ESF project
"Establishment of interdisciplinary scientist group and modelling system for groundwater research"

Groundwater modeling project (PUMa)

Aija Dēliņa

ESF

LATVIJAS UNIVERSITĀTE
ANNO 1919

Project Nr. 2009/0212/1DP/1.1.1.2.0/09/APIA/VIAA/060

Content

- Baltic Artesian Basin – what it is and why should we study it
- Project aims and tasks
- Project organization
- Project activities
- Envisaged results

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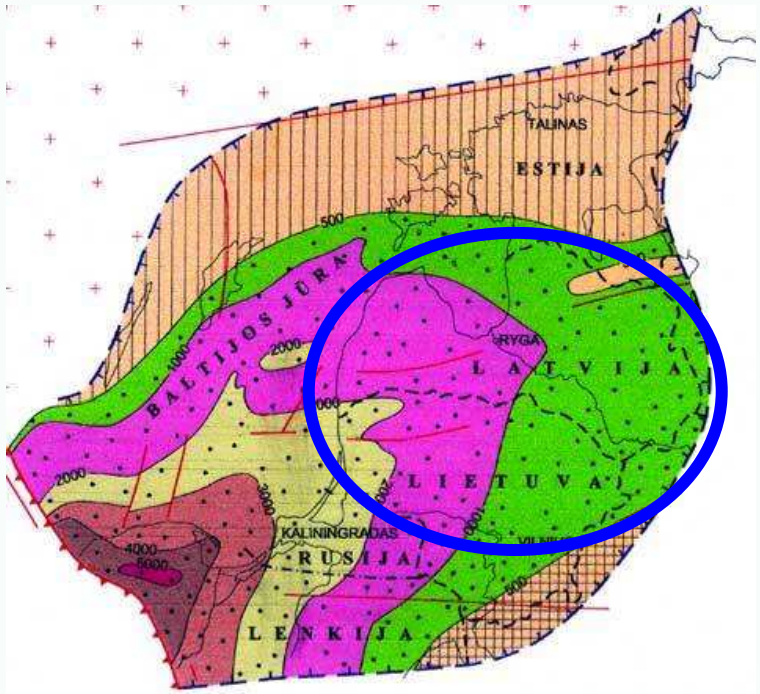
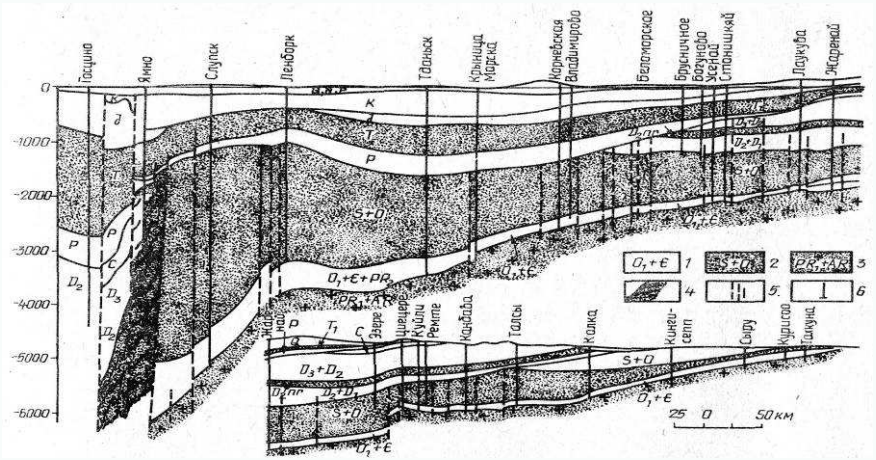
Baltic Artesian Basin (BAB)





- **Outlined for the first time in 1931**
- **Multi-layered and complex hydrogeological system up to 5000 m deep**
- **There are three basic zones distinguished in the cross section by the water exchange intensity and chemical composition of groundwater**
- **The main drinking water source in the Baltic**
- **Resources of mineral and thermal waters**

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Former studies

- There are a lot of data and knowledge obtained on geological structure of the basin, hydrogeological conditions and groundwater chemistry

- We are very thankful to all who had helped in this!

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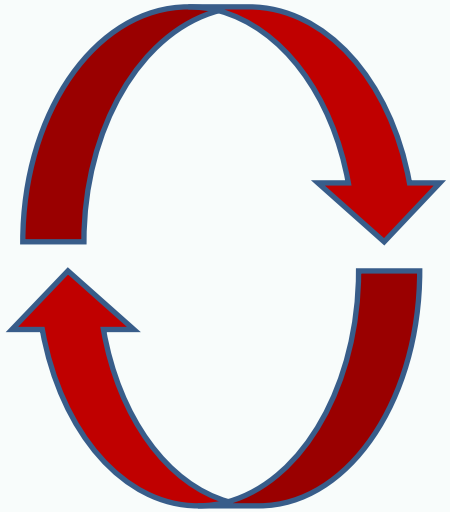
Project outlines and contents

- Project period: 1-Dec-2009 / 30-Nov-2011
- Project scientific personnel: 31

LU ĢZZF
37 %



LU ĶF
10 %

LLU LIF
15 %

LU FMF
38 %

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Project aim

- To develop groundwater investigations at LU, to facilitate cooperation between different branches of science

- To study water flow in the Baltic Artesian Basin within Latvia and adjacent areas in the whole hydrogeological cross-section applying system of numerical modeling tools

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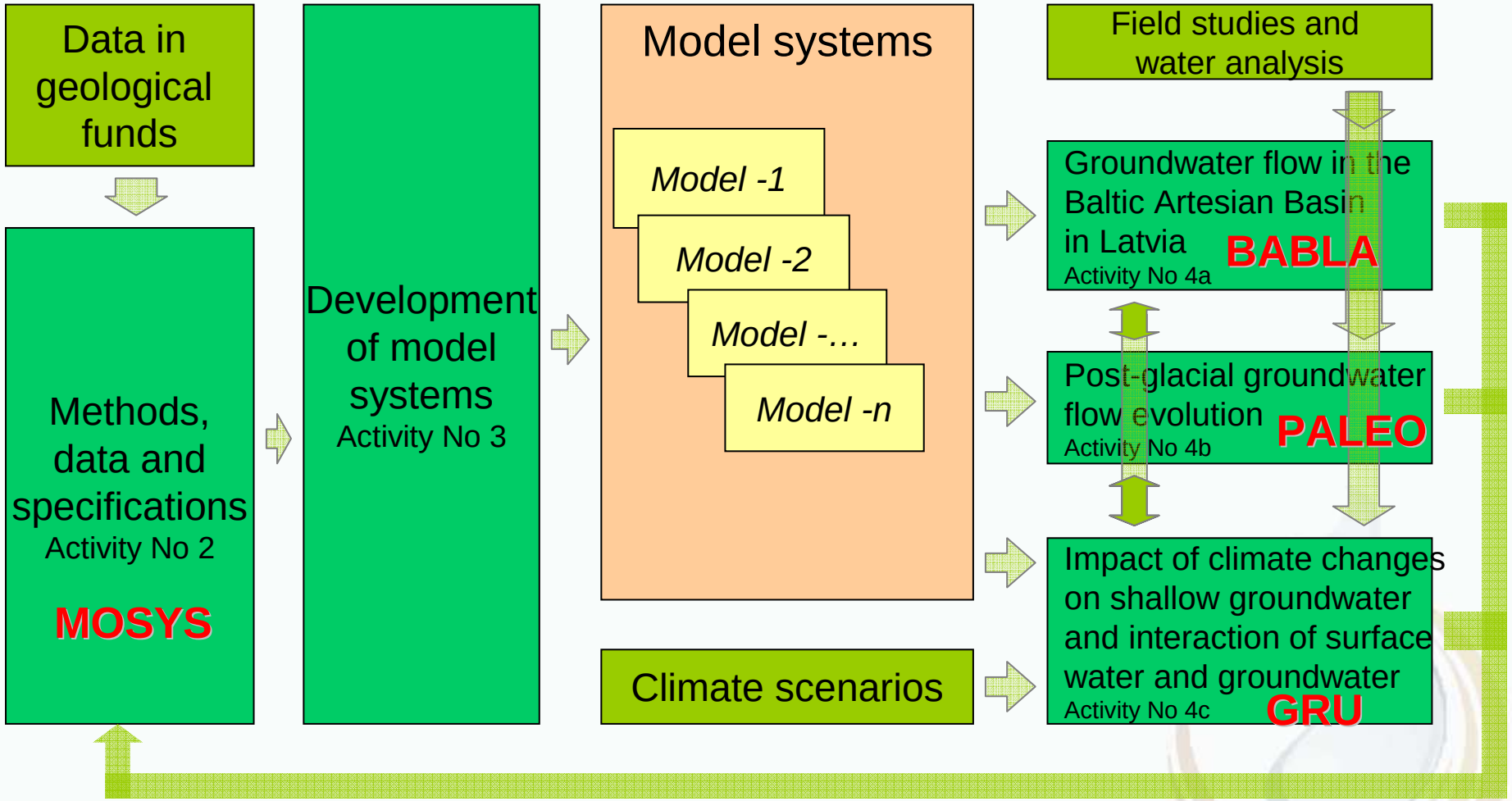
Project logical flowchart



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Methods, materials and specifications and Development of model systems (MOSYS)

- **Methods, materials and specifications**:
  - collection and systematization of necessary input data :
    - geological data (for geometry model),
    - observation data (for hydrogeological model)
  - preparation of model specifications,
  - development of methods for model component creation and their statement,
  - development of project information base;
- Development of model systems:
  - development of separate models, their elements, model calibration and baseline calculations,
  - development of conceptual modules for modeling of geological structure

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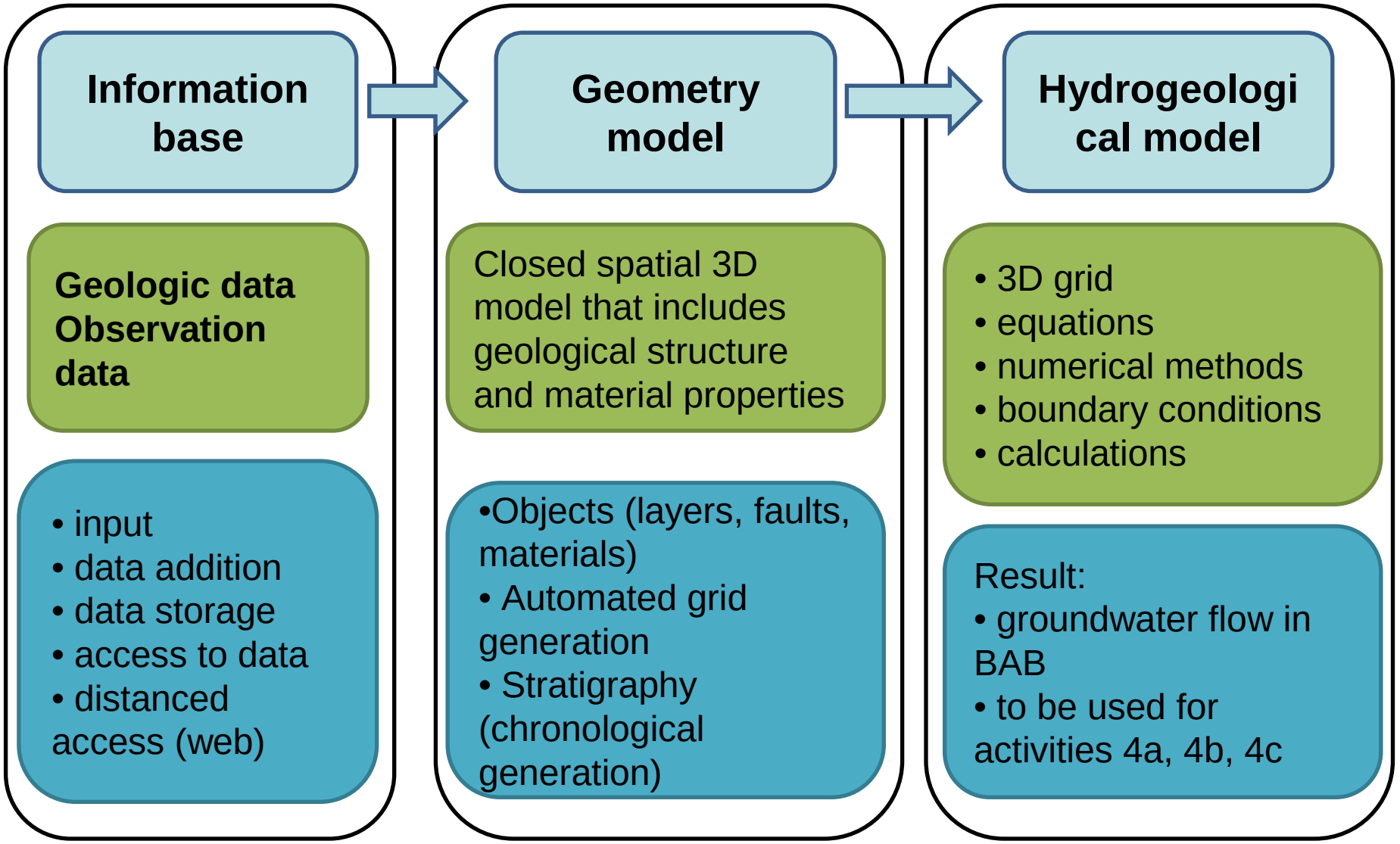
MOSYS

Scheme of development of integrated model system



Development of integrated model system

- **Development and testing of methods for grid generation from geometry model**
  - hierarchic structure: data –> geometry model –> grid for calculations. Selection of methods and algorithms, their checking and testing for automated model development
- **Development of components for numerical (hydrological, groundwater flow) model**
  - Components should be adjusted to solve the basic study problems
- **Integration of geometry and numerical model**
  - Data structure interface etc.
- **Testing of the system on selected base options**
- **System calibration**

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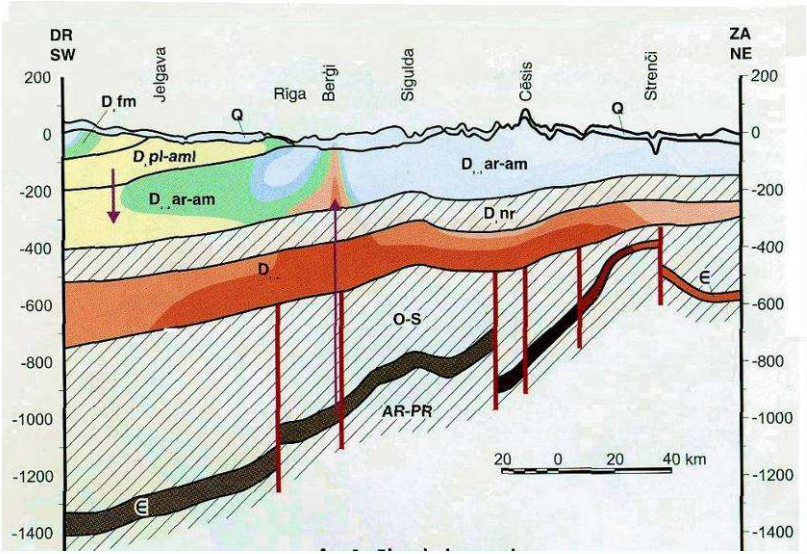
Groundwater flow in BAB within Latvia (BABLA)



- Modeling of groundwater flow within the whole hydrogeological section (up to depth >1000 m).
- To study groundwater age in the upper aquifers (CFC analysis – about 60 samples) and groundwater formation (stable isotope $\delta^{18}O$ and δD (ca. 350 samples), ^{13}C, ^{14}C analysis).
- Outline and specify recharge, stagnation and natural discharge areas, water exchange between aquifers and multi-aquifers, discharge areas in the sea.
- Forecast impact of water abstraction on groundwater resources (amounts, chemical composition).
- Study anomalies of groundwater chemical composition in active water exchange zone (chlorides, sulphates).

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Post-glacial evolution of groundwater flow (PALEO)

- **Aim – to reconstruct possible evolution of groundwater flow systems after deglaciation**
- Why? – Confined groundwater:
  - Hydrogeological conditions have changed significantly after the deglaciation
  - Resulting in radical changes of groundwater regime, including displacement of recharge and discharge areas
  - Modern groundwater composition to a great extent has formed in different conditions than they are today
- Why? – Shallow groundwater:
  - Shallow groundwater is one of the components that links climatic conditions with evolution of vegetation and hydrographic network
  - Understanding groundwater fluctuations due to the climate changes there will be better possibilities to conceive post-glacial evolution of vegetation and hydrographic network

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Impact of climate changes on shallow groundwater and hydrographic network – groundwater interaction (GRU)

- **Main tasks are to study:**
  - impact of climate changes on shallow groundwater flow systems;
  - shallow groundwater and surface water interaction;
  - anthropogenic load on shallow groundwater.
- The studies will be carried out in selected pilot areas, including field oservations of water table, surface water level. discharge, drainage rate etc.
- Set of hydrological models will be applied for parameter studies within pilot areas
- Climate change scenarios will be projected on shallow groundwater regime at least for the territory of Latvia

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Planned results

- Geometric structure of Baltic Artesian Basin and hydrogeological model of BAB
- Digital data set on pjezometric water levels of the aquifers of BAB, that could be used as a boundary conditions or baseline data for other, particular studies;
- Understanding of groundwater composition formation and changes during post-glacial period;
- Future scenarious on climate changes, surface water and groundwater interactions will be developed;
- Scientific publications, reports on scientific conferences, popular scientific papers and materials, input for the dissertations;
- ….

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Thank You!

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