OJSC "VNIPIgazdobycha"

IMPROVEMENT OF GAS UNDERGROUND STORAGE PERFOMANCE BY ADDITIONAL PRODUCTION OF OIL RIM USING MODERN COMPUTER-AIDED TECHNOLOGIES

Location of the Gas Underground Storage (GUS)

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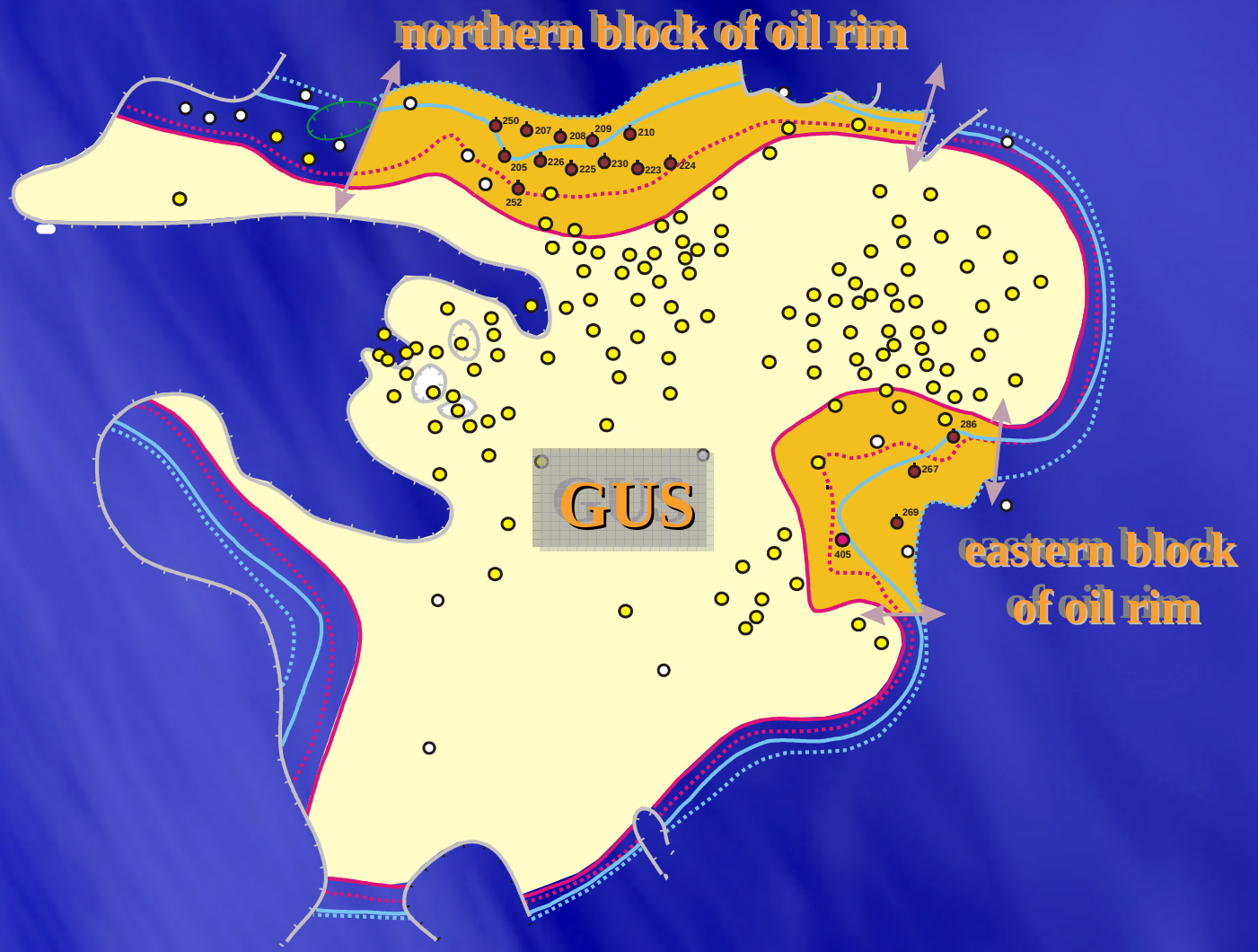
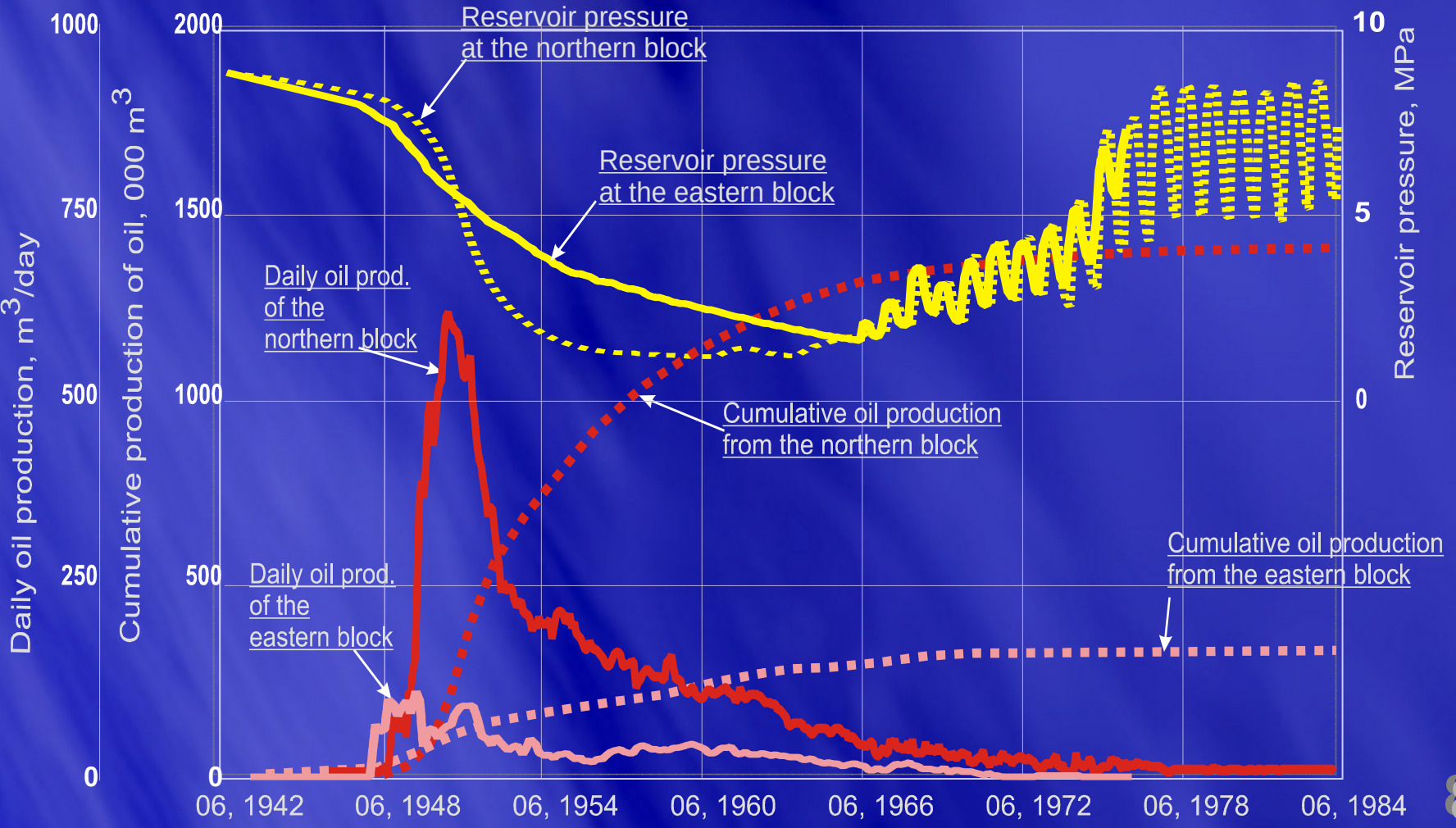
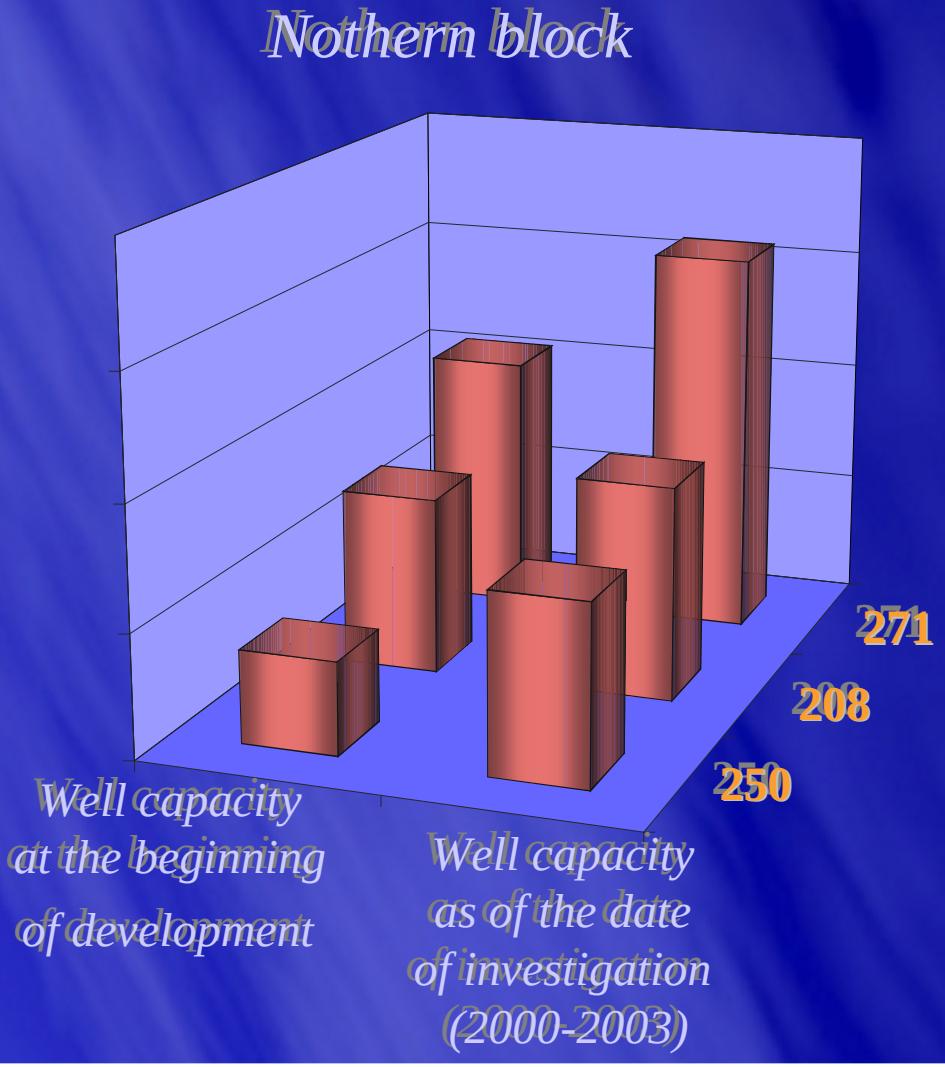
Layout of GUS and oil rim blocks

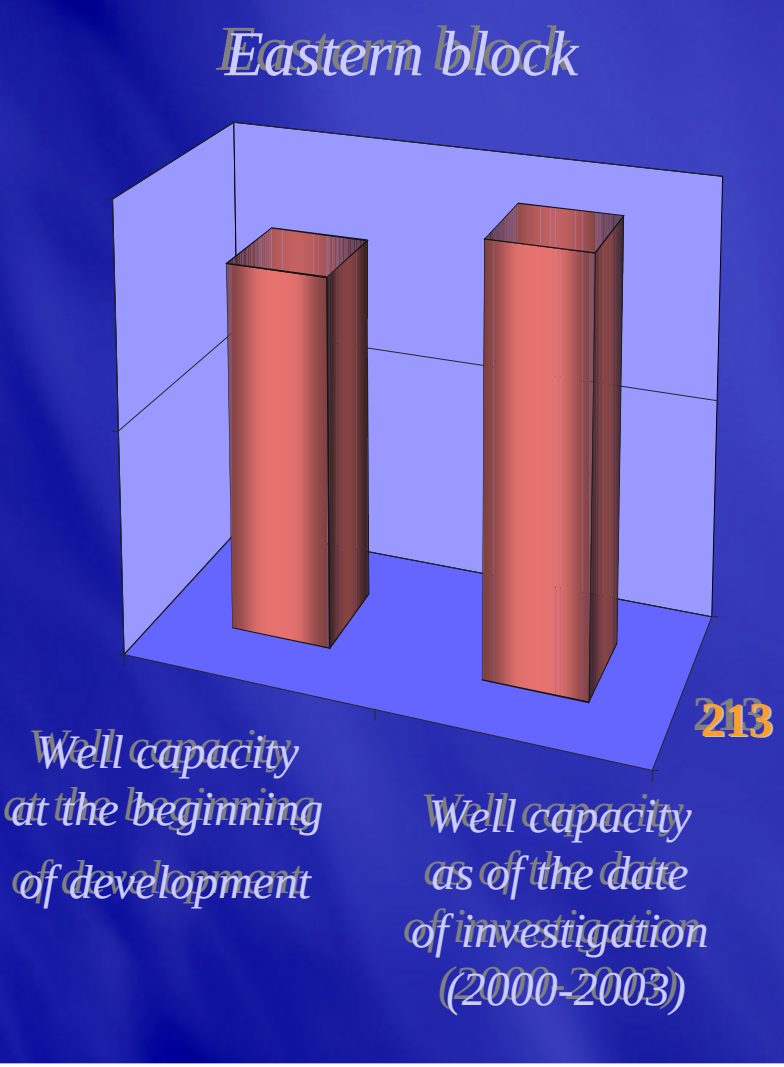


Oil production history at oil rim blocks

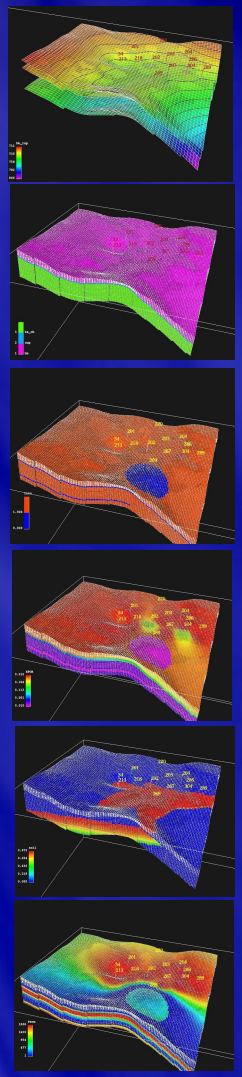


Oil rim wells deliverability



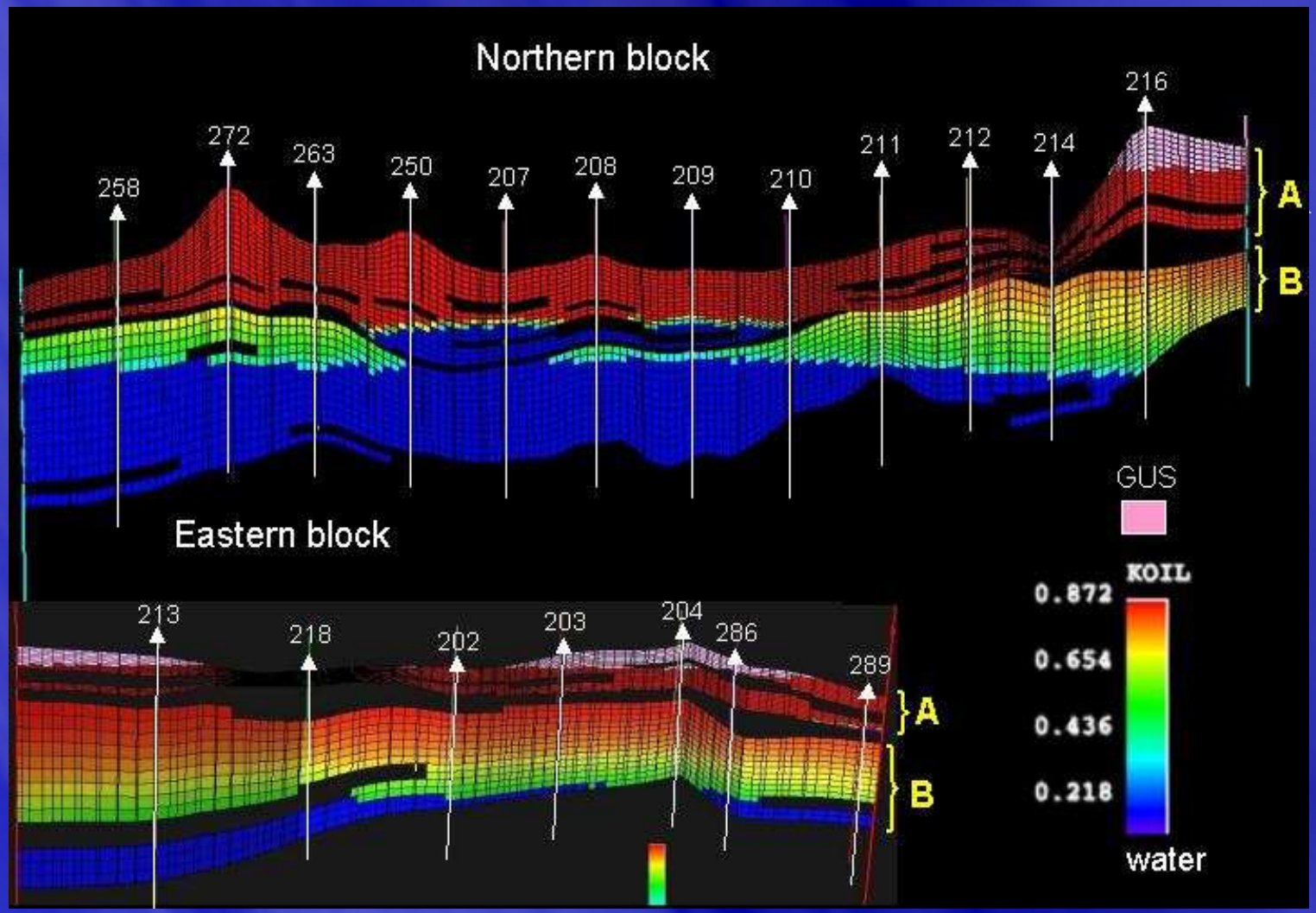


3D GEOLOGYCAL MODEL



- Structure surfaces
- Network model
- Lithology
- Porosity
- Fluids saturation
- Permeability

Diagram of geologic structure of the oil rim in blocks



– sandstones

– carbonate rocks

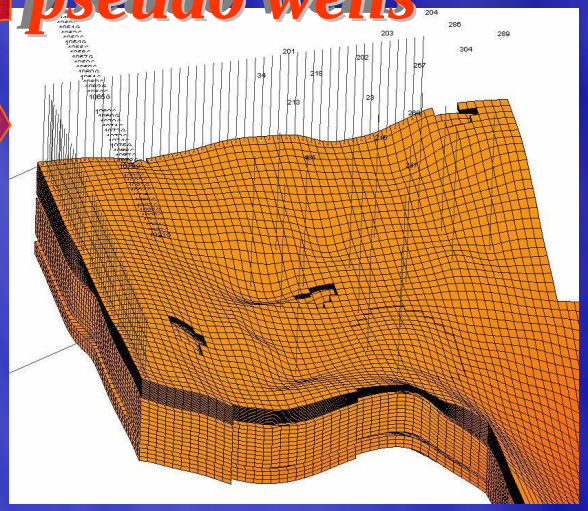
scale of saturation types

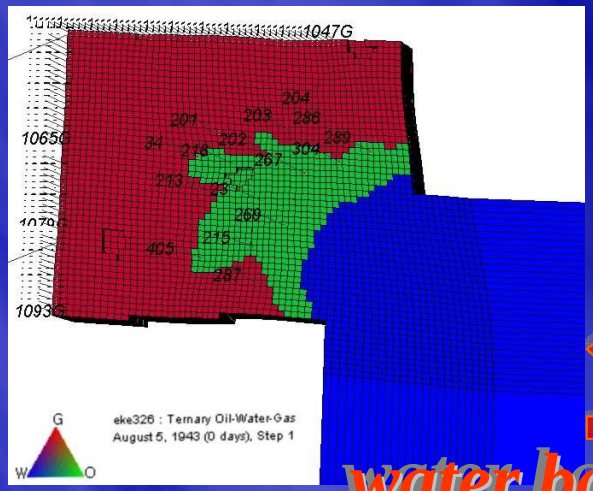
Average properties of the northern and eastern oil rim blocks

Properties	Northern block		Eastern block	
	A	B	A	B
Net oil thickness, m	4,43	15,6	5,9	14,9
Porosity, unit fractions	0,16	0,08	0,18	0,08
Permeability, mDarcy	717	465	856	570
Oil saturation, unit fract.	0,76-0,81	0,71-0,85	0,76-0,81	0,71-0,85
Oil volume factor	0.910	0.864	0.917	0.864
Factor of oil liberation during GUS operation	0.891			
Specific gravity of oil	0.837			
Relative errors of calculations	5.8e-7 – 0,14			

3D SIMULATION MODEL

pseudo wells





water basin

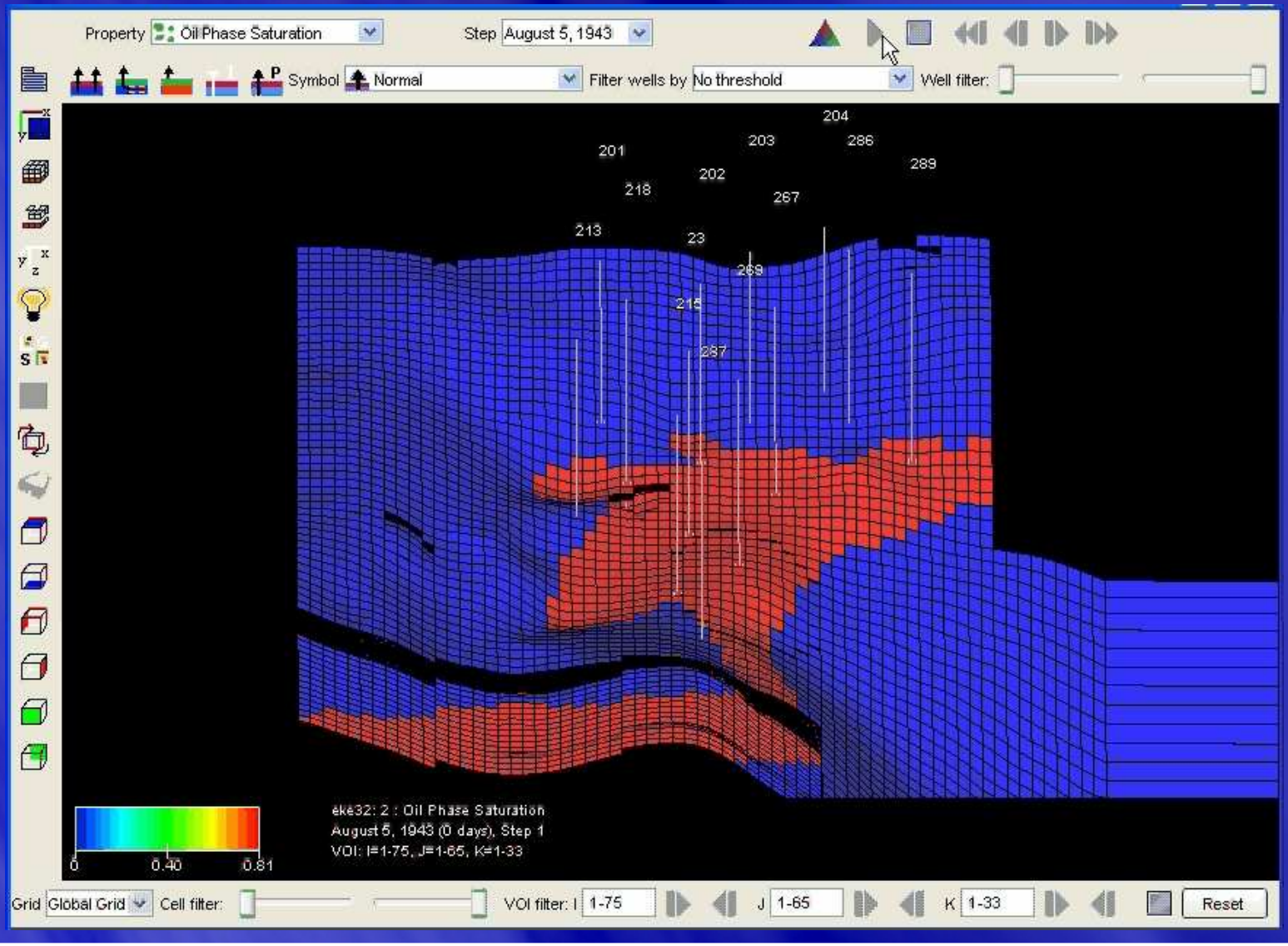
Boundary conditions:

- GUS operaton

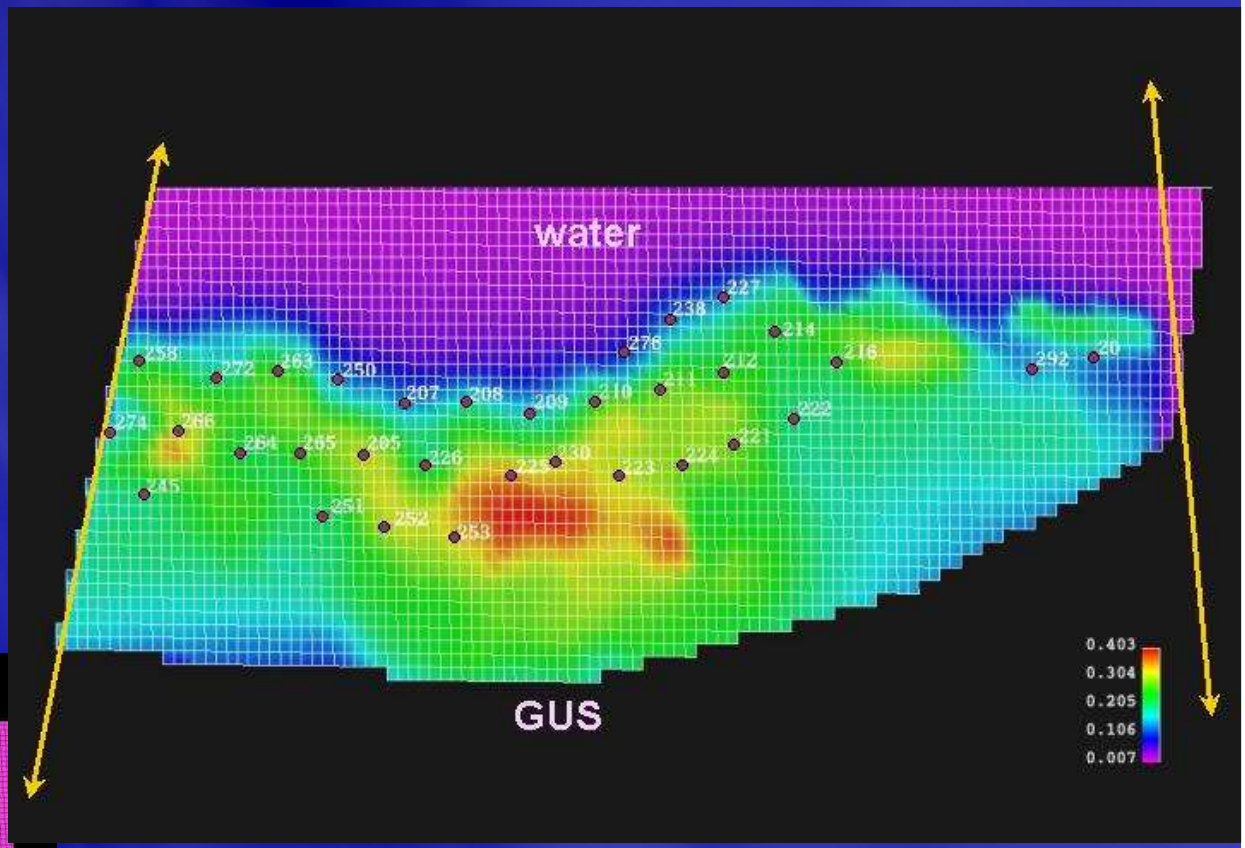
  pseudo wells (limits of pressures)

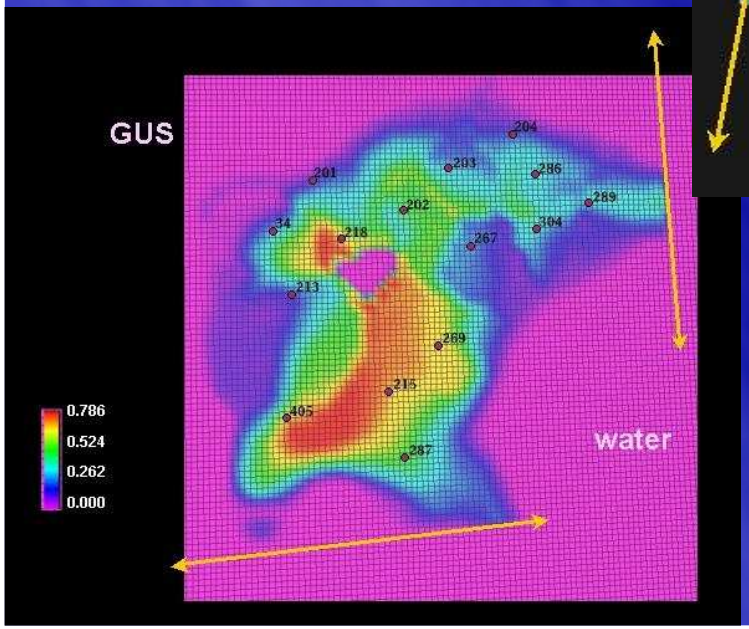
- Water basin types:
  - Karter-Tracy type (average parameters)
  - grid type (stay field parameters)

Oil saturation of the eastern block in dynamic



Average oil saturation of the nothern block as of 2005





Average oil saturation of the easten block as of 2005

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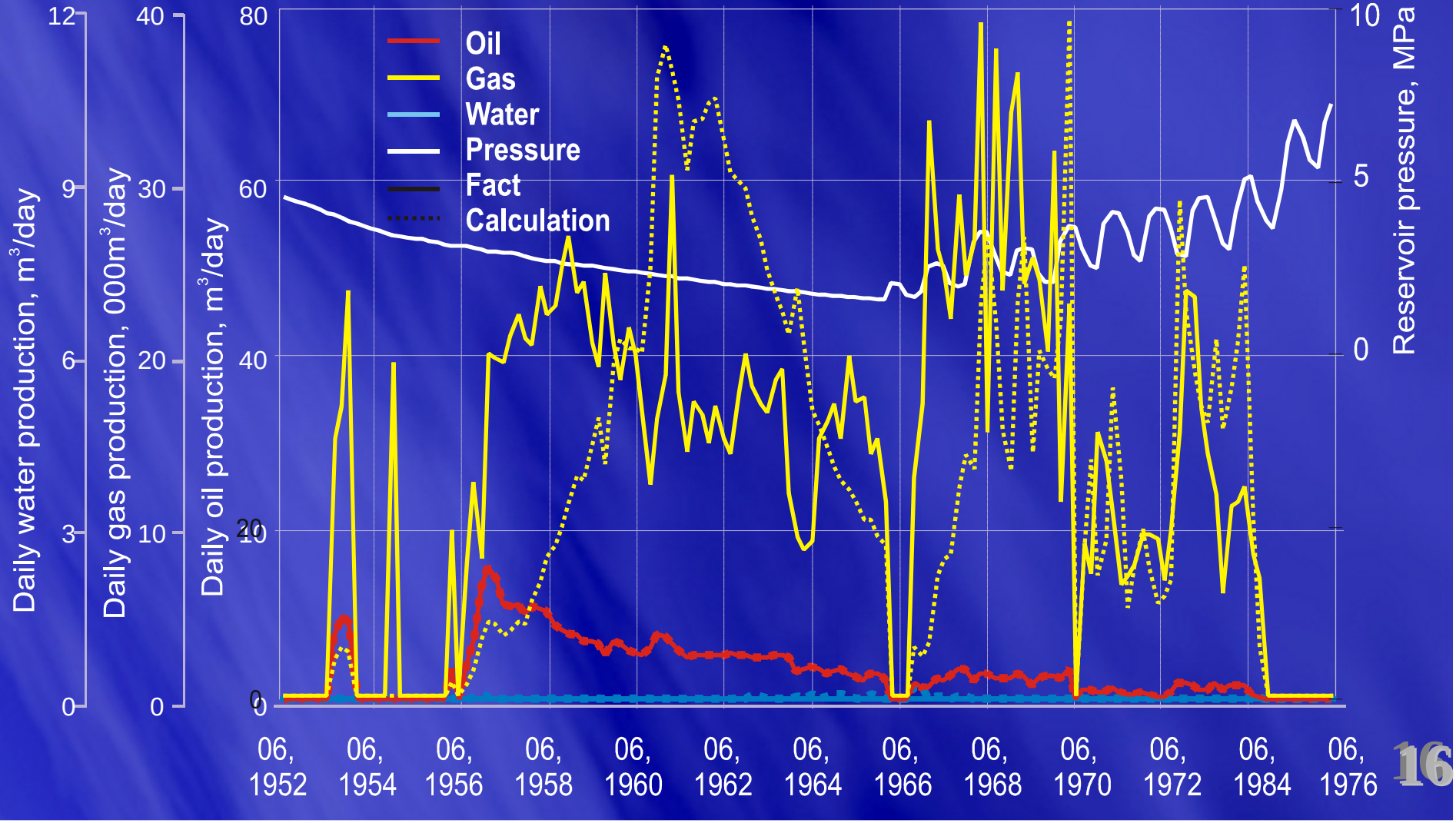
Results of development adaptation of well of the easten block



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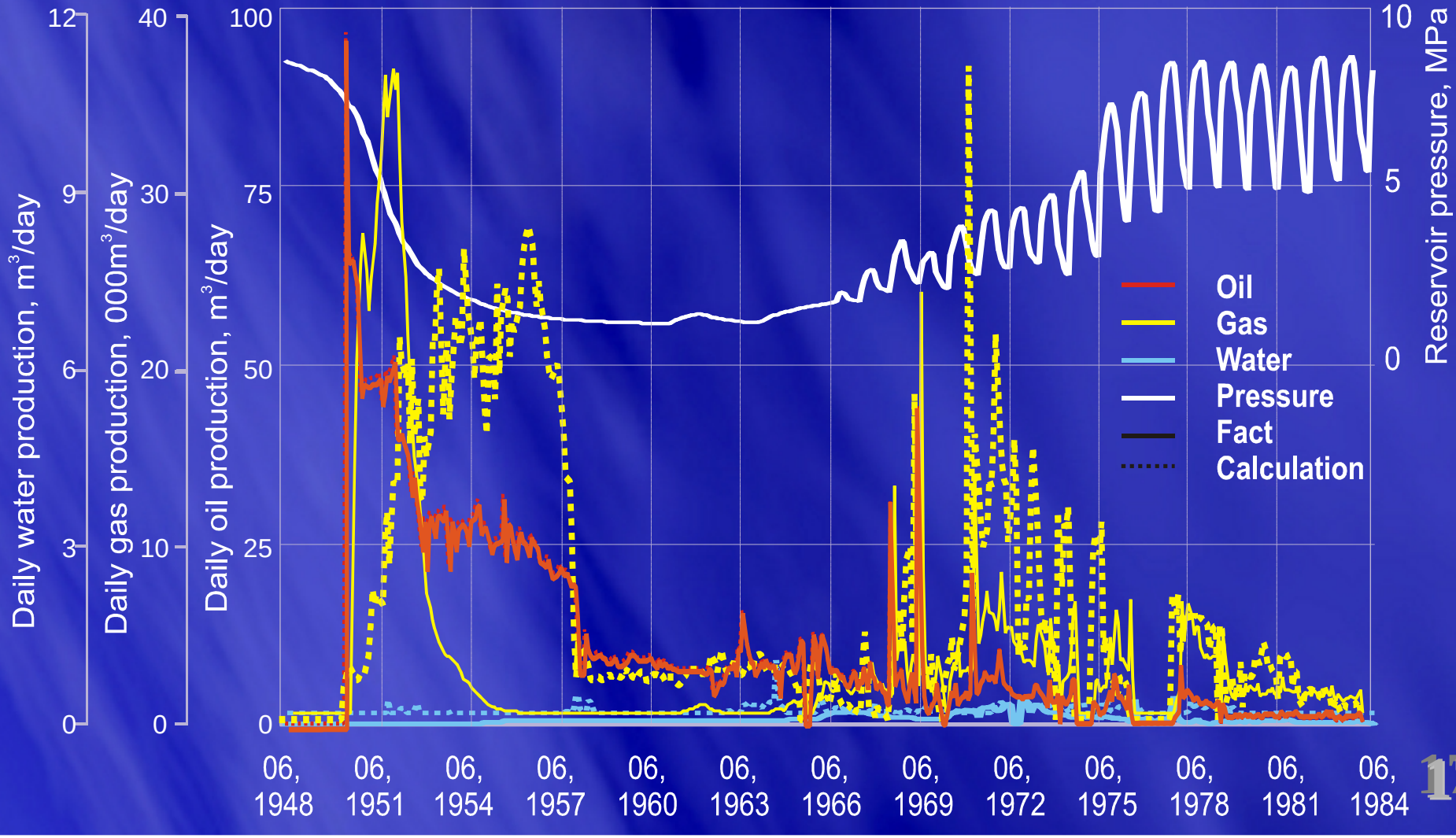
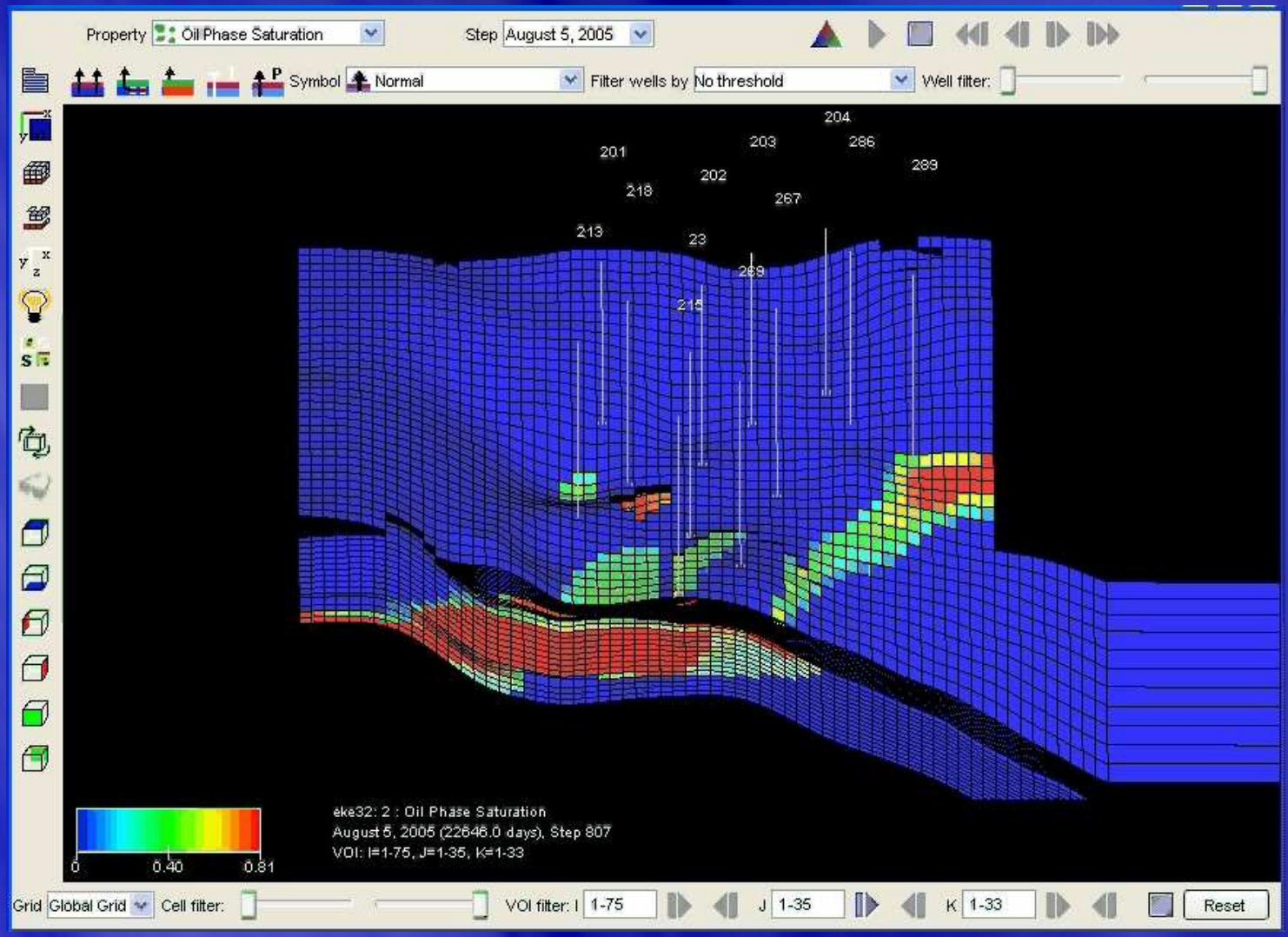
Results of development adaptation of well of the northern block



3D simulation model – oil production forecast



Alternative 1

Conditions:

- Use idle oil wells
- All wells are vertical
- Production strings perforate a reservoir A
- Critical pressure drawdown values

as the basic boundary data for oil wells

Results:

- All wells are operated with sufficiently high gas factor
- Minor water production during the whole calculation period
- The dependence of oil outputs on reservoir pressure fluctuation
- As a result of cyclic fluctuation of reservoir pressure the gas content in oil wells production is changed and water production is somewhat increase in the periods of low reservoir pressure
- OEF reached to 0.5 and 0.4 for eastern and northern blocks consequently

Alternative 2

Conditions:

- Use idle oil wells
- Abandoned wells are to be reconstructed
- Production strings perforate a reservoir A and B
- The wells are operated at their own accepted values of drawdown

Results:

- OEF reached 0.7 and 0.72 for eastern and northern blocks consequently

Alternative 3

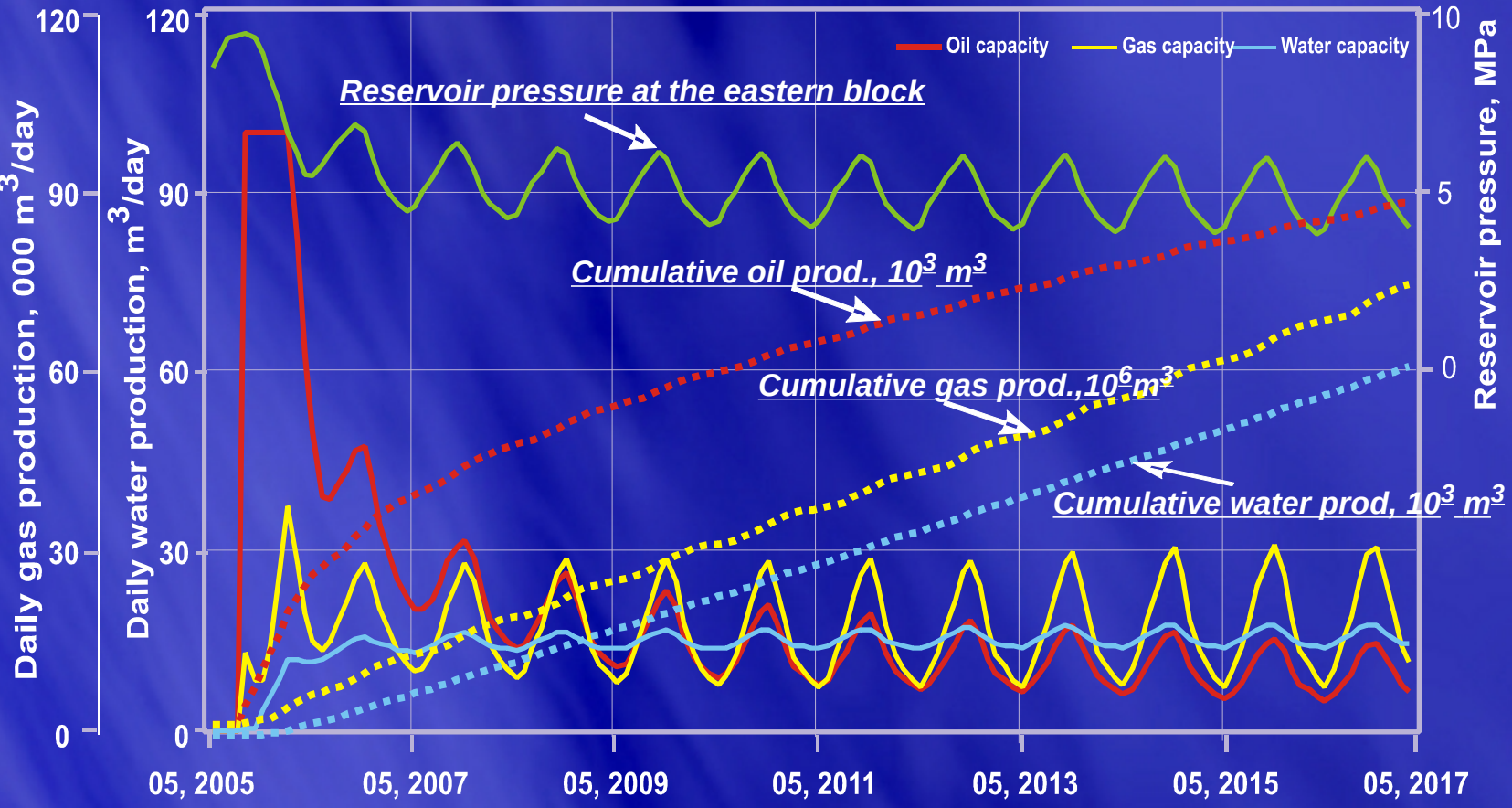
Conditions:

- Use all vertical wells
- The horizontal wells are put into operation
- The horizontal wells are perforated along the whole length of horizontal string at the level reservoir B
- A horizontal part of the borehole has a height of 500 meters
- To determine an optimal disposition of horizontal wells the geologic simulation results were used

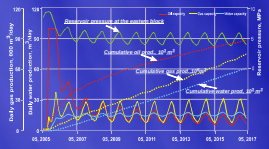
Results:

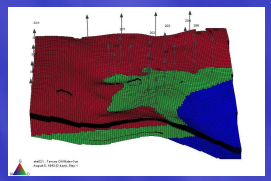
- OEF reached consequently **0.82** and **0.85** for eastern and northern blocks

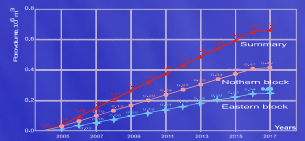
Development forecast parameters of horizontal well of the easten block. Alternative 3

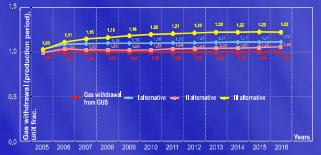


CONCLUSION



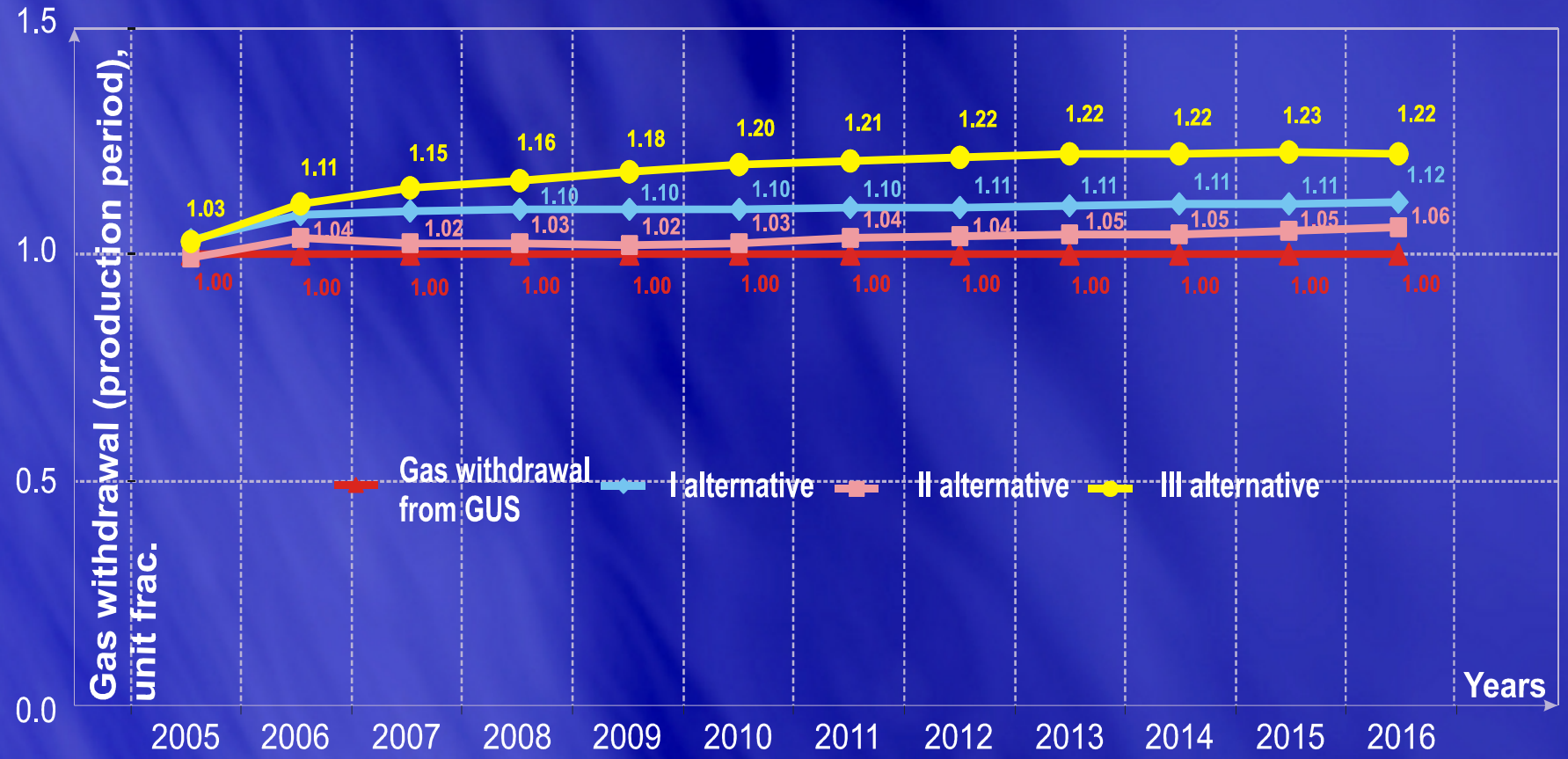




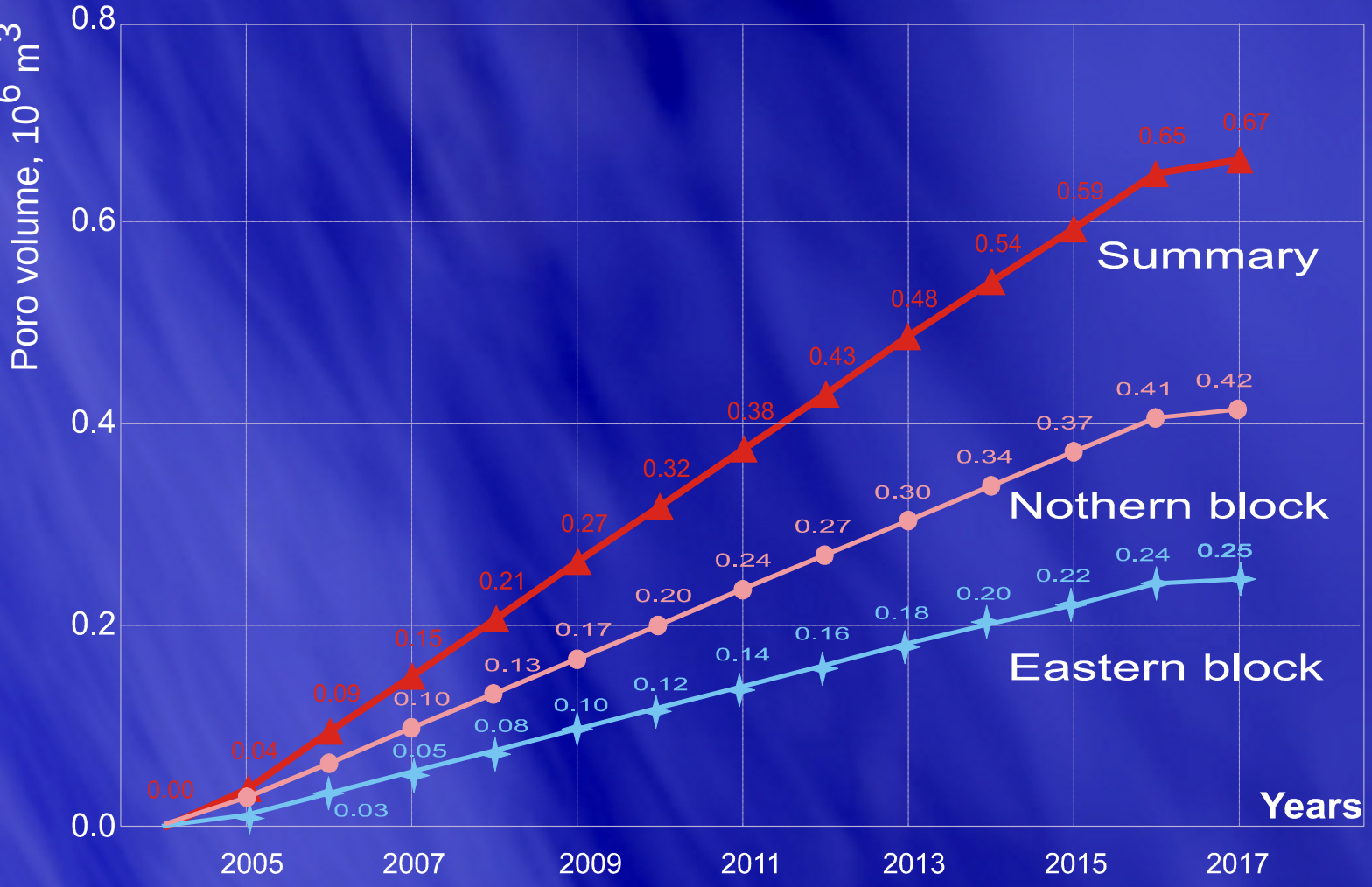


- Additional oil production in GUS conditions is practicable
- Oil rim reservoir pressure is a result of behavior of GUS pressure
- Oil recovery increase during periods of GUS reservoir maximum pressure
- Increase porous volume for GUS
- Increase active gas volume

Comparative figures of gas withdrawal



Results of additional oil recovery



THANK YOU

FOR YOUR ATTENTION!