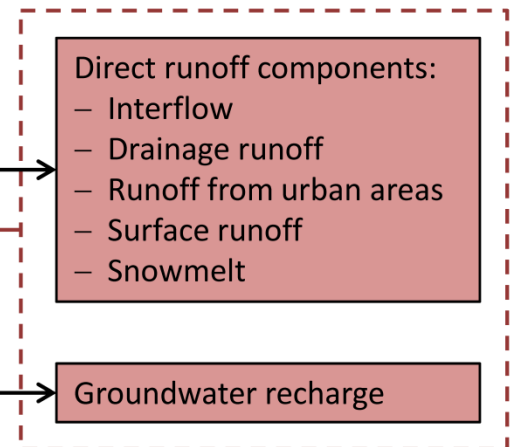
Simulation of snowpack, evapo-transpiration and runoff generation



Rule-based computation of variables and indices



Separation of runoff components and groundwater recharge



Drought – water scarcity ...



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mGROWA model results connected to drought, water scarcity:

- runoff quantities
- groundwater recharge
- ...
- snow accumulation
- ...
- soil water deficit

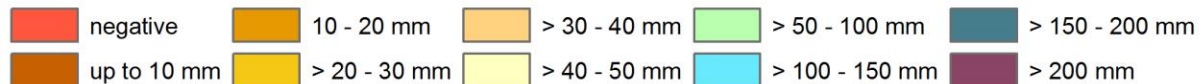
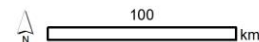
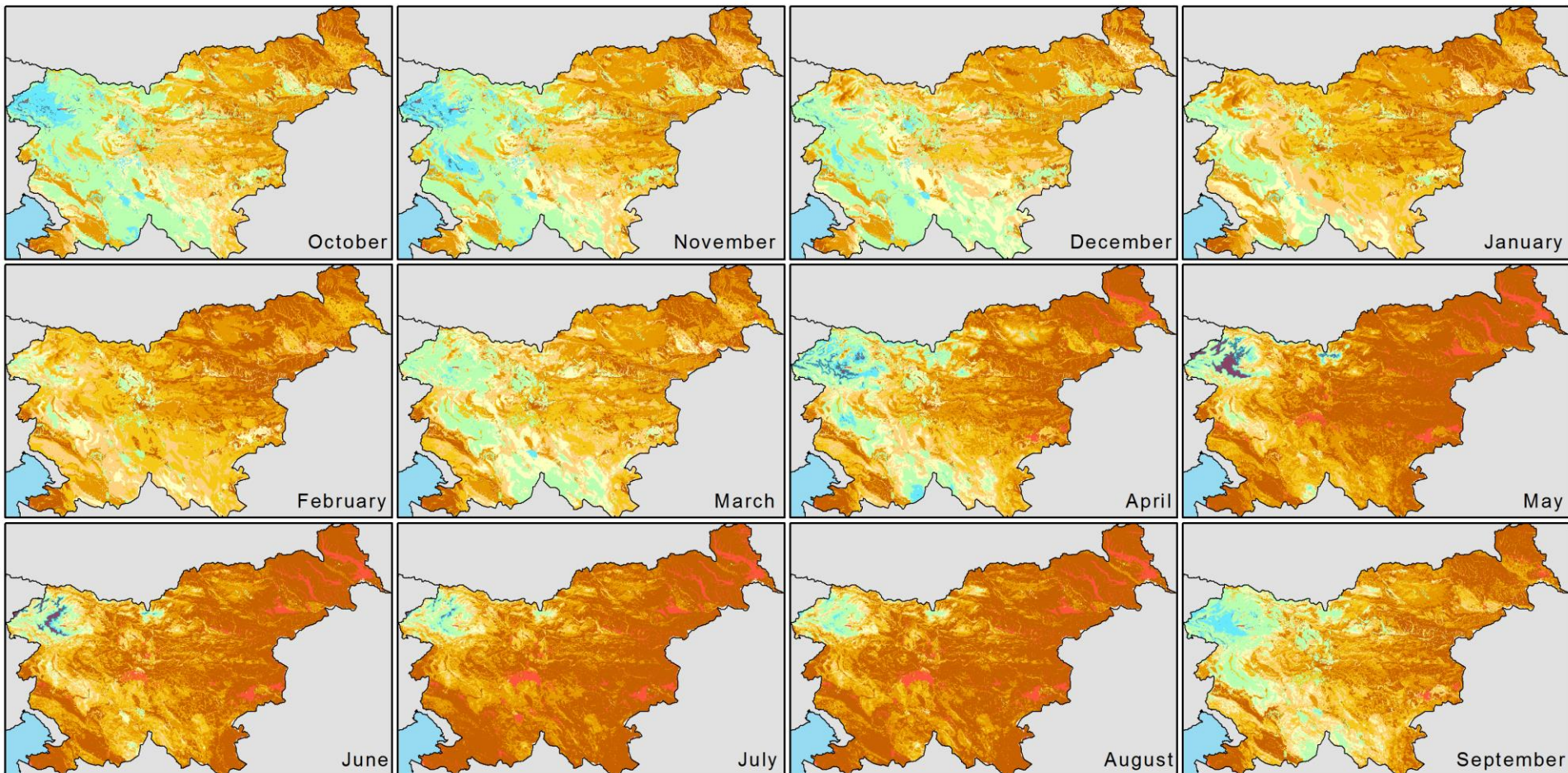
mGROWA → groundwater recharge



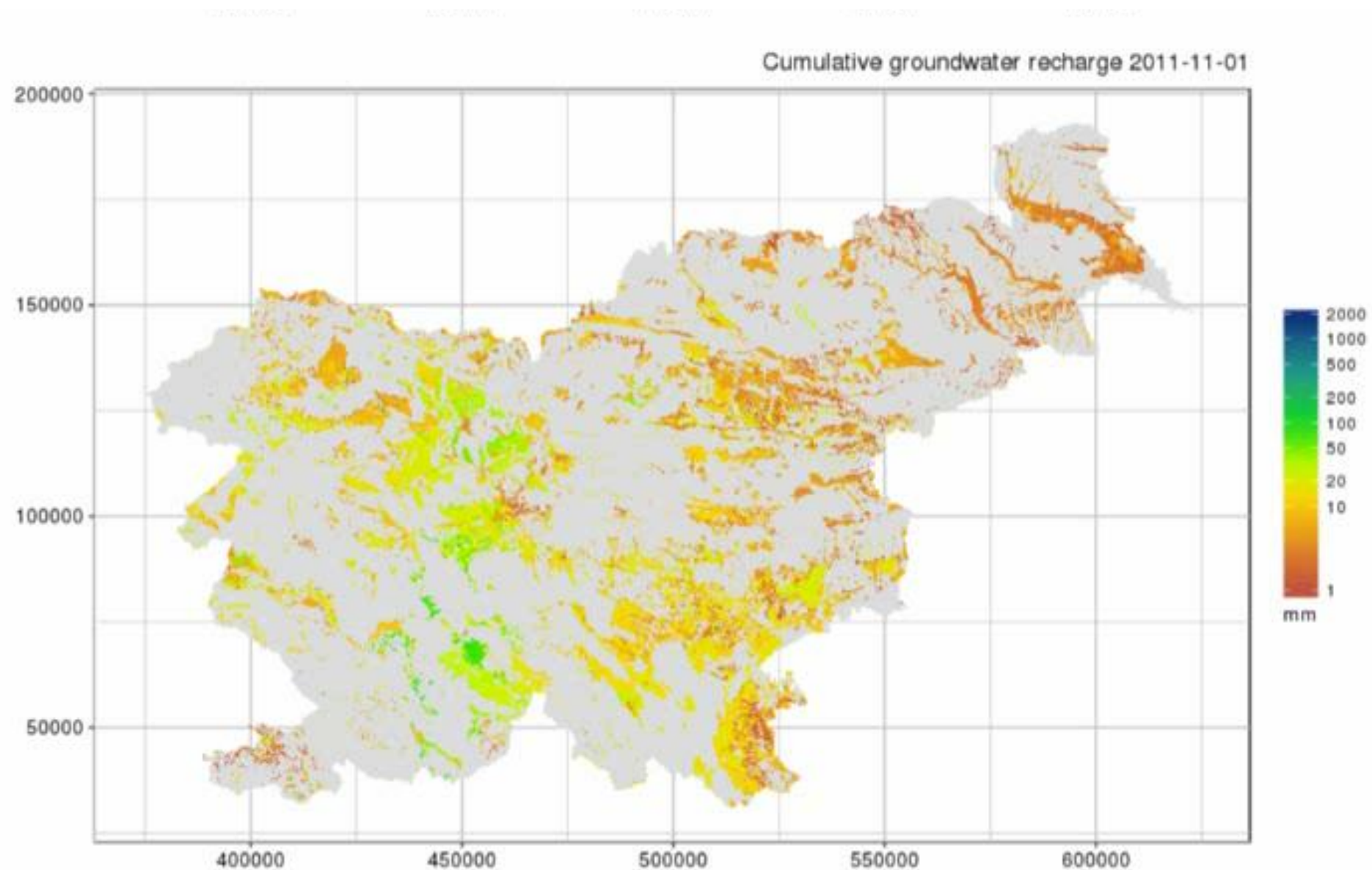
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mean monthly gw recharge 1981-2010

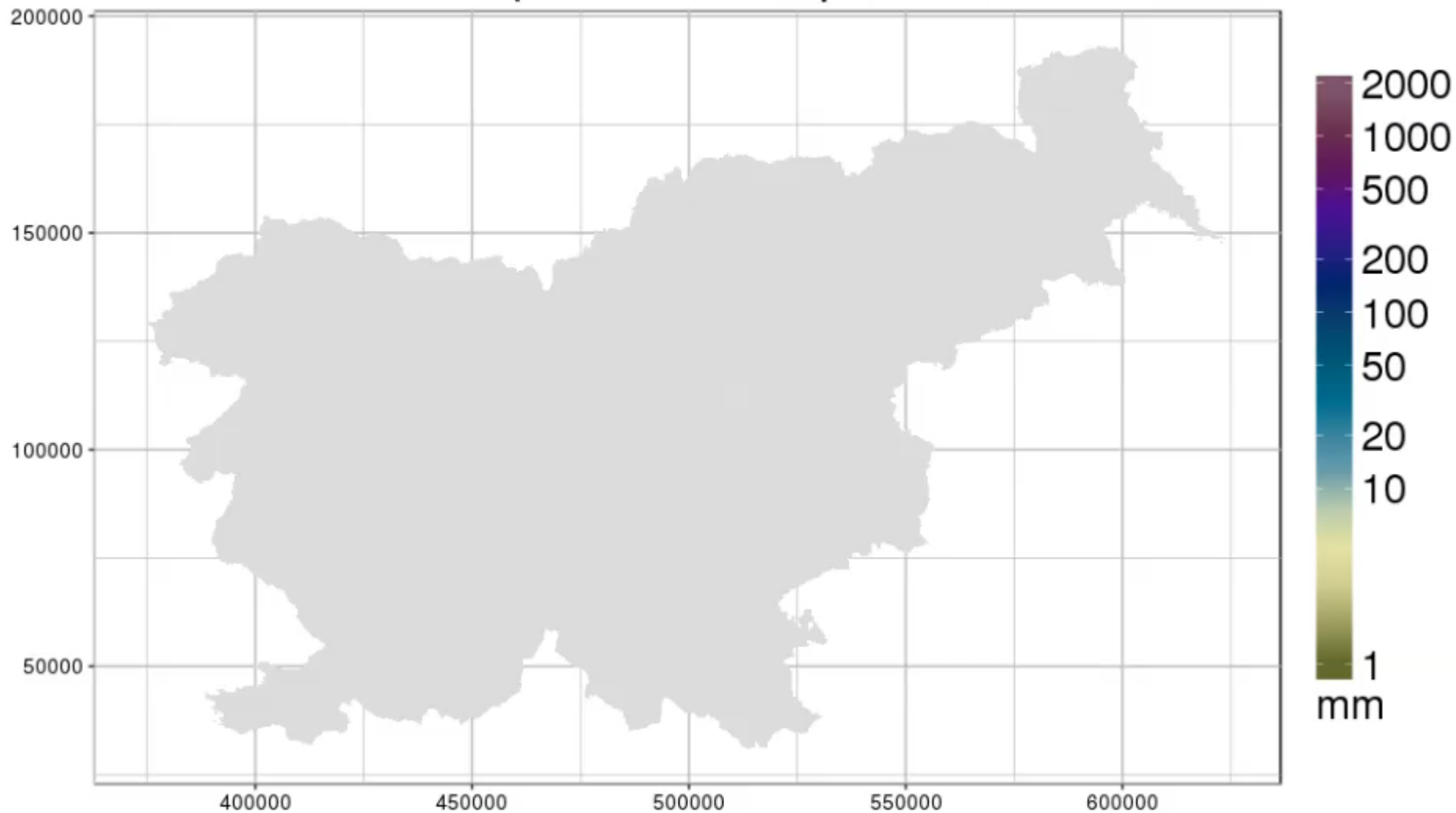


Cumulative GW recharge



Snow Water - mGROWA

Snowpack water equivalent 2011-09-01



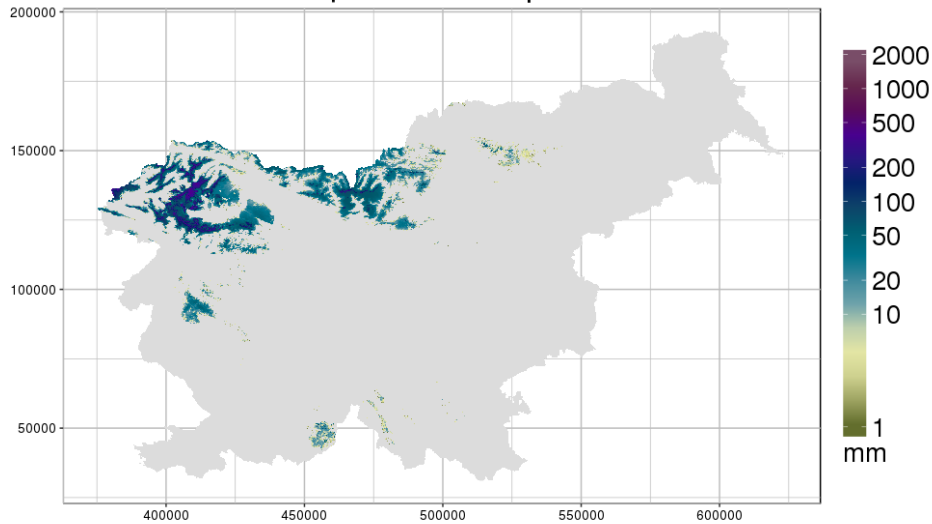
Snow Water feeds rivers in spring



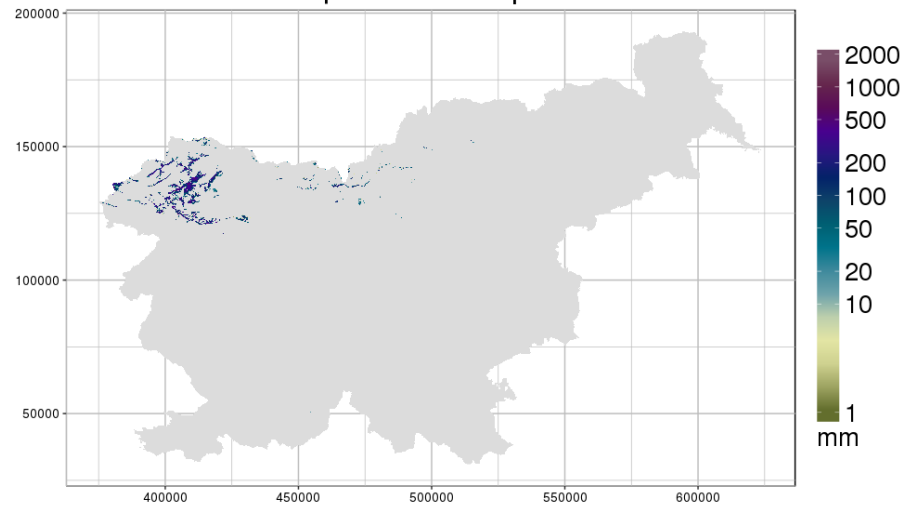
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Snowpack water equivalent 2012-04-13

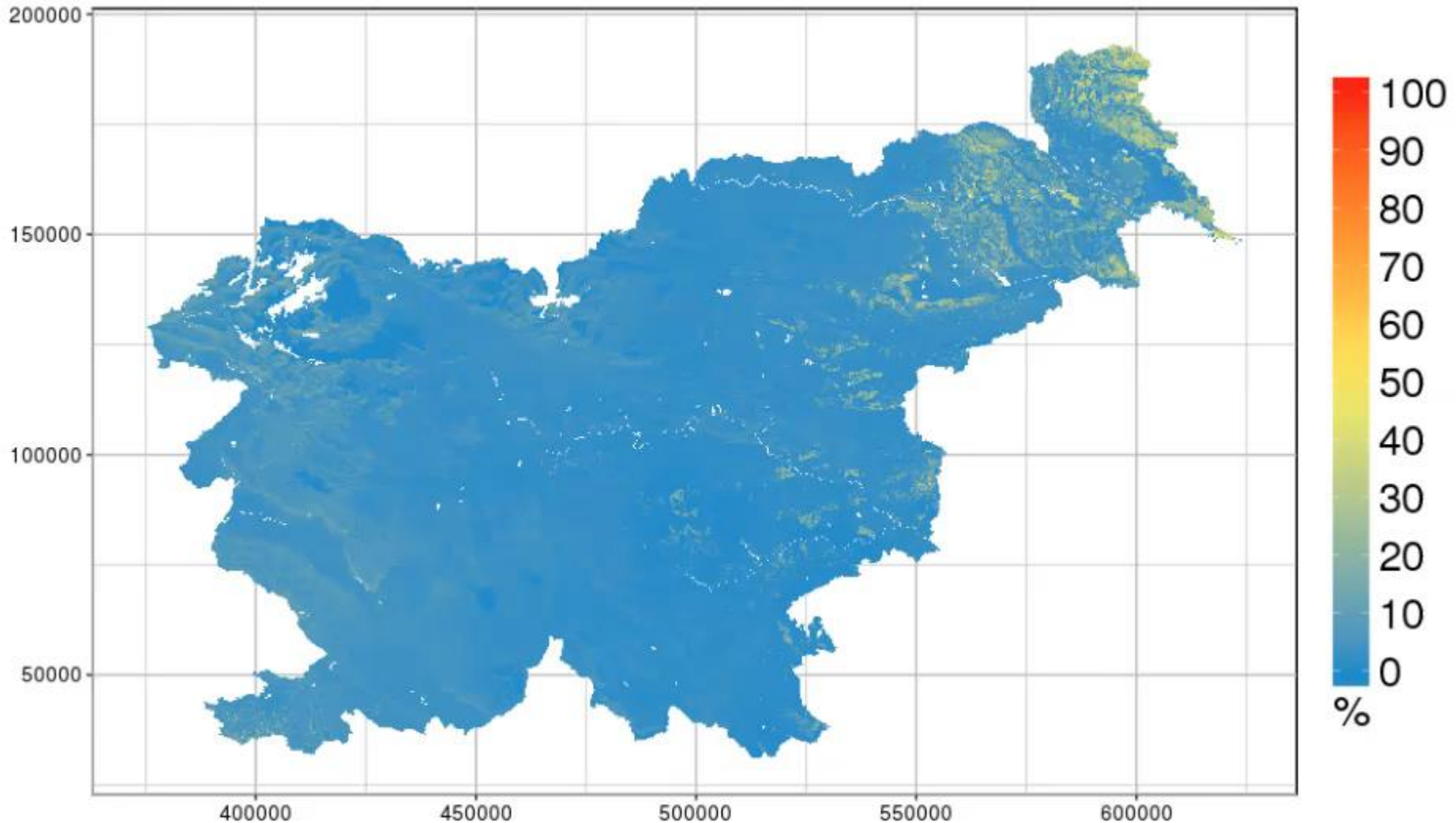


Snowpack water equivalent 2012-05-02



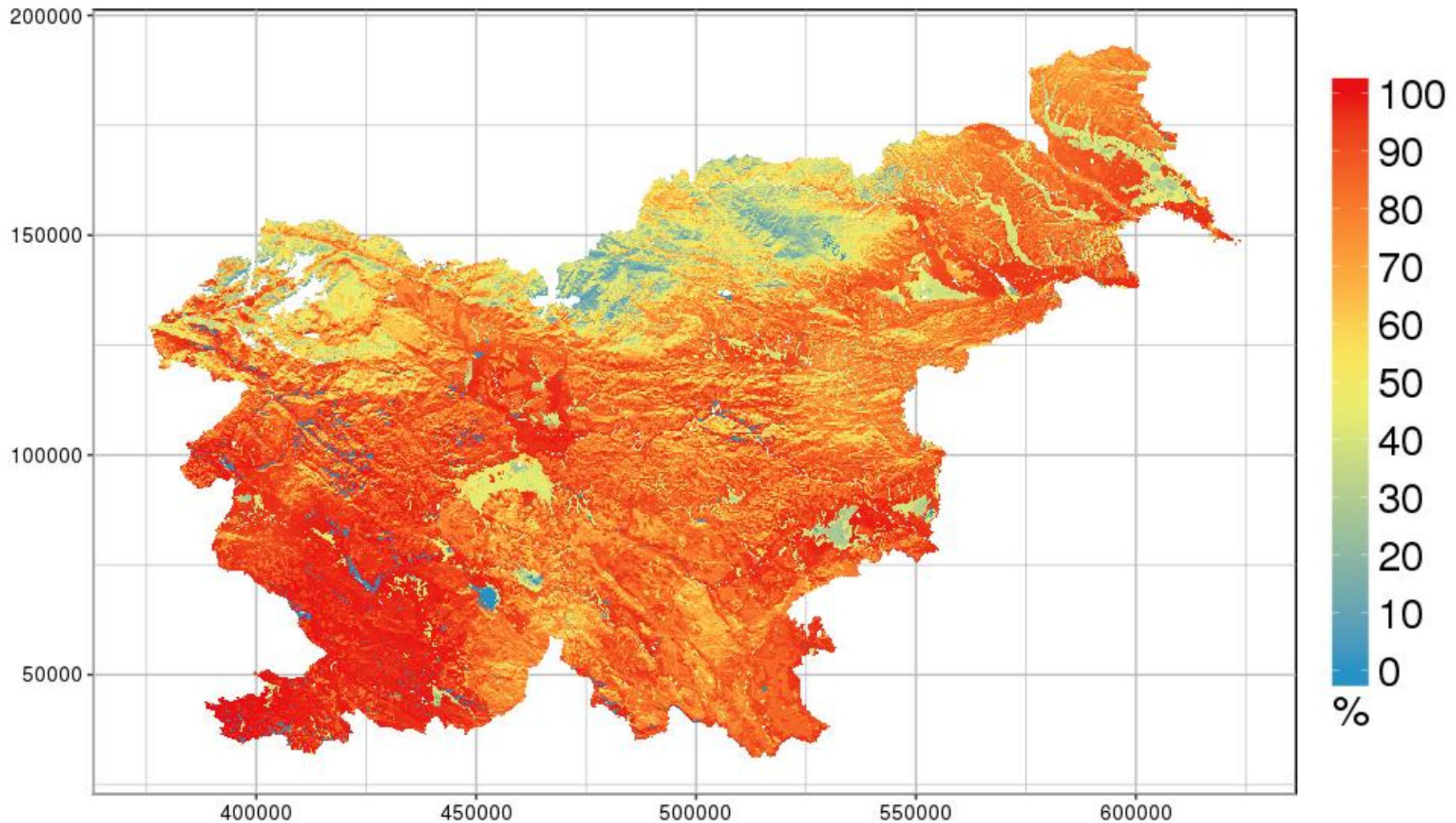
Soil Water Deficit - mGROWA

Soil water deficit in the root zone 2011-11-01



High water stress also in the Alps

Soil water deficit in the root zone 2012-08-16



mGROWA → drought indicators



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- soil water deficit
- soil water content
- groundwater recharge
- connection to CLIMATE SCENARIOS

Water scarcity and drought



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- definition
- tools „exist“
- indicators
- application of measures



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thanks...