



NIGGG



IEPT



Sofia

University

4ти семинар „Физика и химия на  
Земята, атмосферата и океана

# Modelling of seismicity in the territory of Bulgaria

*S. Dimitrova<sup>1</sup>, I. Vorobieva<sup>2</sup>, A. Gorshkov<sup>2</sup>, L. Dimova<sup>3</sup>, and R. Raykova<sup>3</sup>*

<sup>1</sup> *National Institute of Geophysics, Geodesy and Geography, BAS, Sofia*

<sup>2</sup> *Institute of Earthquake Prediction Theory and Mathematical Geophysics, RAS, Moscow,*

<sup>3</sup> *Faculty of Physics, Sofia University “St. Kliment Ohridski”, Sofia*



NIGGG

# Scope of the researche

We apply a block and fault dynamics (BAFD) model for the Bulgarian region to model regional earthquakes to understand better the seismic hazard in the region.

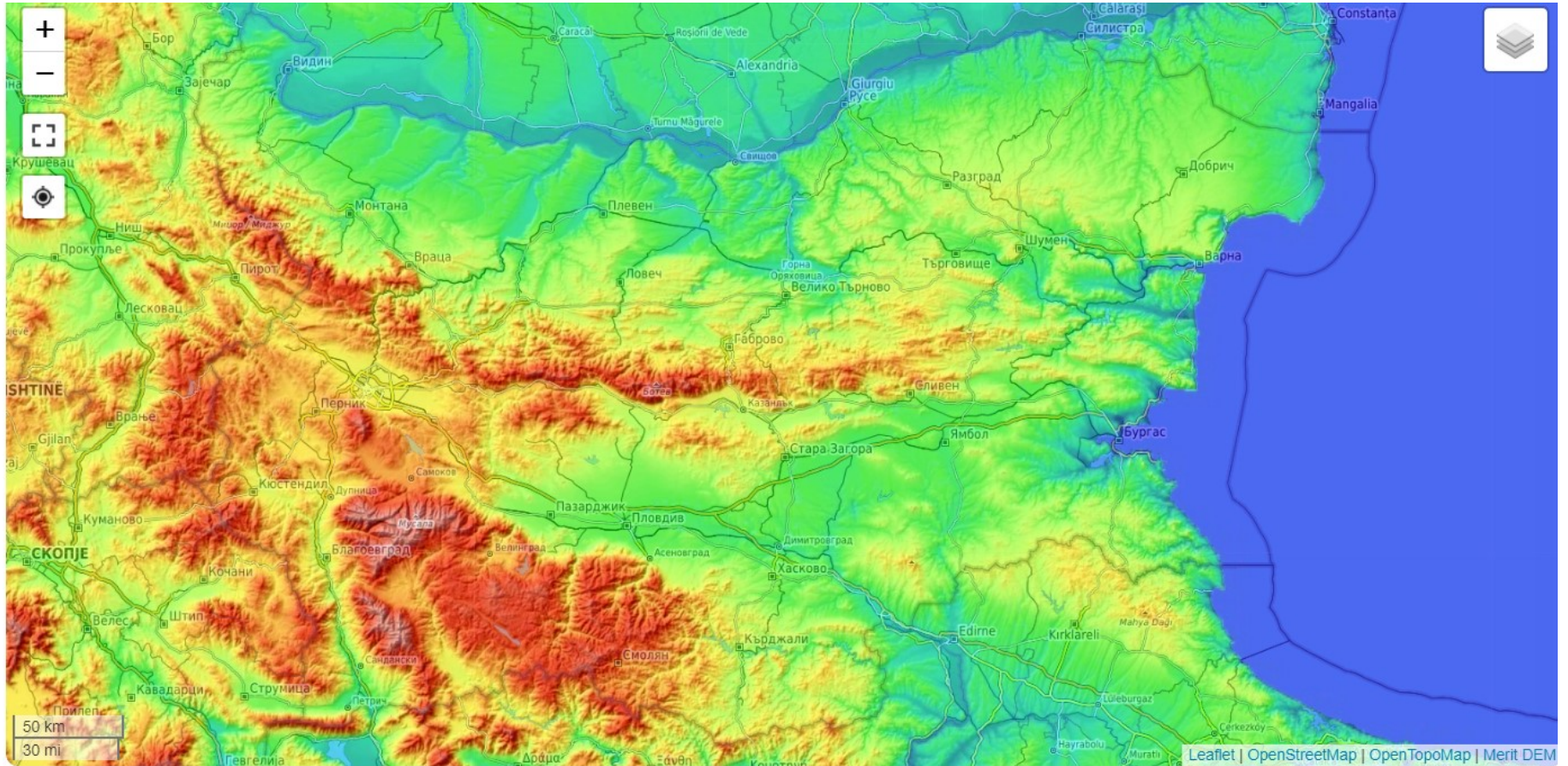


IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана







NIGGG

# Seismicity of Bulgaria

Solakov et al., 2020

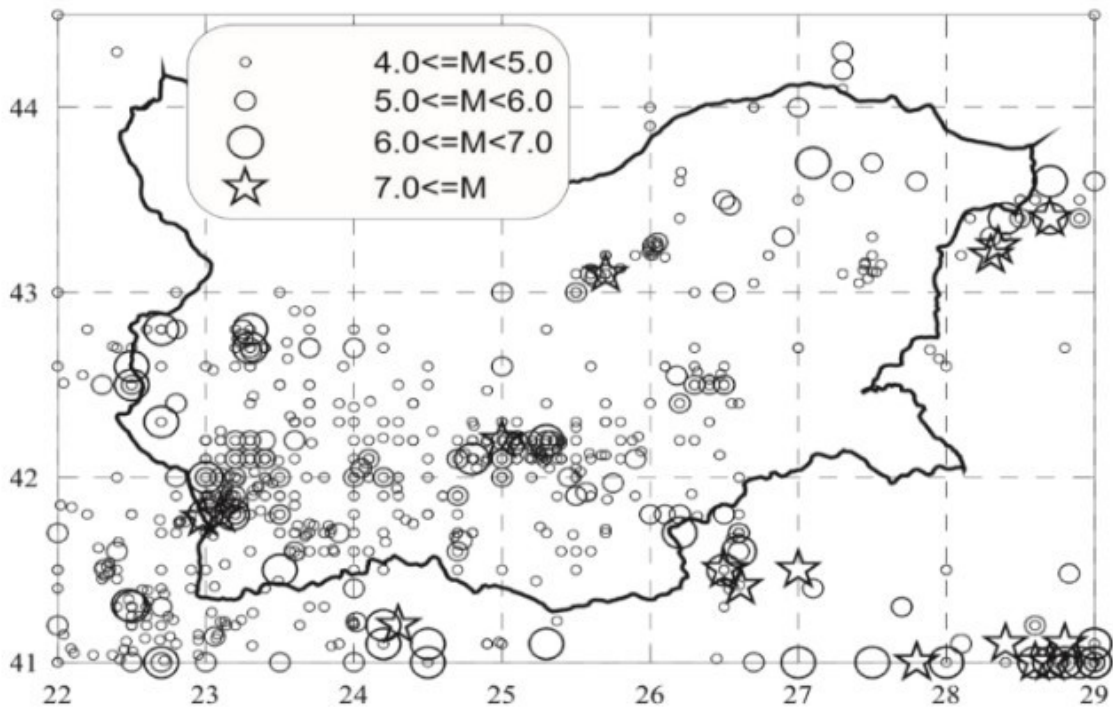
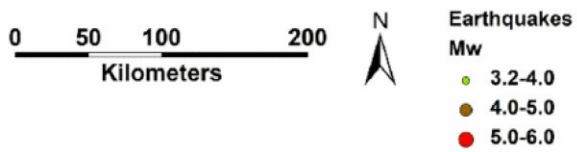
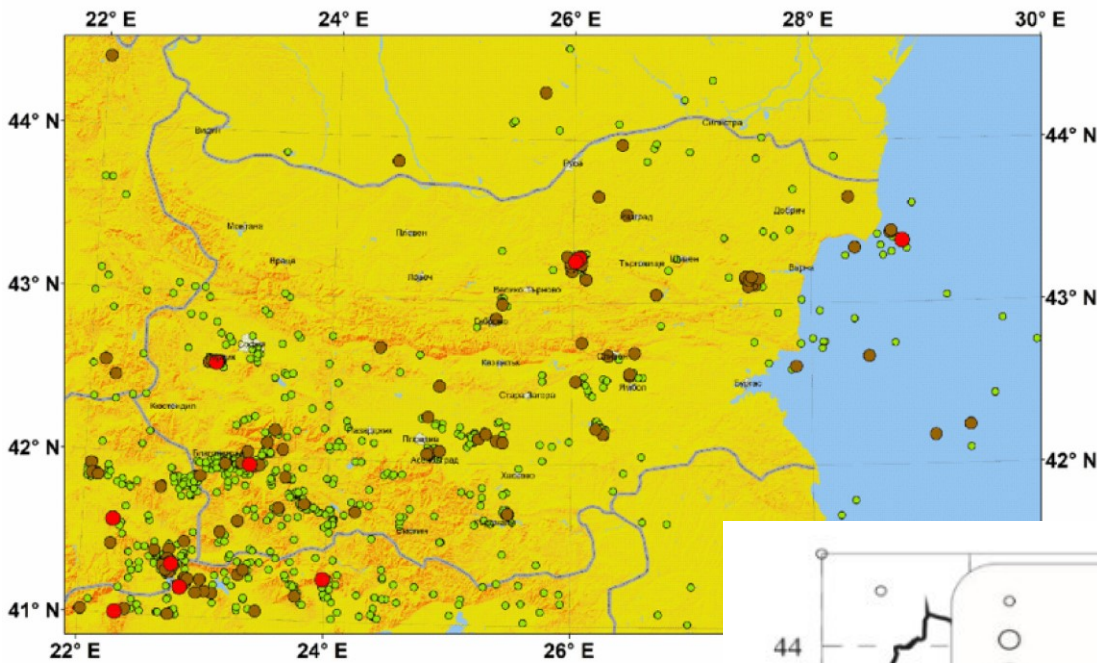


IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана“



Grigorova et al., 1978



NIGGG

# Morfostructural analysis

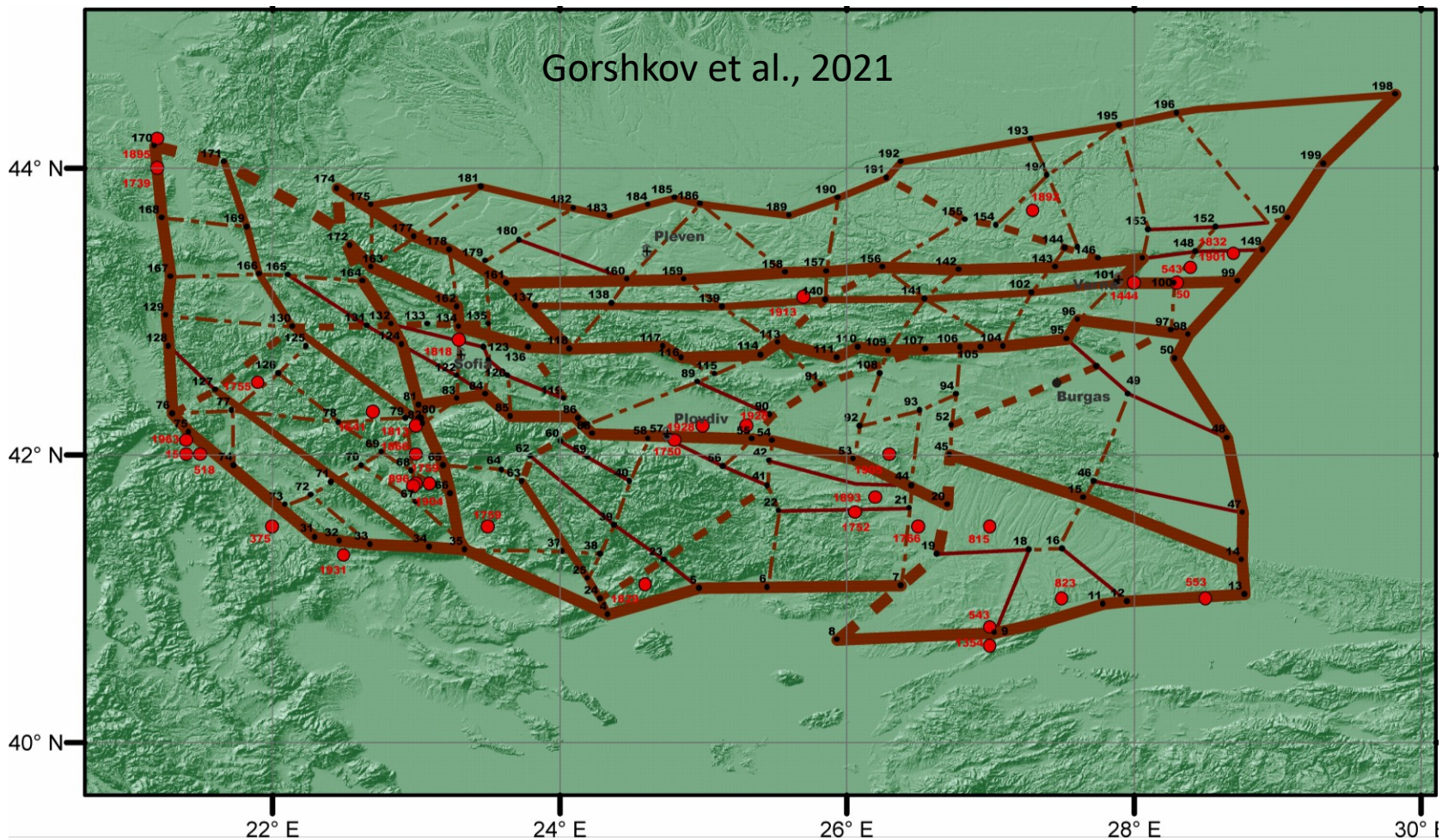


IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана“



Thick lines are the lineaments of the first rank, medium lines are the lineaments of the second rank, thin lines are the lineaments of the third rank; continuous lines note longitudinal lineaments, dashed ones - transverse lineaments. Red dots are epicenters of earth-quakes with  $M \geq 6.0$ .



# GNSS data for the motions in Bulgaria



Vassileva and Atanasova, 2015



NIGGG



IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана



NIGGG

# Active faults in Bulgaria

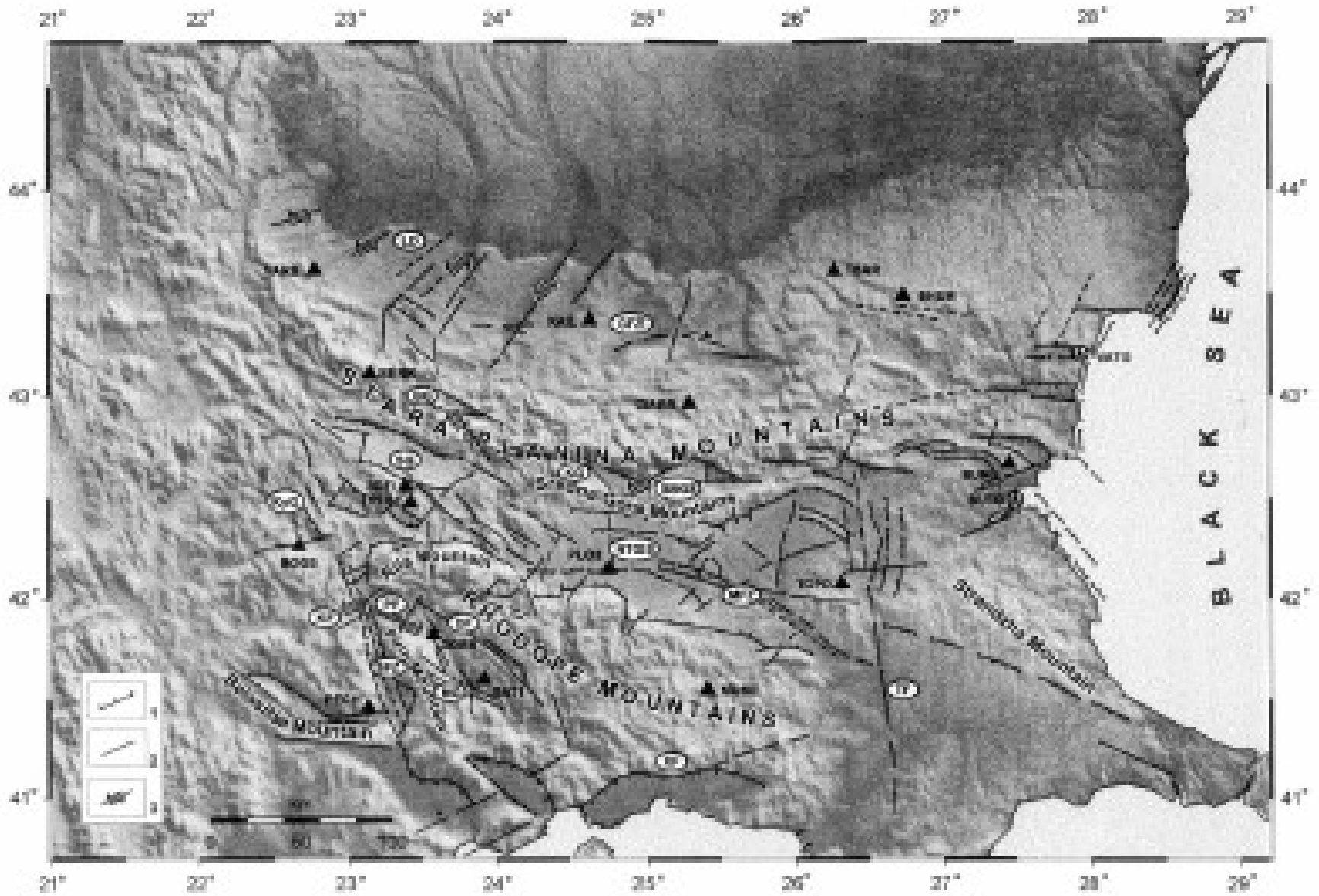


IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана



Kotzev et al., 2001



NIGGG



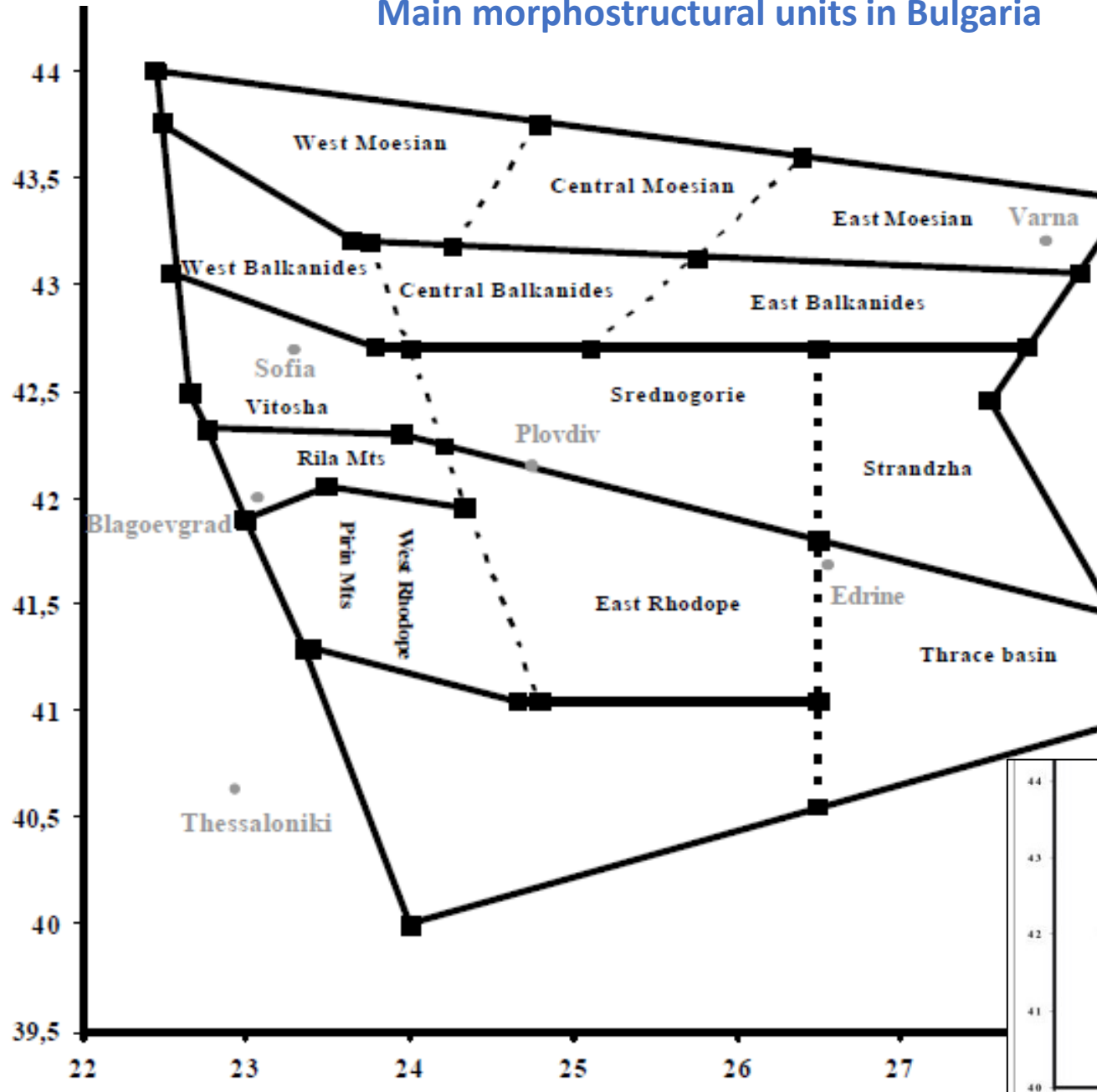
IEPT



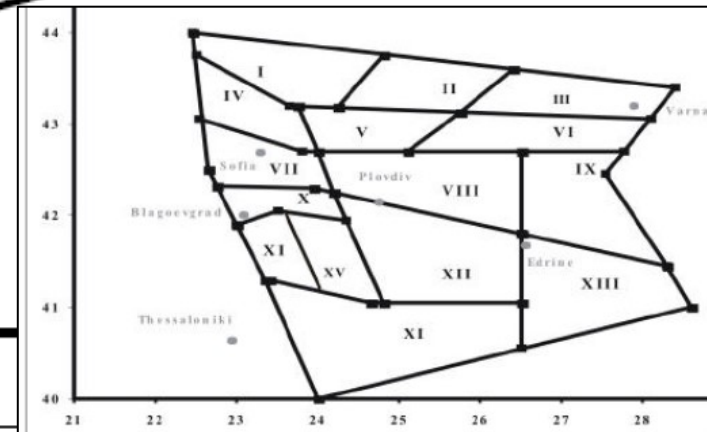
Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана

# Main morphostructural units in Bulgaria



15 block are defined in Bulgarian territory



# Geological and geophysical data for the faults dip



NIGGG

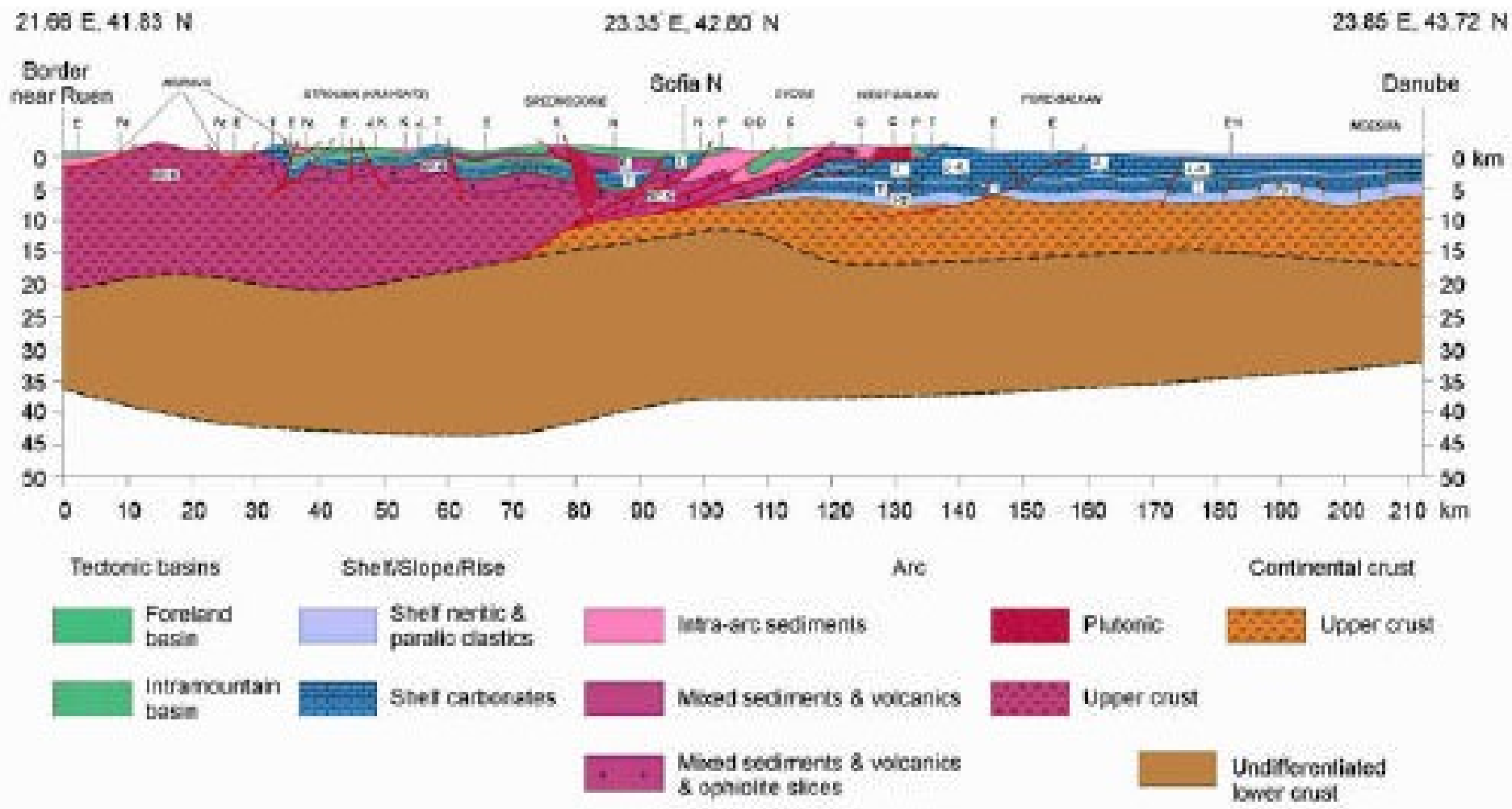


IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана







NIGGG

# Geological and geophysical data for the faults dip

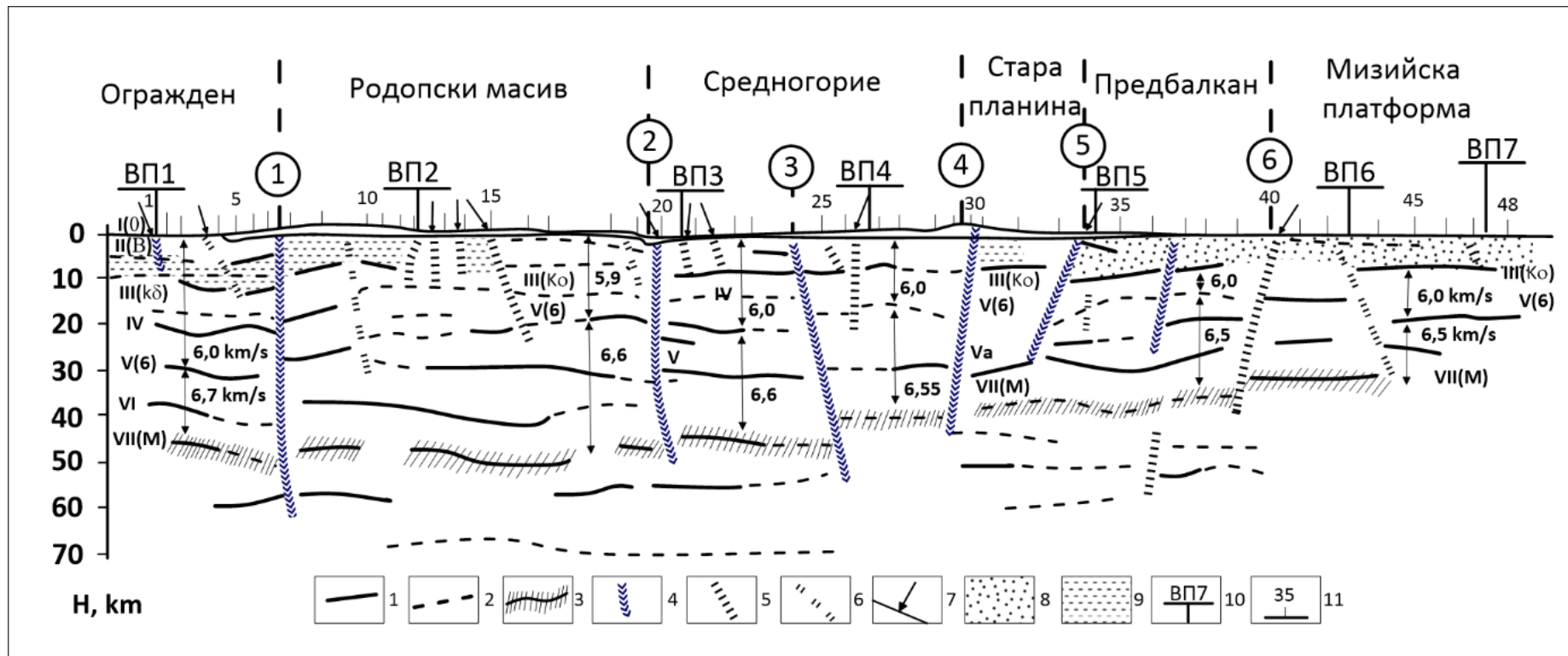


IEPT



Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана“



Petrich-Nikopol seismic profile (Volvovski et al., 1985)



NIGGG

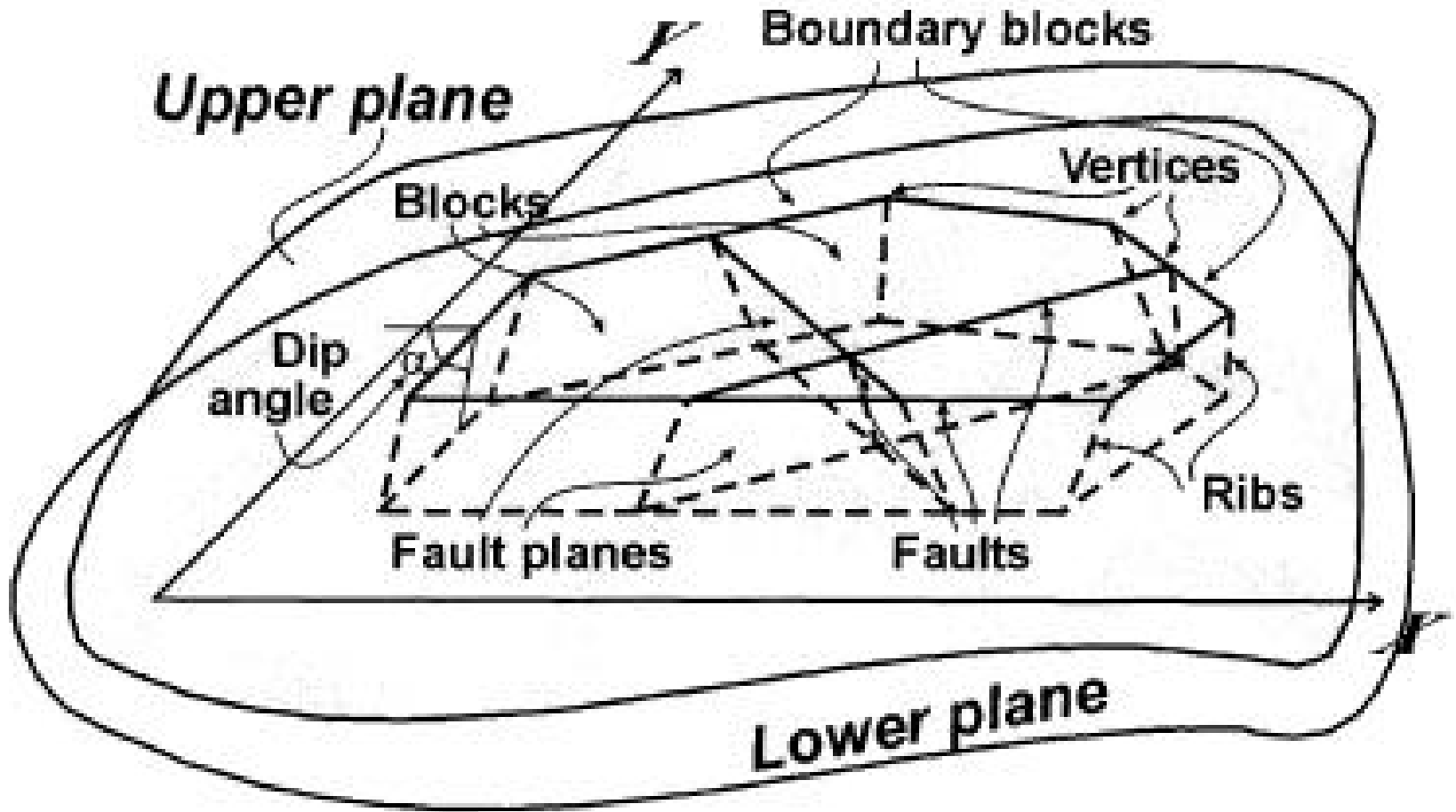
# Block structure model



IEPT



Sofia University



Average thickness of the crust is fixed to 35 km (Raykova and Nikolova, 2007)



NIGGG

## Defined dip angle of the main faults in Bulgaria



IEPT



Sofia  
University

4ти семинар „Физика и химия на  
Земята, атмосферата и океана

<i>Fault</i>	<i>Dip angle</i>	<i>Fault</i>	<i>Dip angle</i>	<i>Fault</i>	<i>Dip angle</i>	<i>Fault</i>	<i>Dip angle</i>
<i>1</i>	135	<i>6</i>	80	<i>11</i>	60	<i>16</i>	120
<i>2</i>	45	<i>7</i>	120	<i>12</i>	60	<i>17</i>	85
<i>3</i>	60	<i>8</i>	135	<i>13</i>	60	<i>18</i>	85
<i>4</i>	60	<i>9</i>	120	<i>14</i>	45	<i>19</i>	85
<i>5</i>	85	<i>10</i>	115	<i>15</i>	120	<i>20</i>	85
<i>21</i>	60						





NIGGG

## Comparison between modeled and observed seismicity

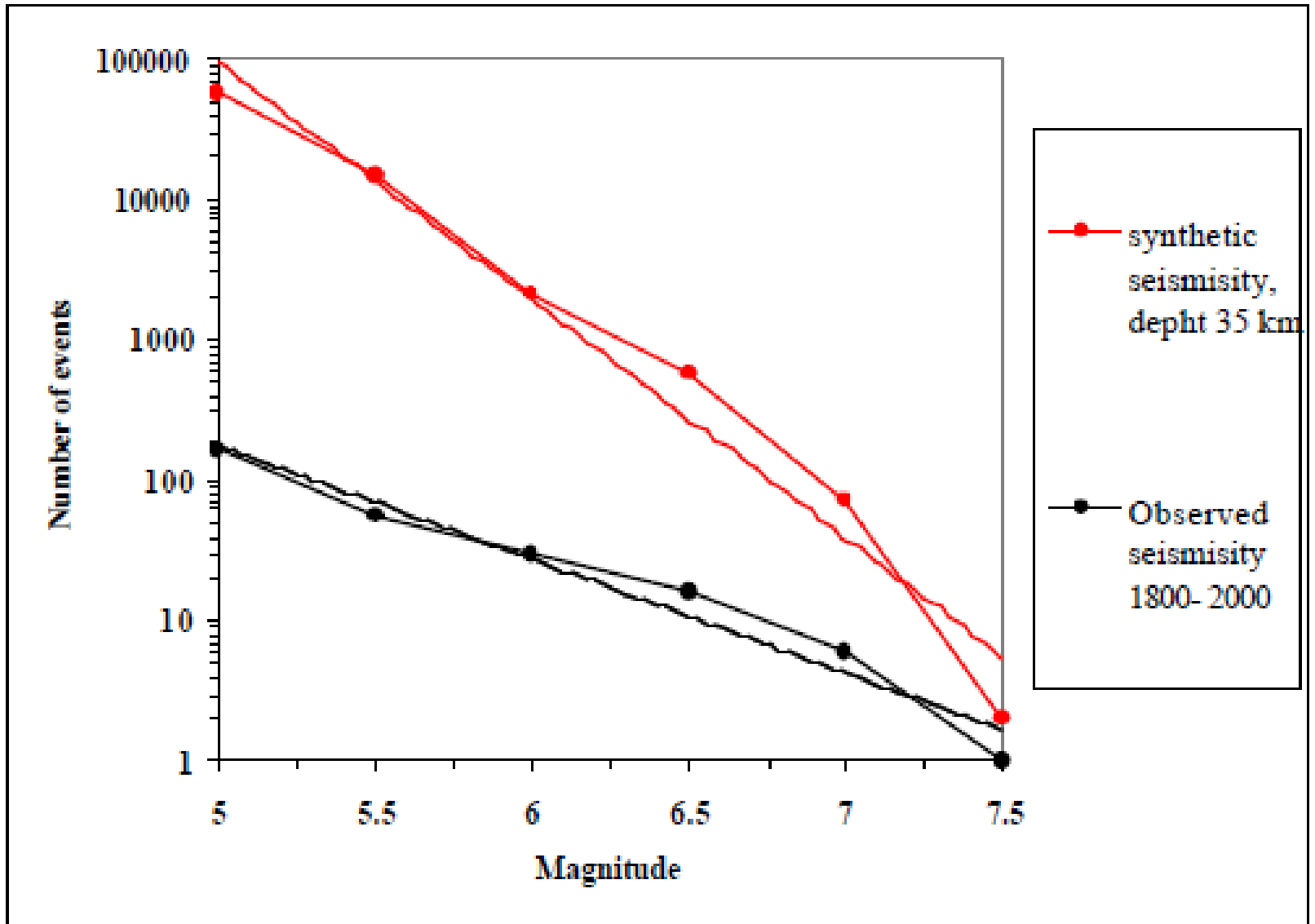


IEPT



Sofia University

4ти семинар „Физика и химия на  
Земята, атмосферата и океана



Gutenberg-Richter relation for the observed and the synthetic M5+ seismicity for dimensionless time - 100 units.



NIGGG



IEPT

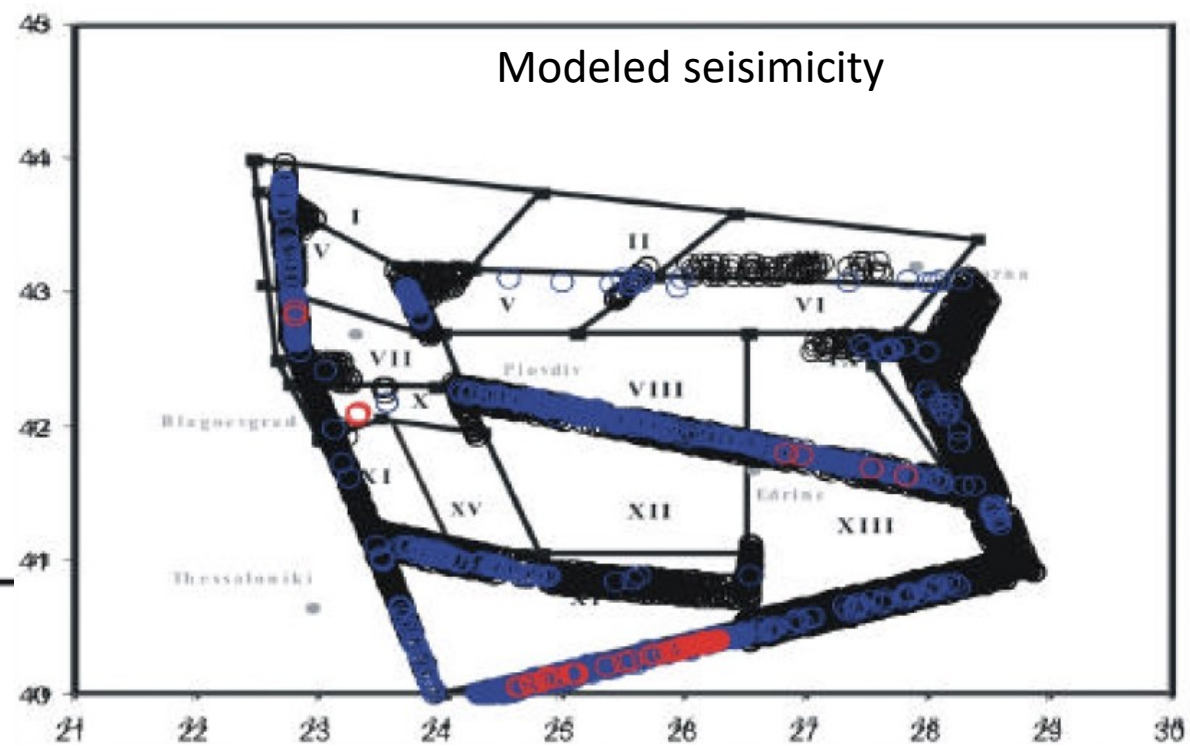
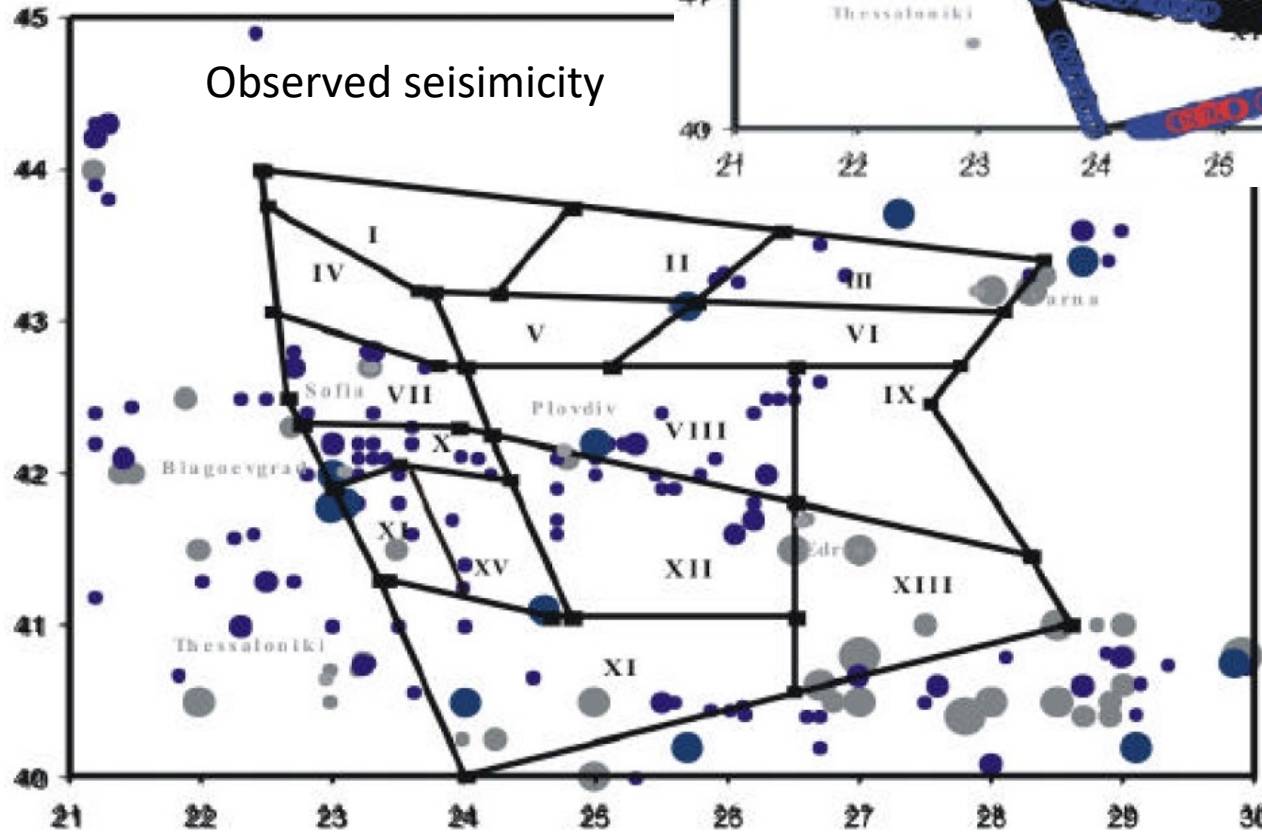


Sofia University

4ти семинар „Физика и химия на Земята, атмосферата и океана

# Comparison between modeled and observed seismicity

The black circles indicate EQ with  $M > 5$ , the blue circles EQ with  $M > 6$  and the red circles EQ with  $M > 7$ .



The blue points are instrumental seismicity, the gray points indicate historical seismicity.



**NIGGG**



**IEPT**



**Sofia  
University**

**Thank you for attention!**

**4ти семинар „Физика и химия на  
Земята, атмосферата и океана**