Chicxulub and Popigai

after 15 years*

double or multiple impact craters?

* Klokočník J., Kostelecký J., Pešek I., Novák P., Wagner C.A., Sebera J. 2010. Candidates for multiple impact craters?: Popigai and Chicxulub as seen by the global high resolution gravitational field model EGM08, *Solid Earth EGU* **1**, 71-83; DOI: 10.5194/se-1-71-2010. See also: Is Chicxulub a double impact crater? *6th EGU A. von Humboldt Interntl. Conf. on Climate Change, Natural Hazards, and Societies*, Mérida, México, Section: The Cretaceous/Tertiary Boundary and the Chicxulub Impact Crater, paper AvH6-5, 15 March 2010.

Astronomical Institute of the Czech Academy of Sciences

Supplement 3
Popigai family

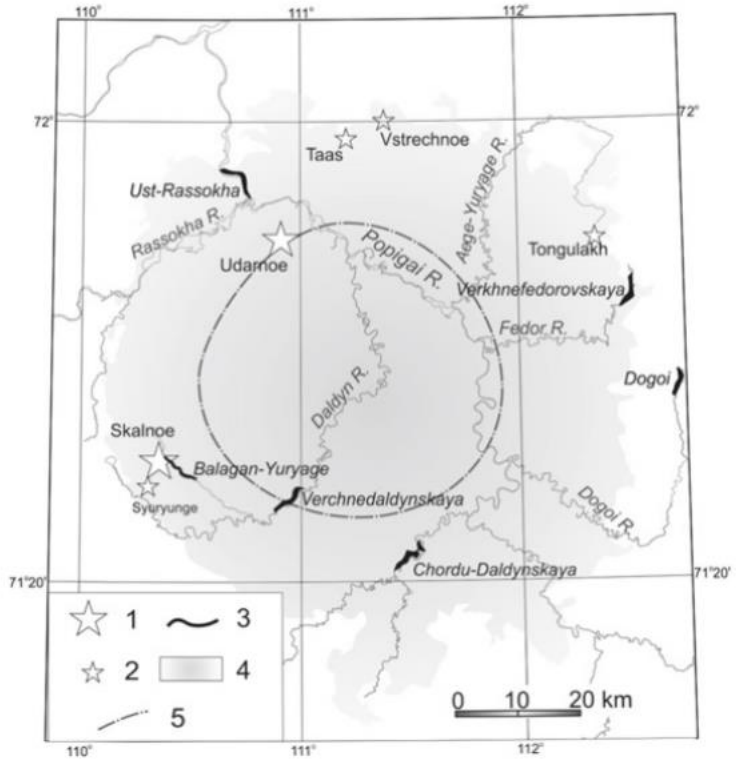

Fig. 7.7 Impact diamond deposits in the Popigai area (modified from Masaitis et al. 2013). 1—Large indigenous diamond deposits with proved resources, 2—Small indigenous diamond deposits estimated tentatively, 3—Large diamond alluvial placers estimated tentatively, 4—Area of

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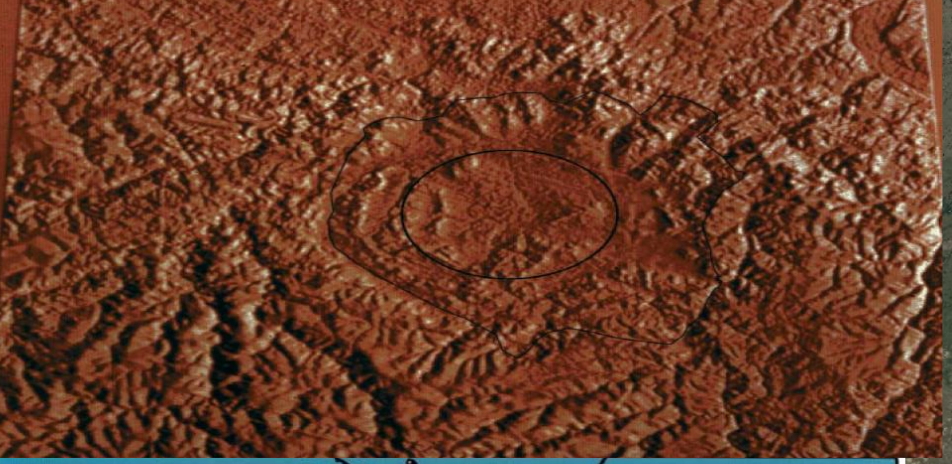
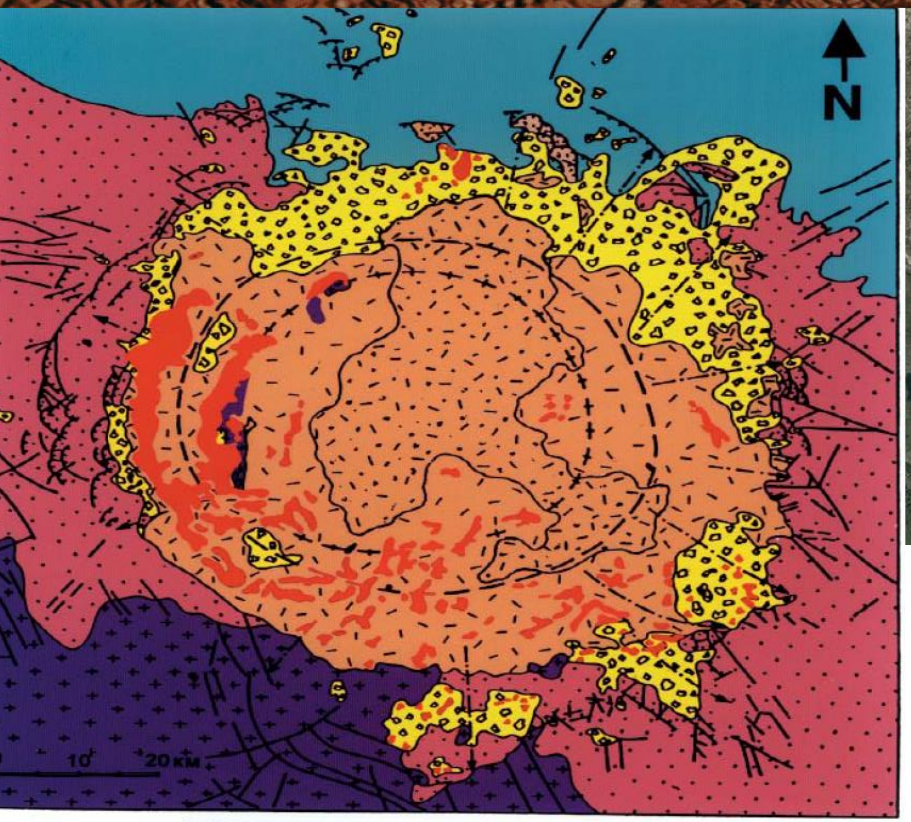
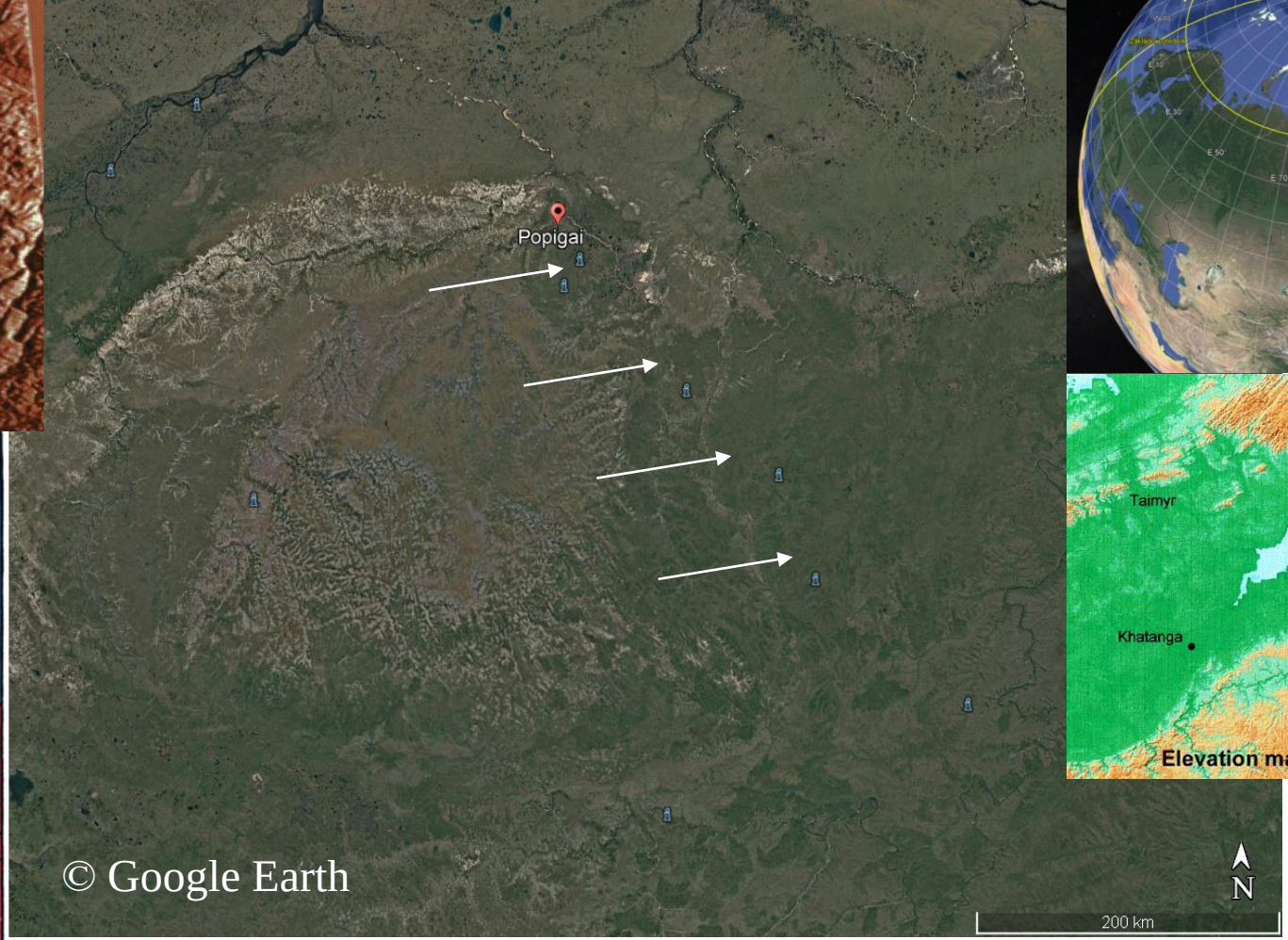
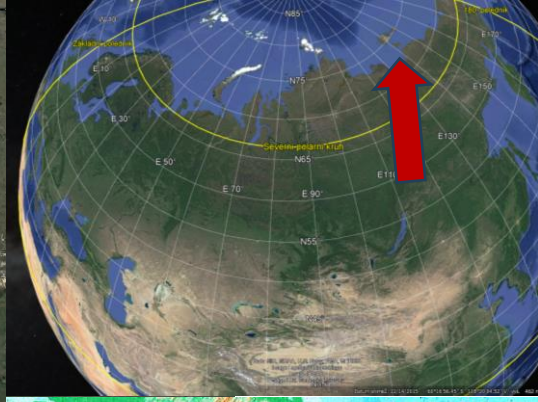
Reproduced from:
Mashchak, M.S., Masaitis, V.L., Raikhlin, A.I., Selivanovskaya, T.V., Naumov, M.V. 2019. Ed. Masaitis V.L. Popigai Impact Structure and its Diamond-Bearing Rocks, Impact Studies, Springer International Publishing AG, Springer Nature; https://doi.org/10.1007/978-3-319-77988-1_2



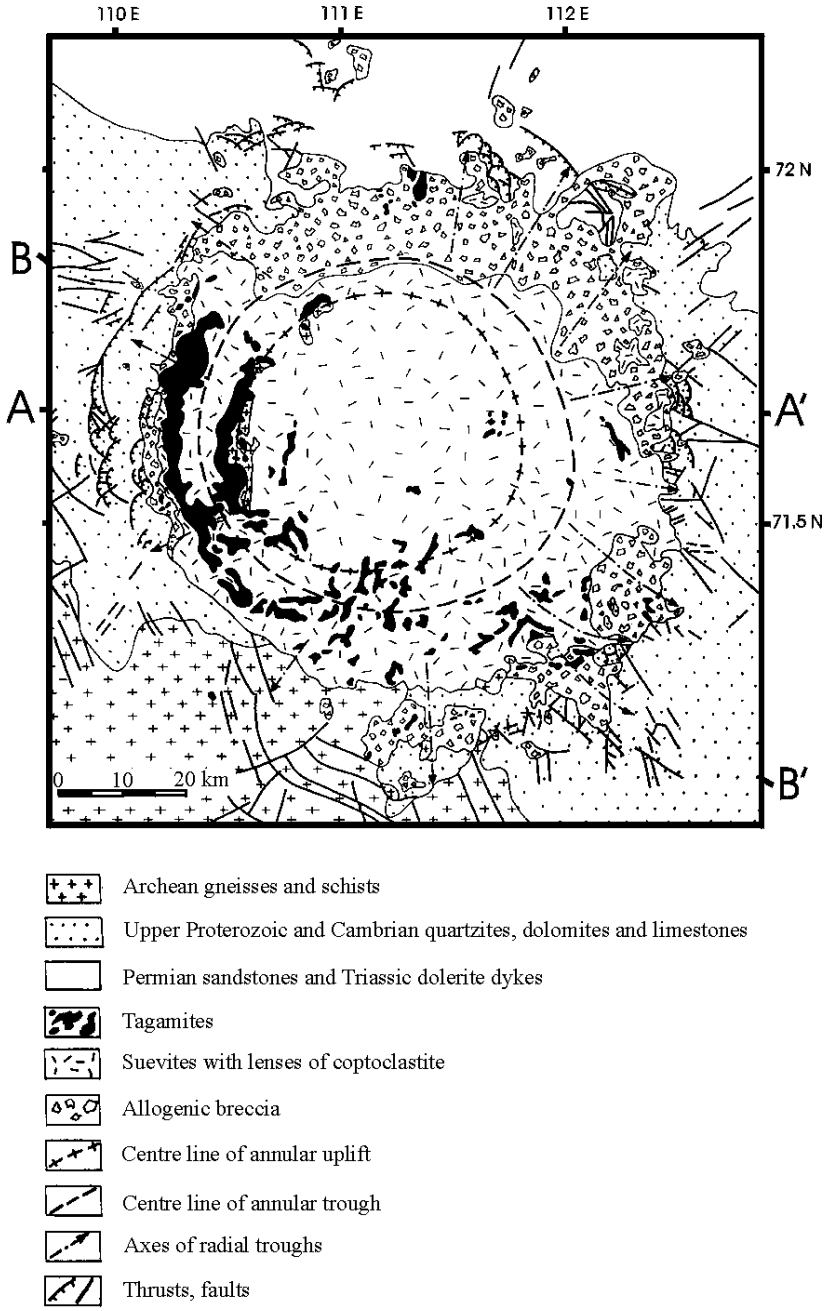






left

Geological sketch map of the Popigai impact structure, modified after Masaitis et al. (1980). (1) Archean gneisses and schists; (2) Upper Proterozoic and Cambrian quartzites, dolomites, and limestones; (3) Permian sandstones and argillites with sills and dikes of Triassic dolerites; (4) tagamites; (5) suevites with lenses of fine-grained allogenic breccia, (6) allogenic breccia; (7) center line of annular uplift; (8) center line of annular trough, (9) axes of radial troughs; (10) thrusts, faults.



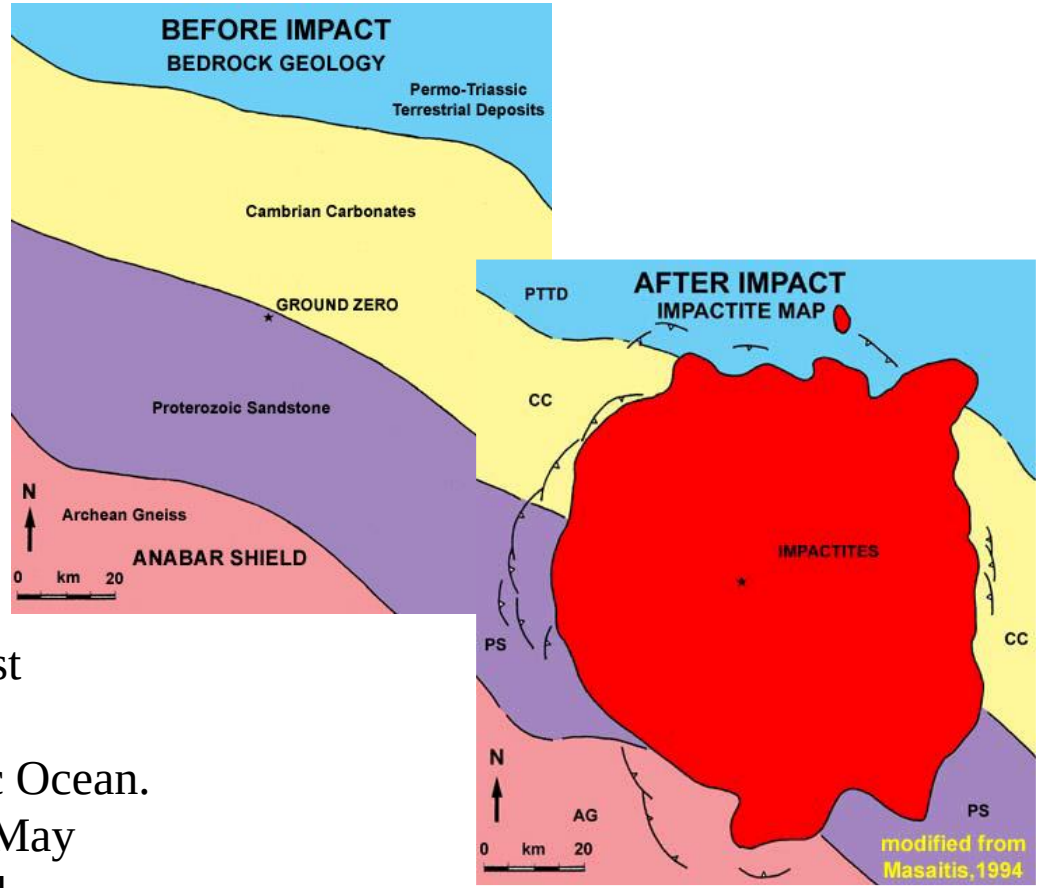
Geology of the Popigai impact structure, after Masaitis (1994).

Popigai

geology of the main
proved impact crater

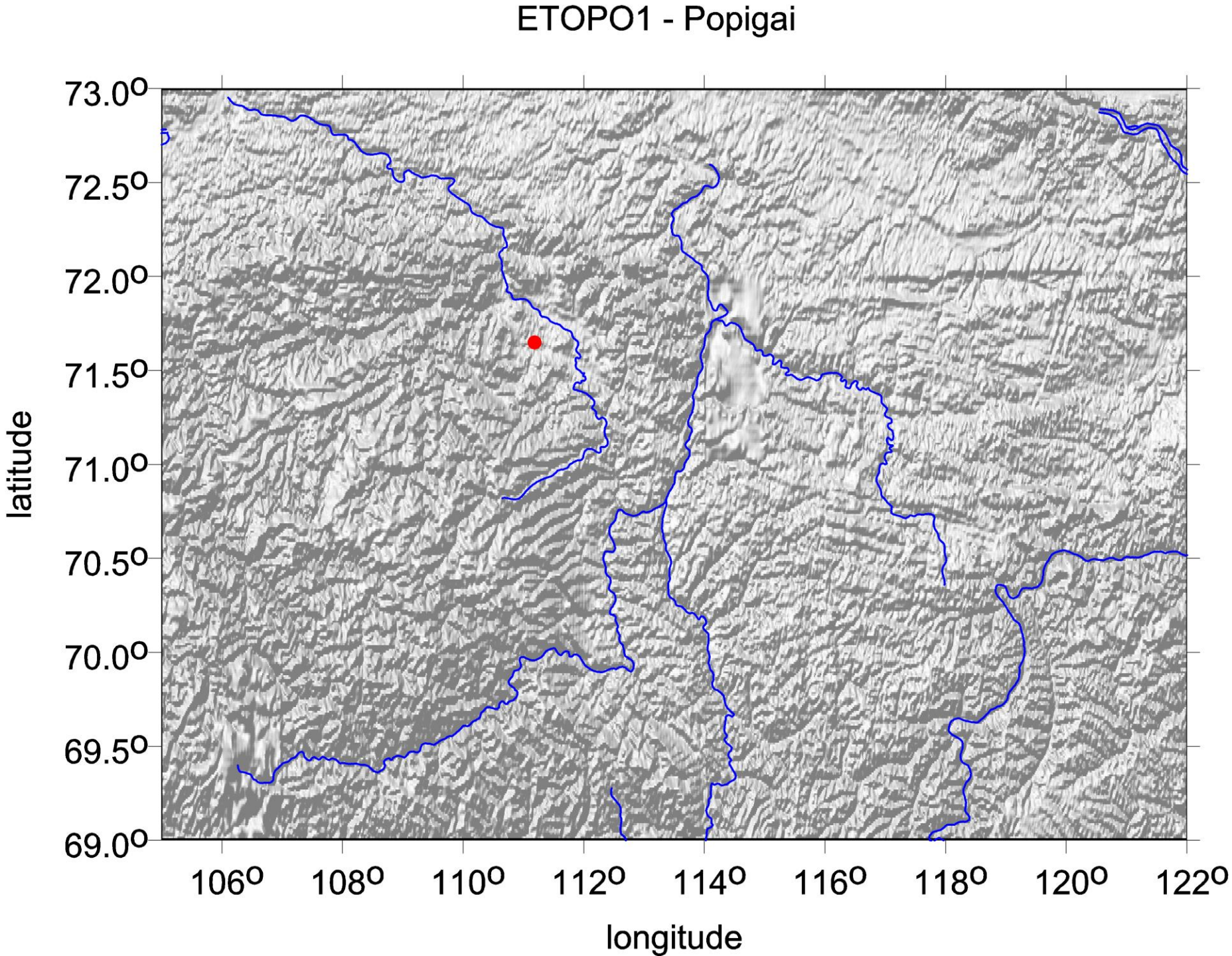
71o38N. 111o11E
crater center

North Central Siberia
about 100 km from the coast
of the Laptev Sea,
an embayment of the Arctic Ocean.
Late Eocene - 35.7 (± 0.2) May
[by stepwise heating Ar-Ar].

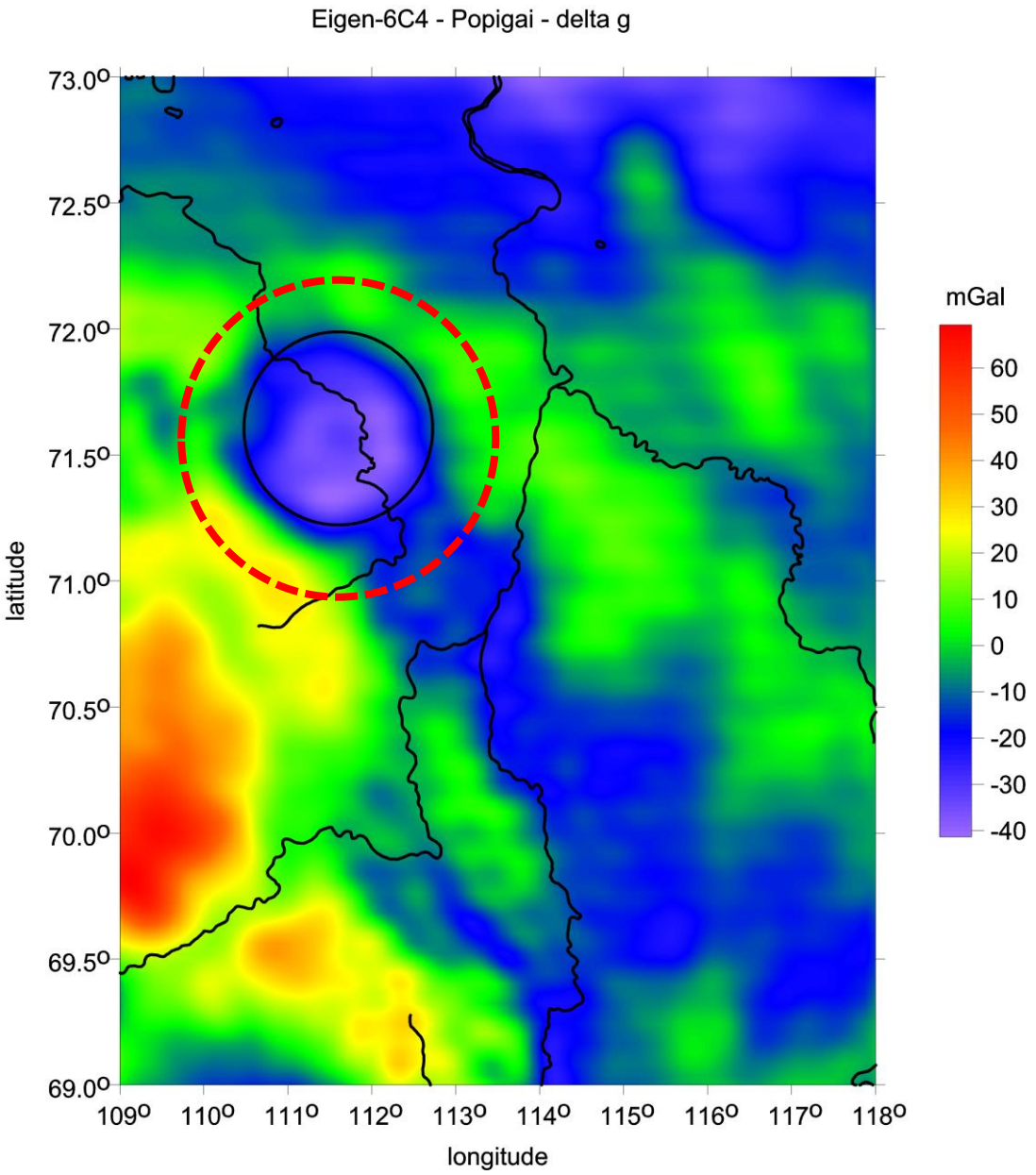


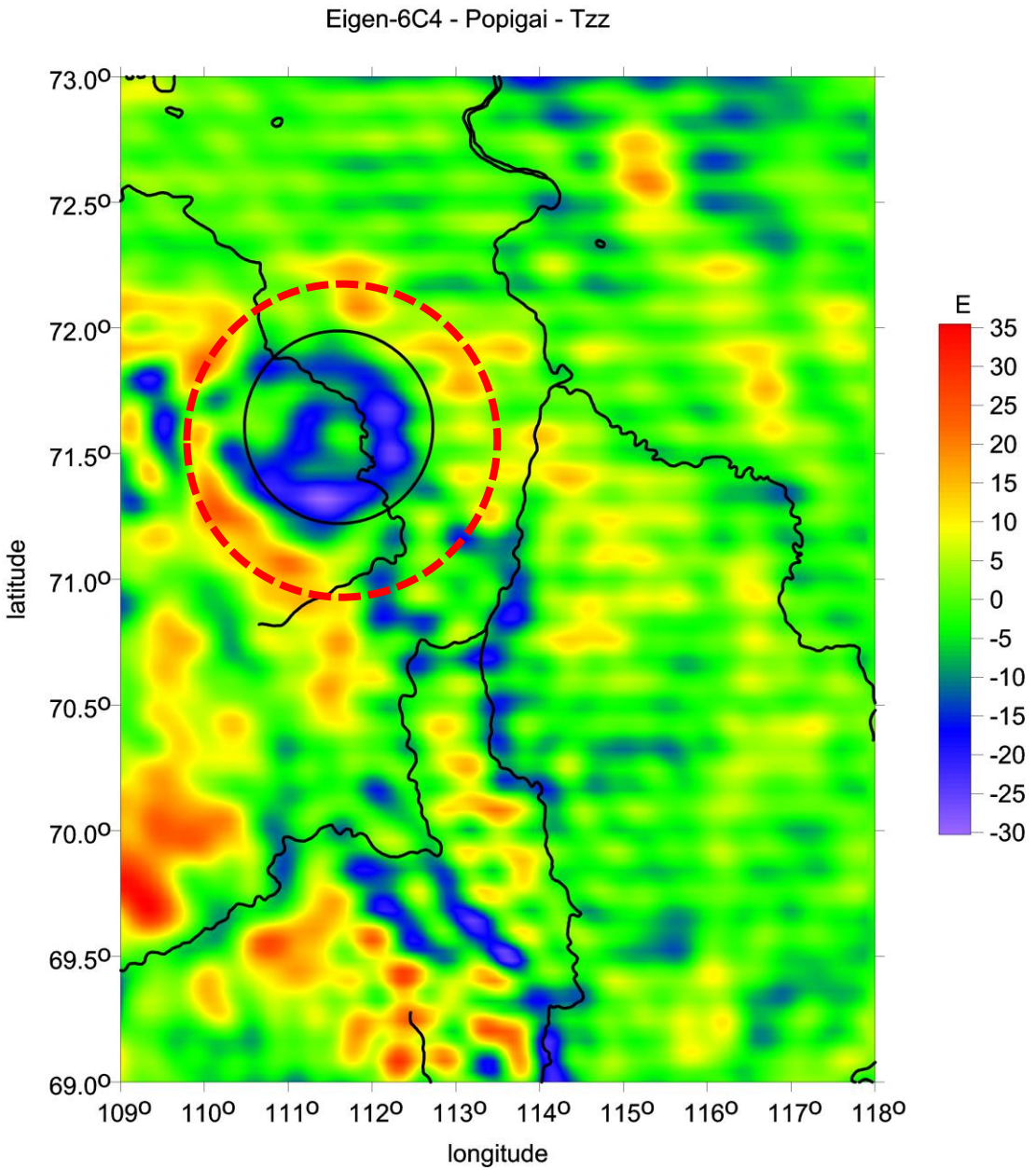
35.7-Ma-old and -100-km-wide multi-ring Popigai
a well- preserved impact structure at the Anabar shield,
central Arctic Siberia, filled with melted and shocked material
that included shock-generated impact diamonds.
Because the structure is exposed, but only slightly eroded,
a variety of impactites are preserved
and accessible for petrological studies.

POPIGAI
ETOPO 1
topography [m]

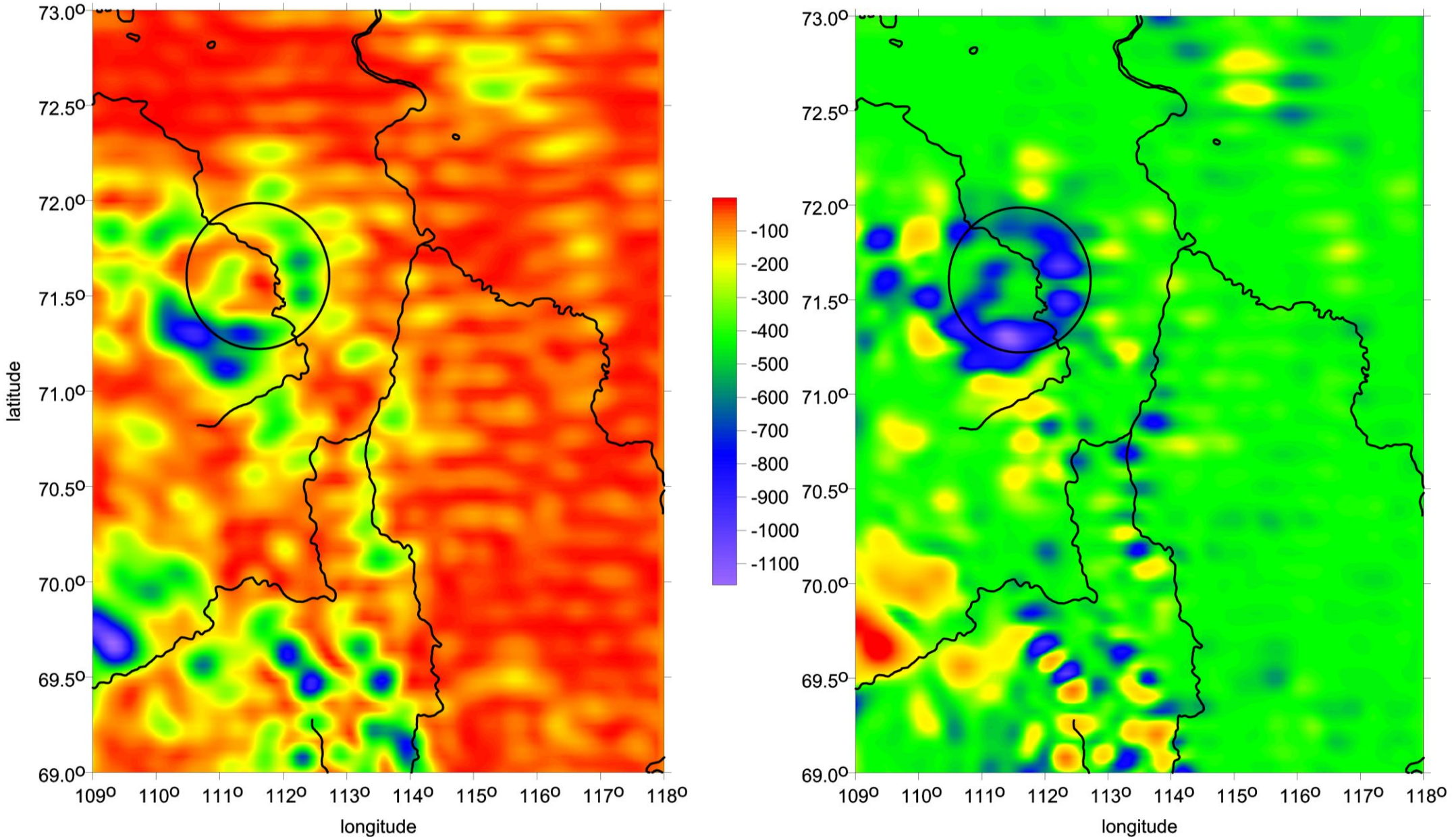


Popigai family: gravity anomalies [mGal] and second radial derivative [E]

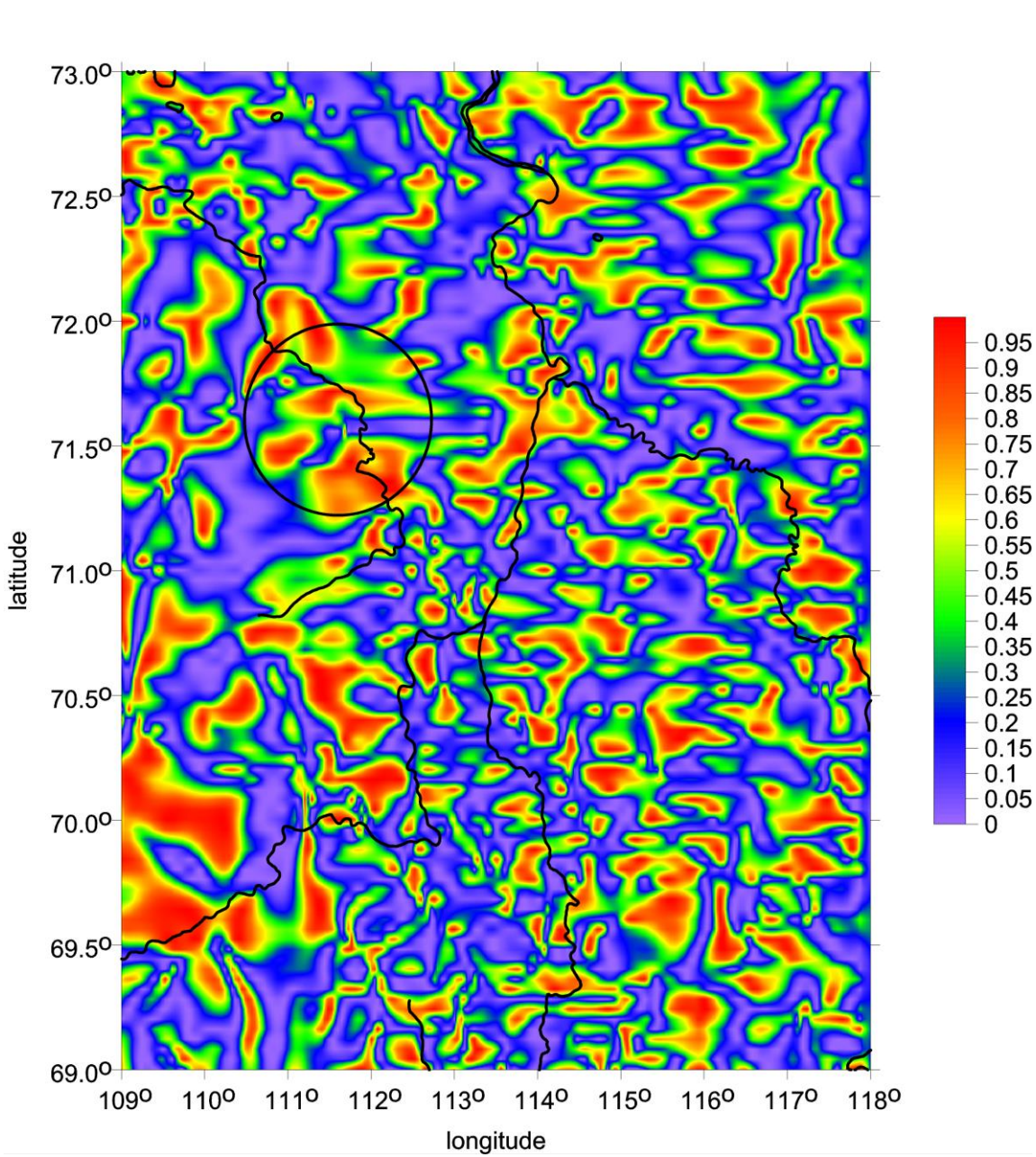


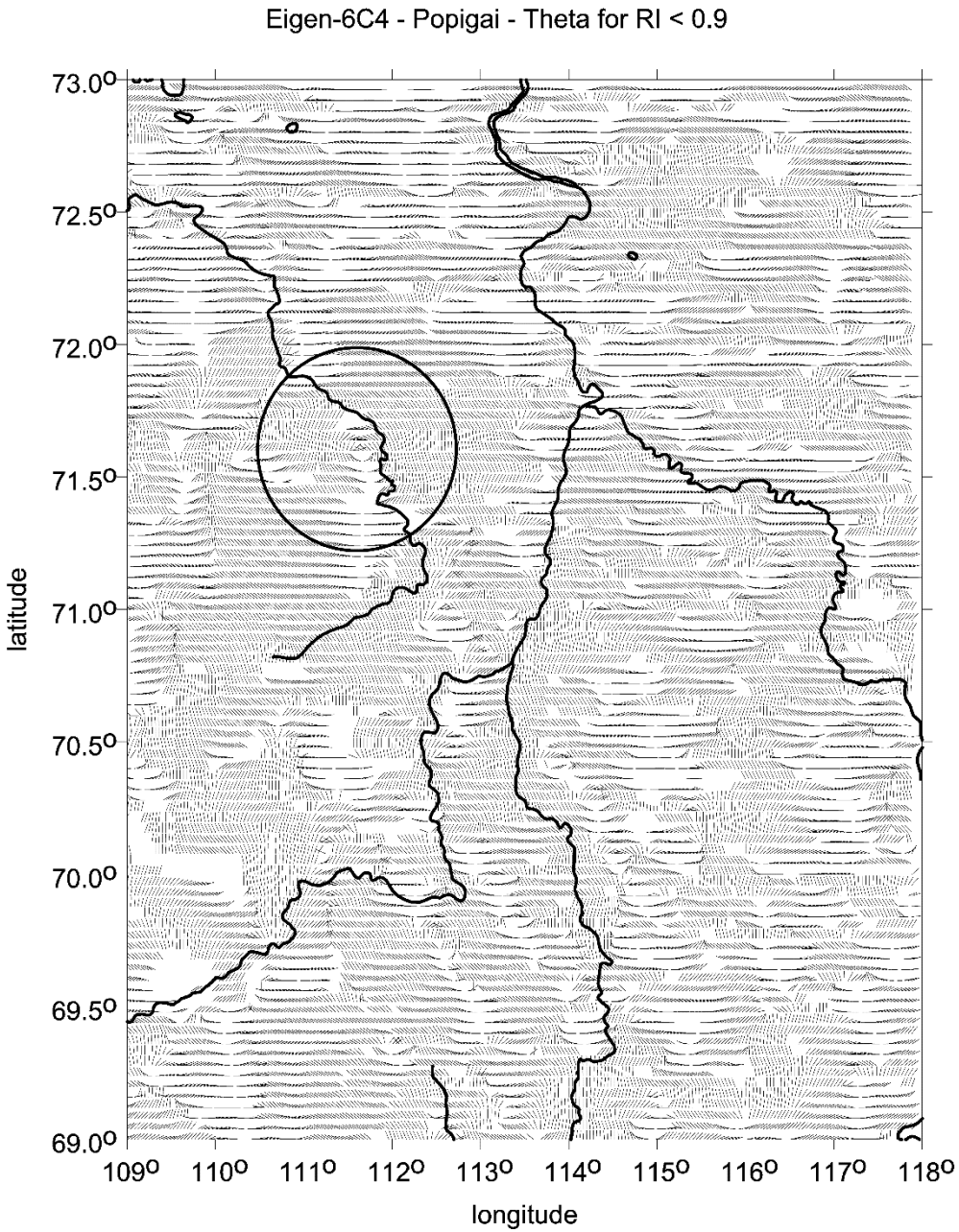


Popigai family: the invariants I_1 [s-4] and I_2 [s-6]



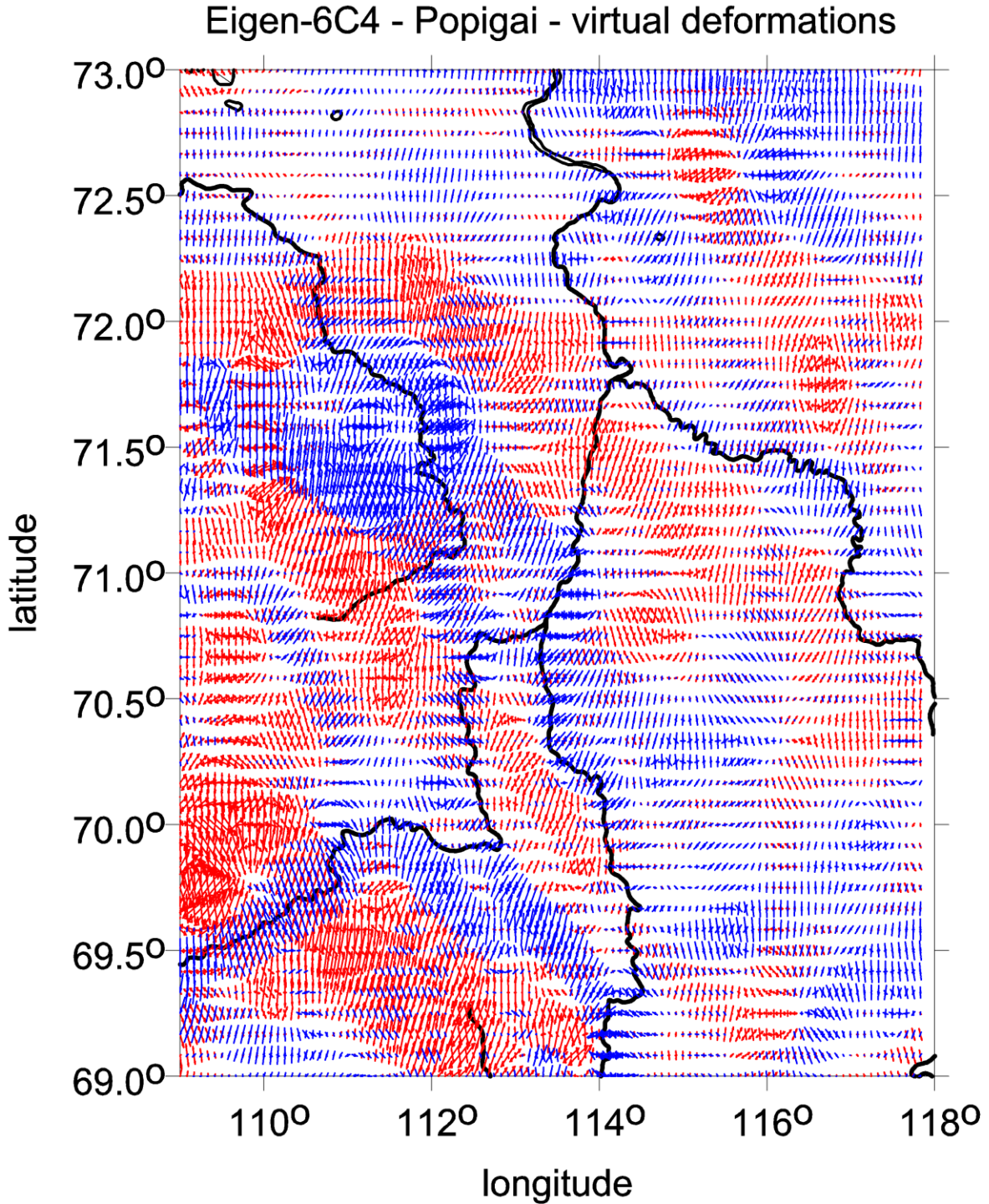
Popigai family: the ratio *I* of the invariants, strike angles [deg]



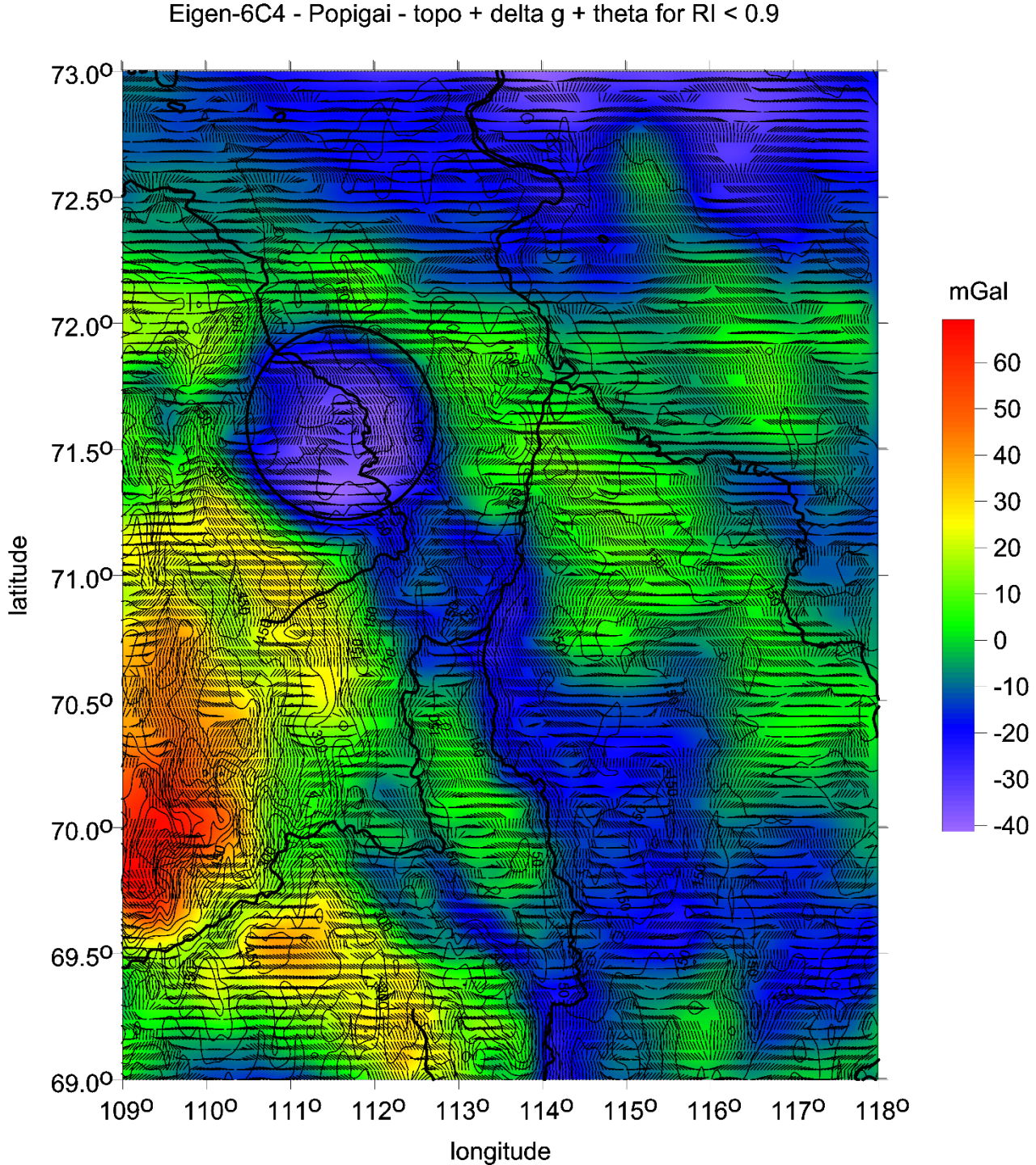


Popigai family:

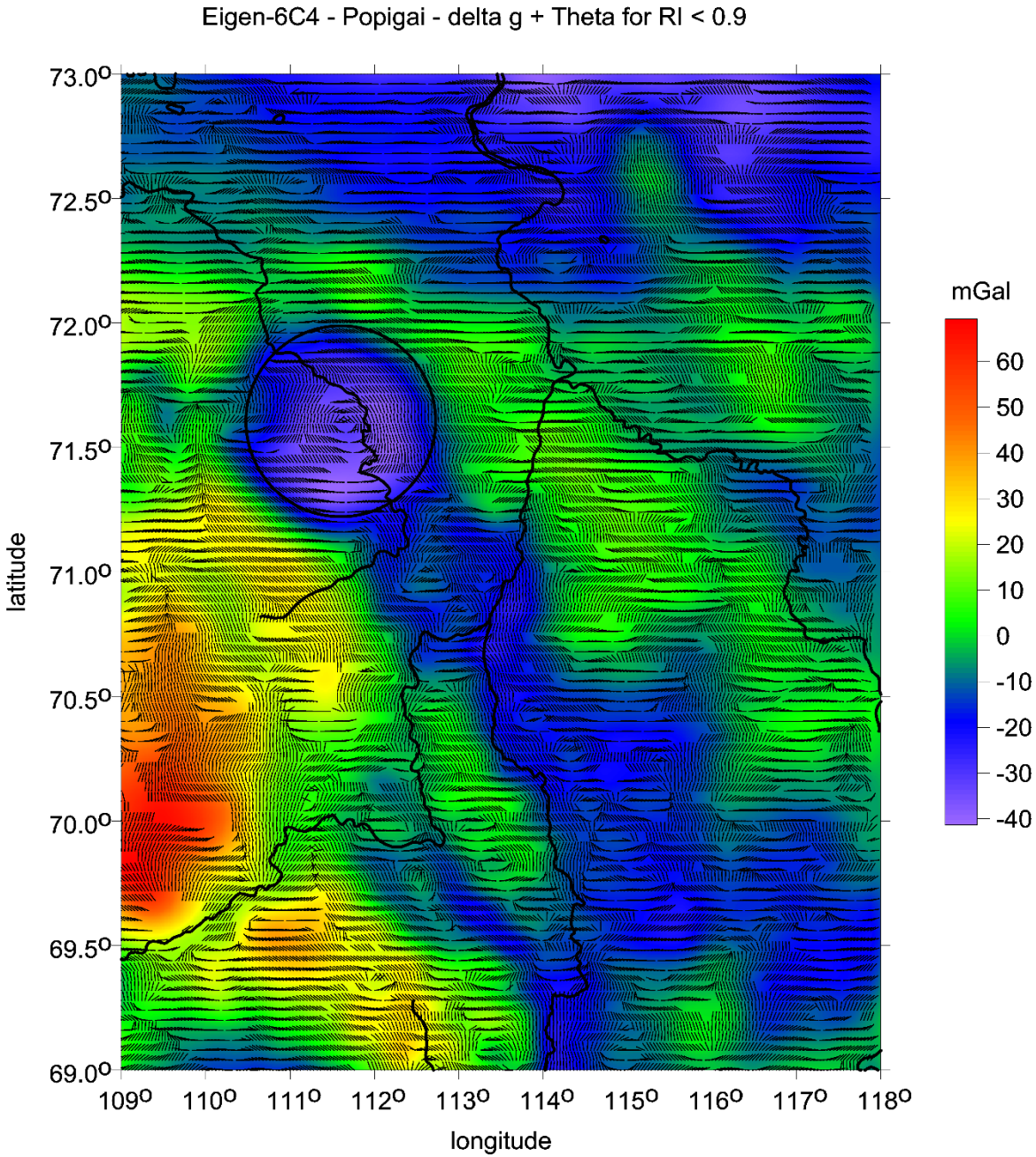
virtual deformations [-]

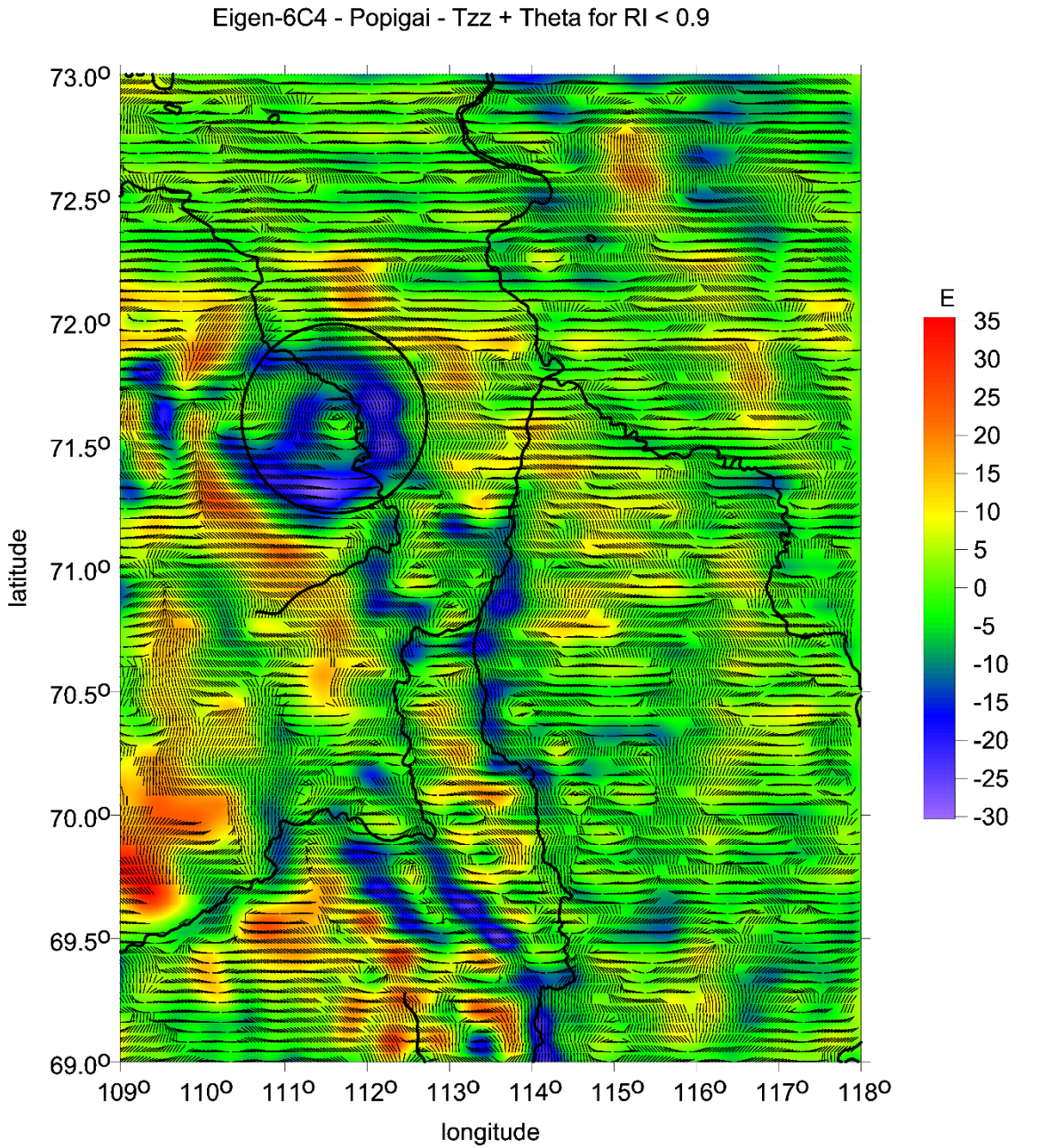


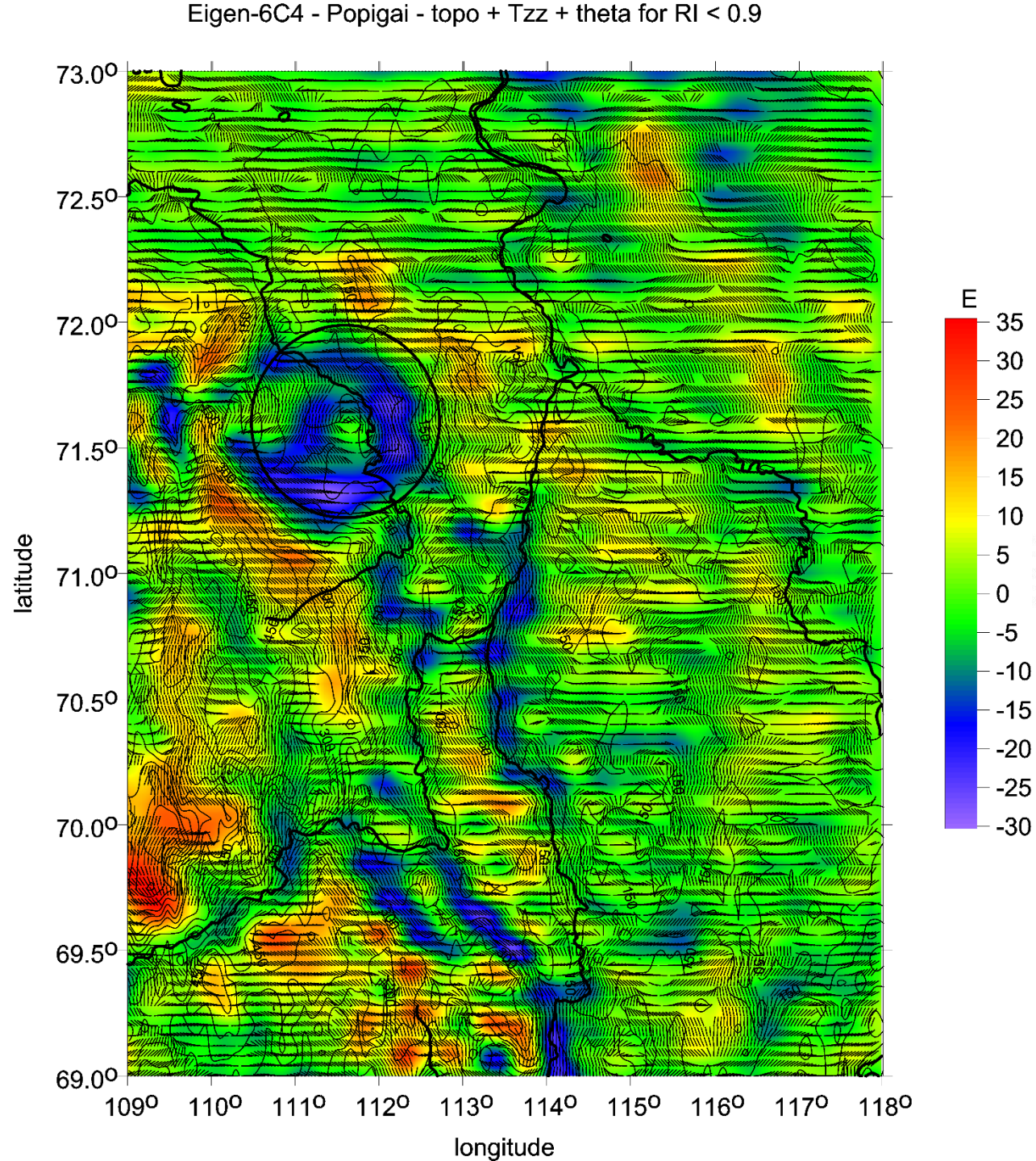
Series of figures
with the gravity aspects,
combined with the strike angles
and surface topography ETOPO 1
(contour lines)

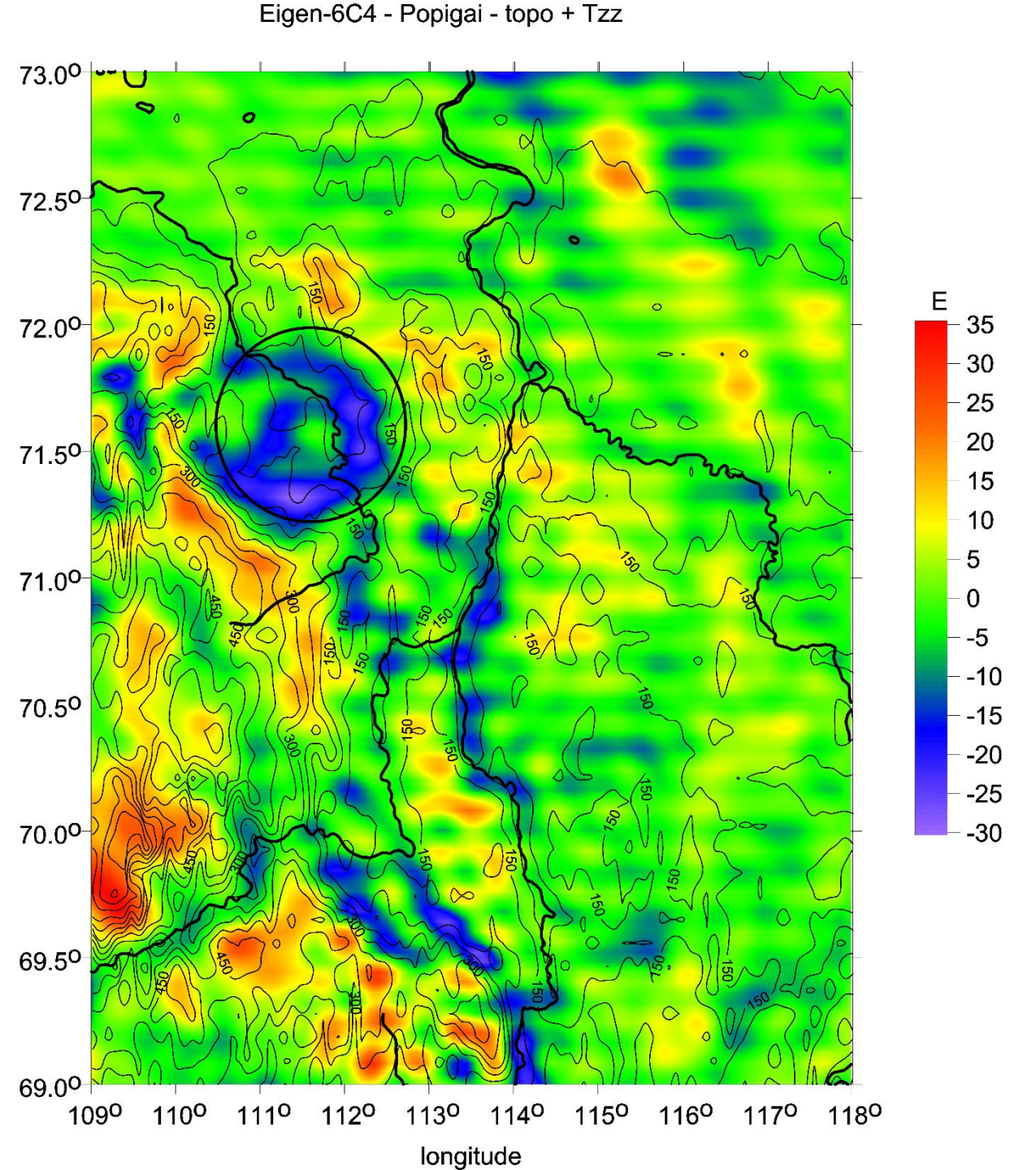

Eigen-6C4 - Popigai - topo + delta g + theta for RI < 0.9
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
109°
110°
111°
112°
113°
114°
115°
116°
117°
118°
longitude
mGal
60
50
40
30
20
10
0
-10
-20
-30
-40

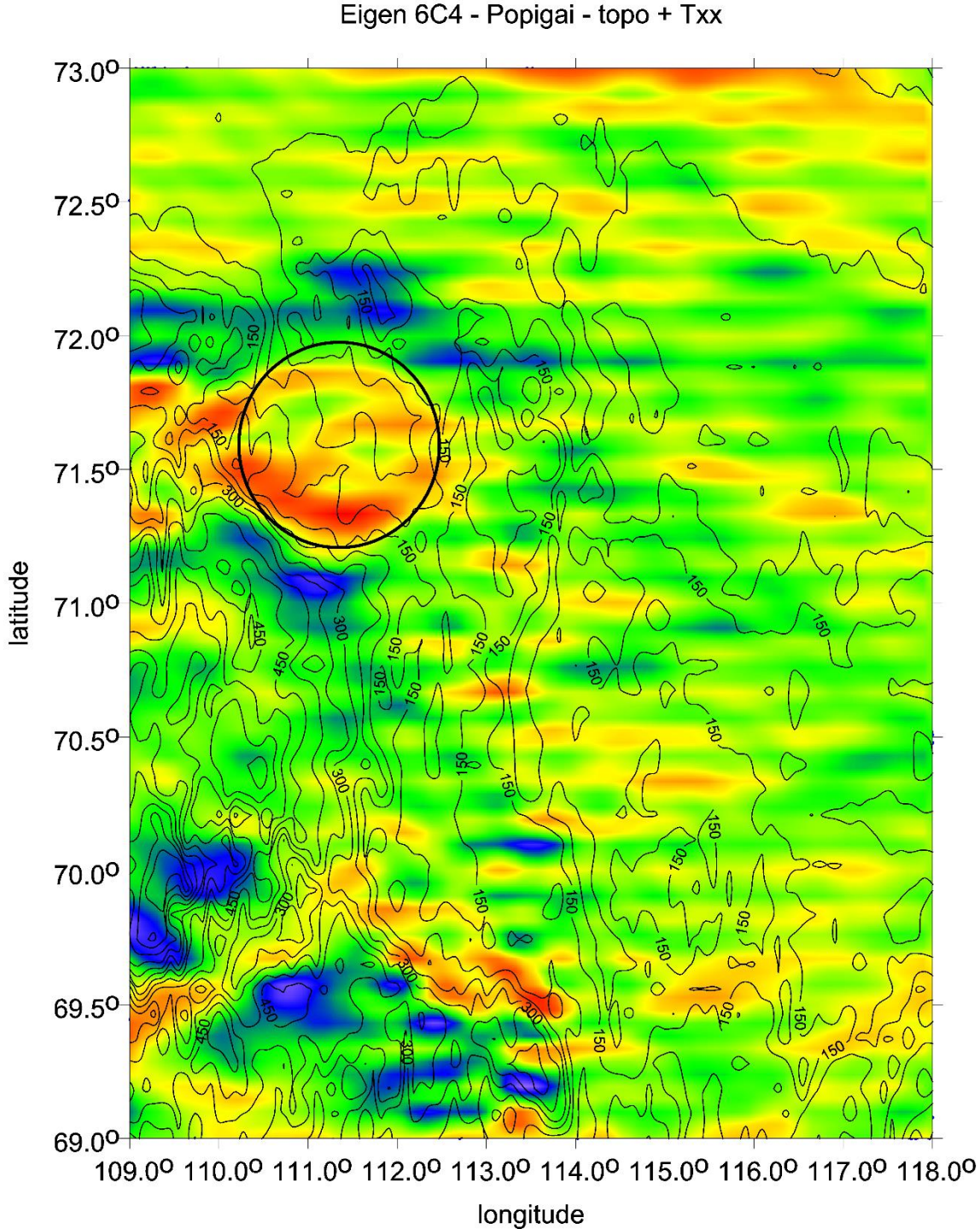
Popigai family: gravity anomalies [mGal] and second radial derivative [E] together with the strike angles [deg]

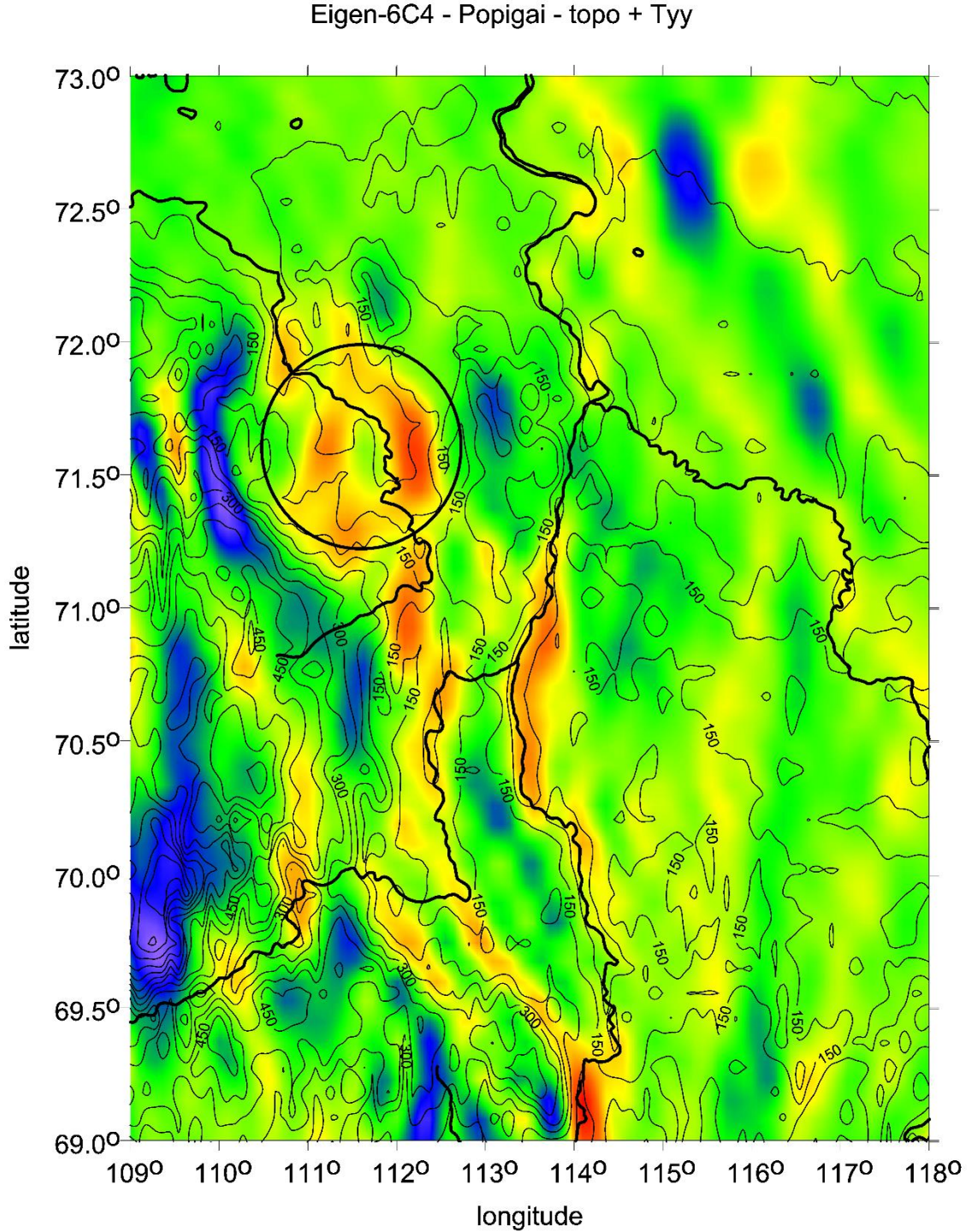




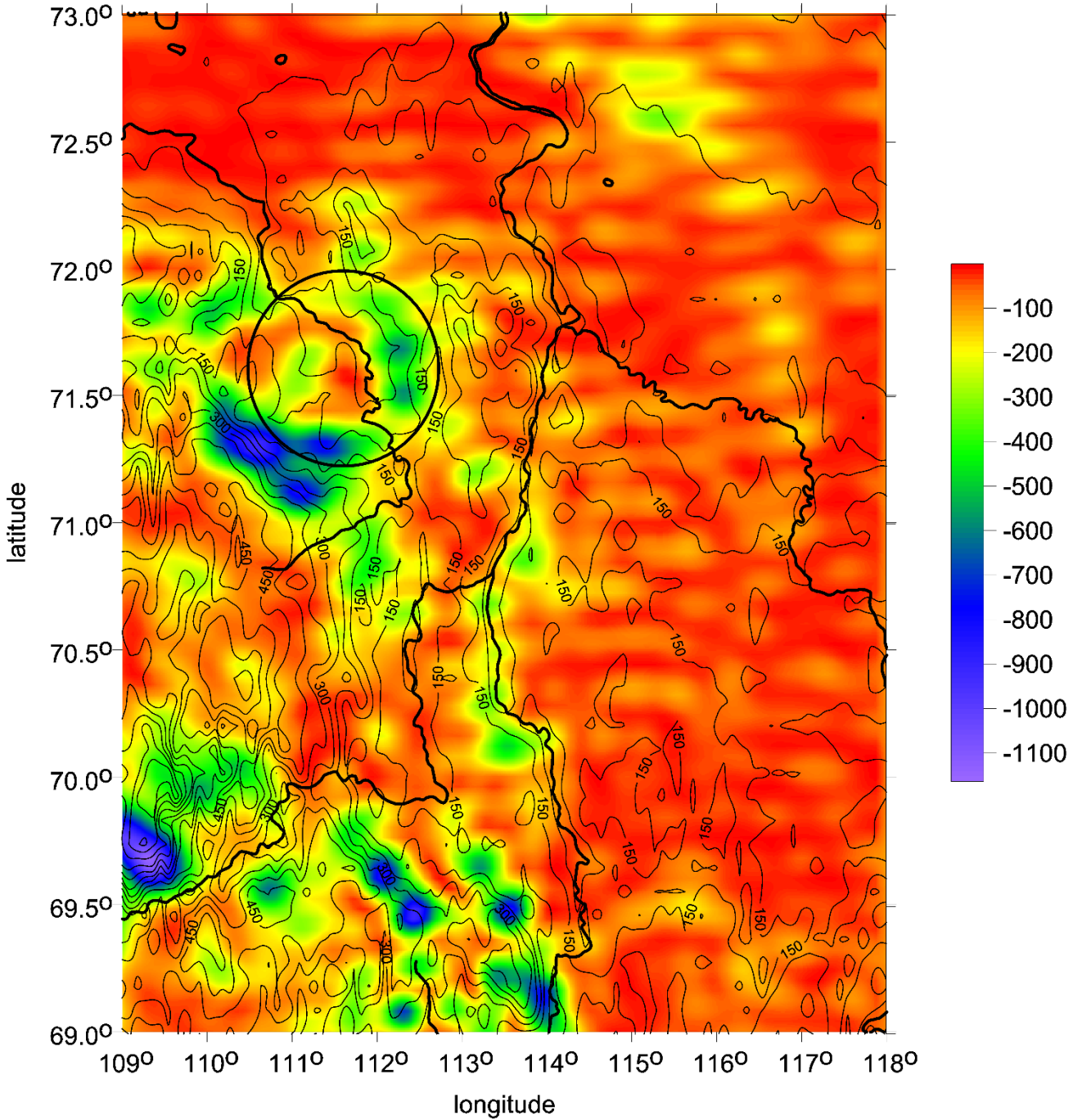

Eigen-6C4 - Popigai - topo + Tzz + theta for RI < 0.9
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
109°
110°
111°
112°
113°
114°
115°
116°
117°
118°
longitude
E
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30

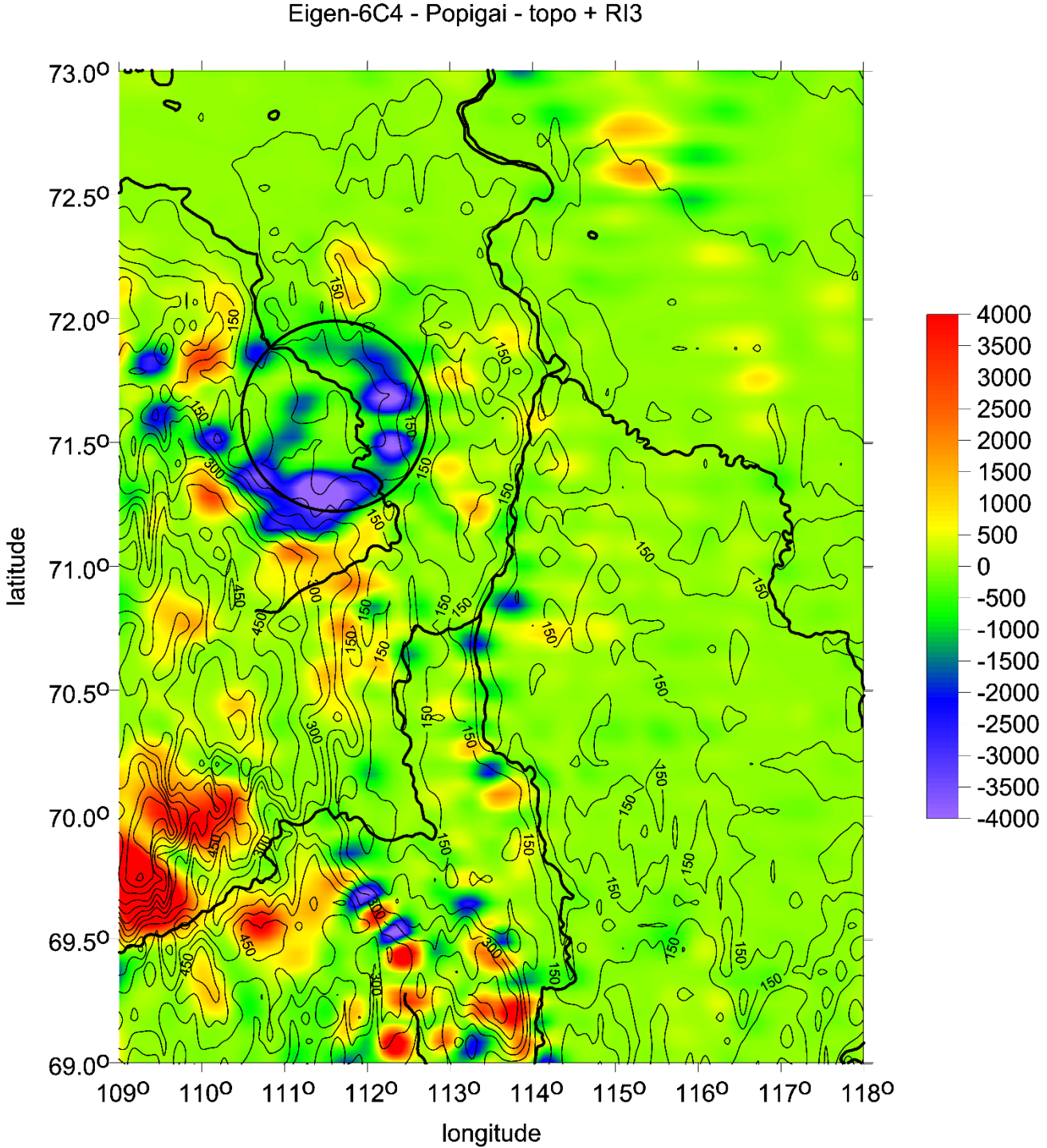

Eigen-6C4 - Popigai - topo + Tzz
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
109°
110°
111°
112°
113°
114°
115°
116°
117°
118°
longitude
E
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30

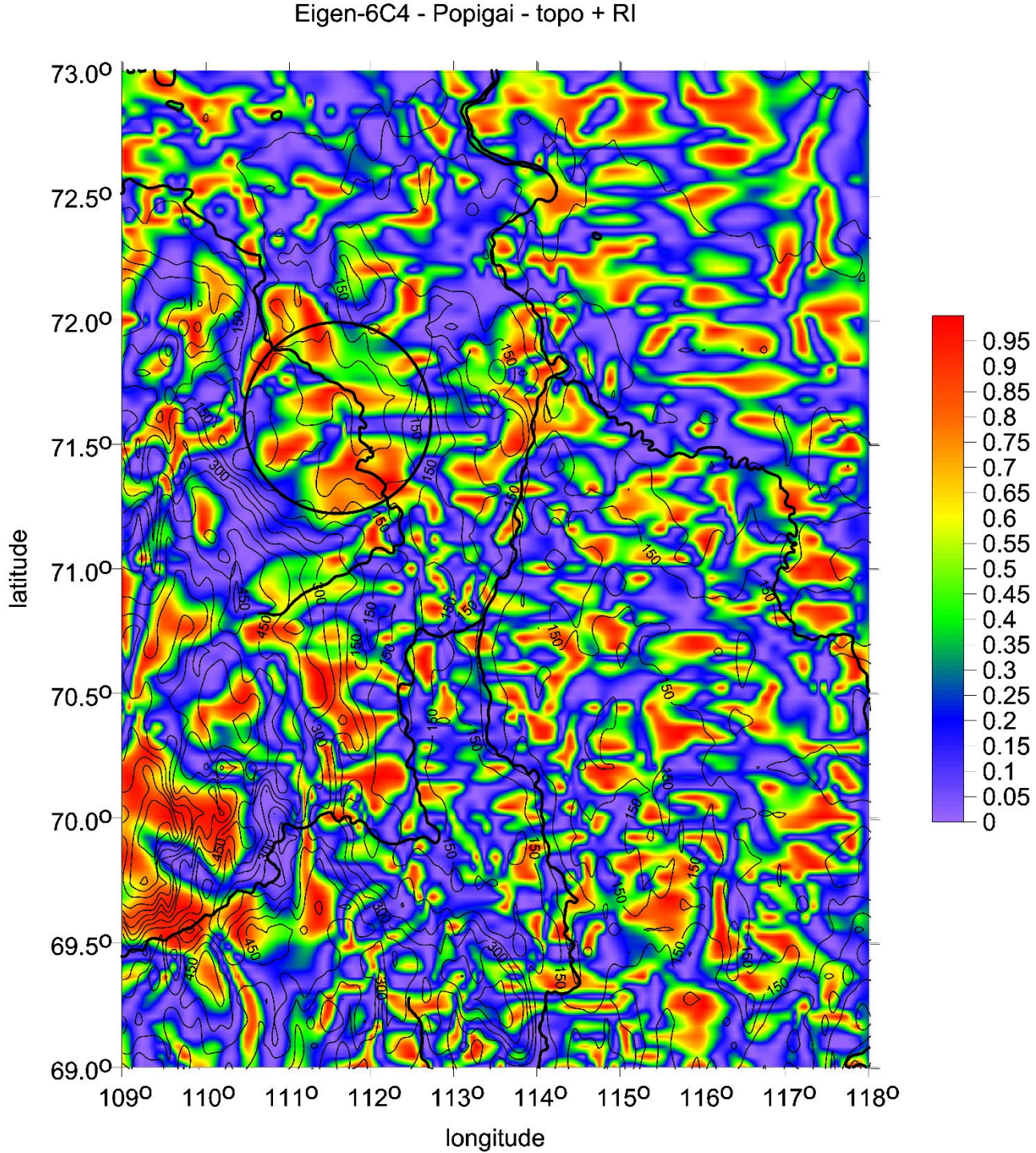

Eigen 6C4 - Popigai - topo + Txx
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
109.0° 110.0° 111.0° 112.0° 113.0° 114.0° 115.0° 116.0° 117.0° 118.0°
longitude

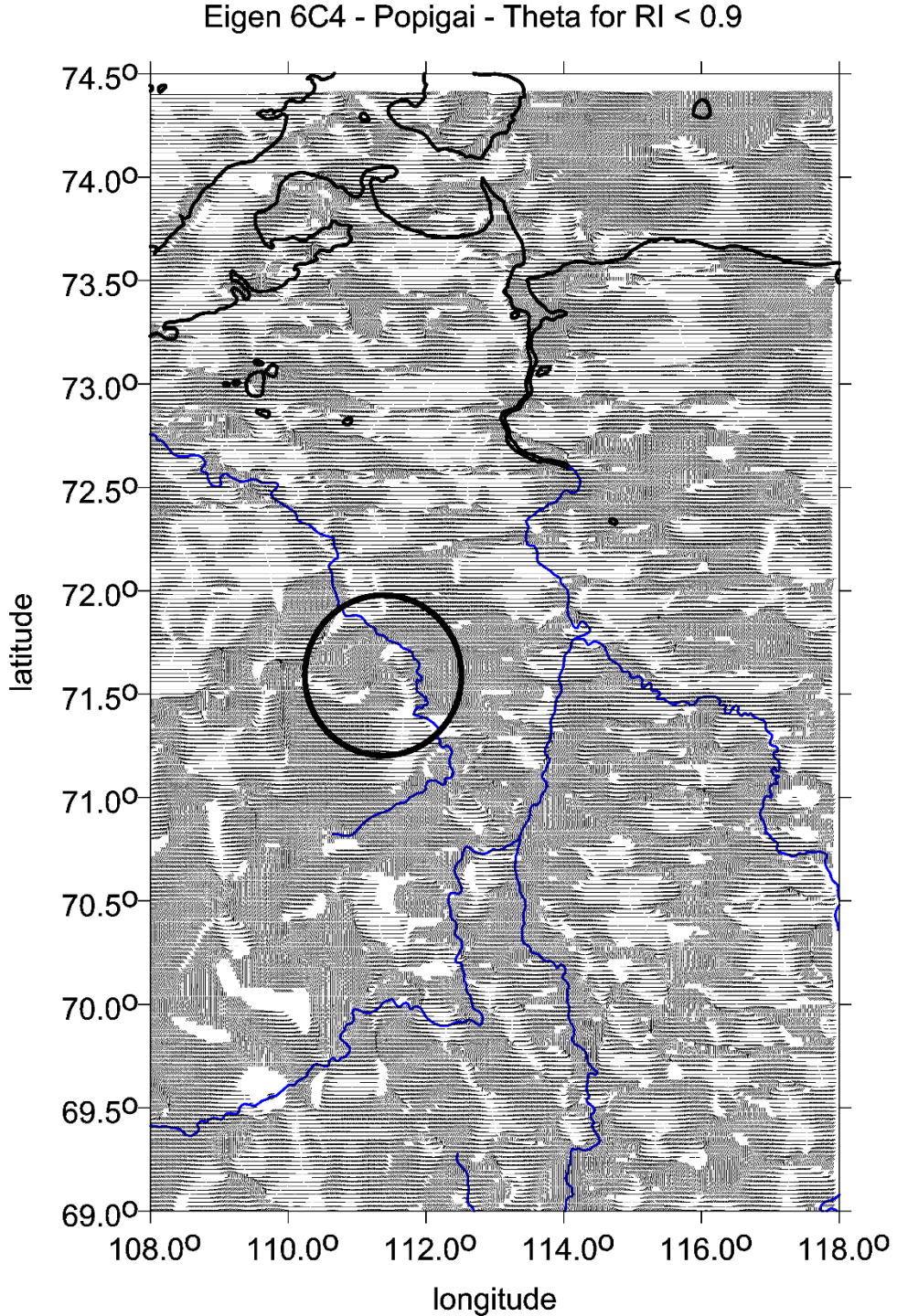

Eigen-6C4 - Popigai - topo + Tyy
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
109°
110°
111°
112°
113°
114°
115°
116°
117°
118°
longitude

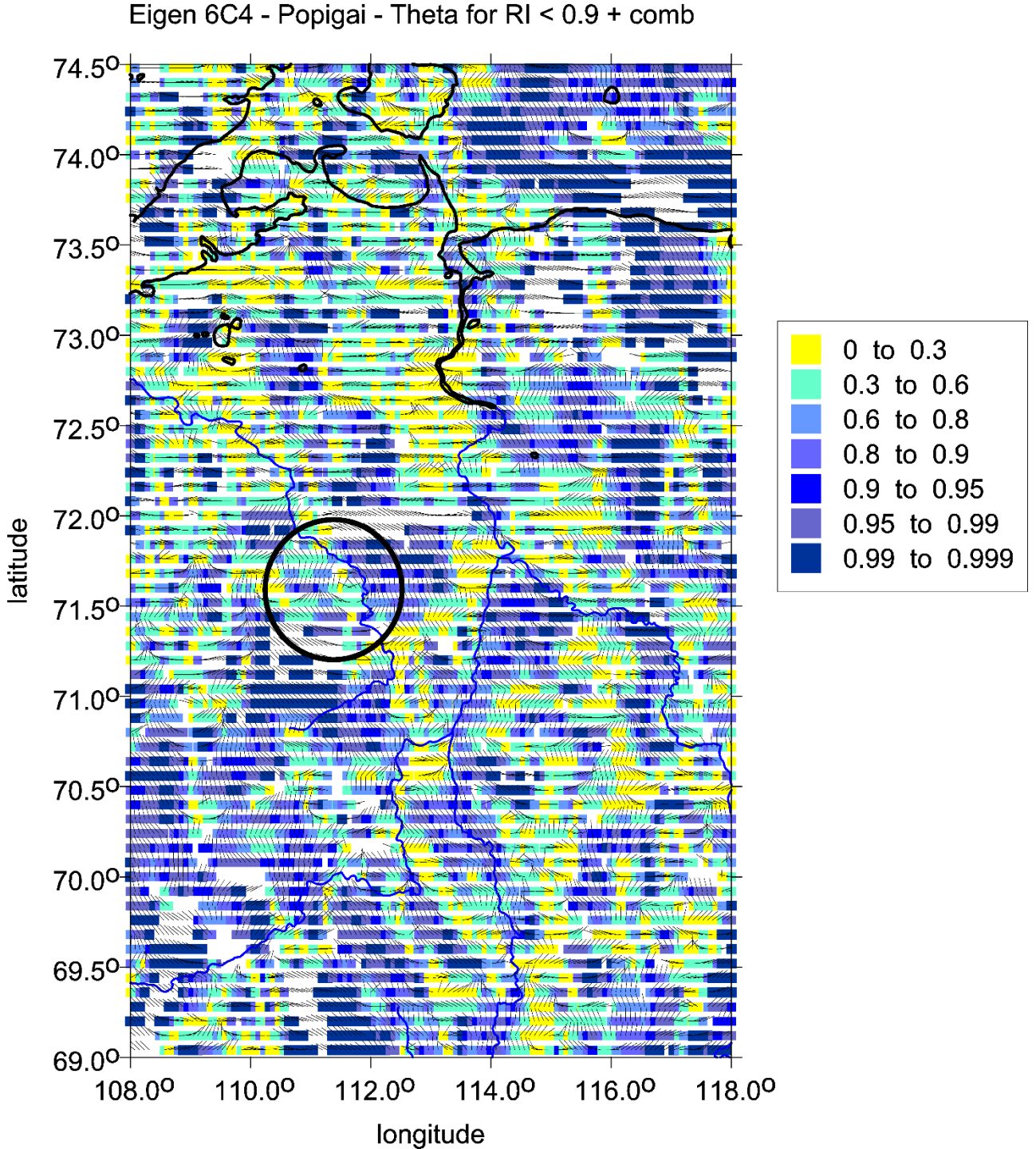
Eigen-6C4 - Popigai - topo + RI2




Eigen-6C4 - Popigai - topo + RI3
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
109°
110°
111°
112°
113°
114°
115°
116°
117°
118°
longitude
4000
3500
3000
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000


Eigen-6C4 - Popigai - topo + RI
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
109°
110°
111°
112°
113°
114°
115°
116°
117°
118°
longitude
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0

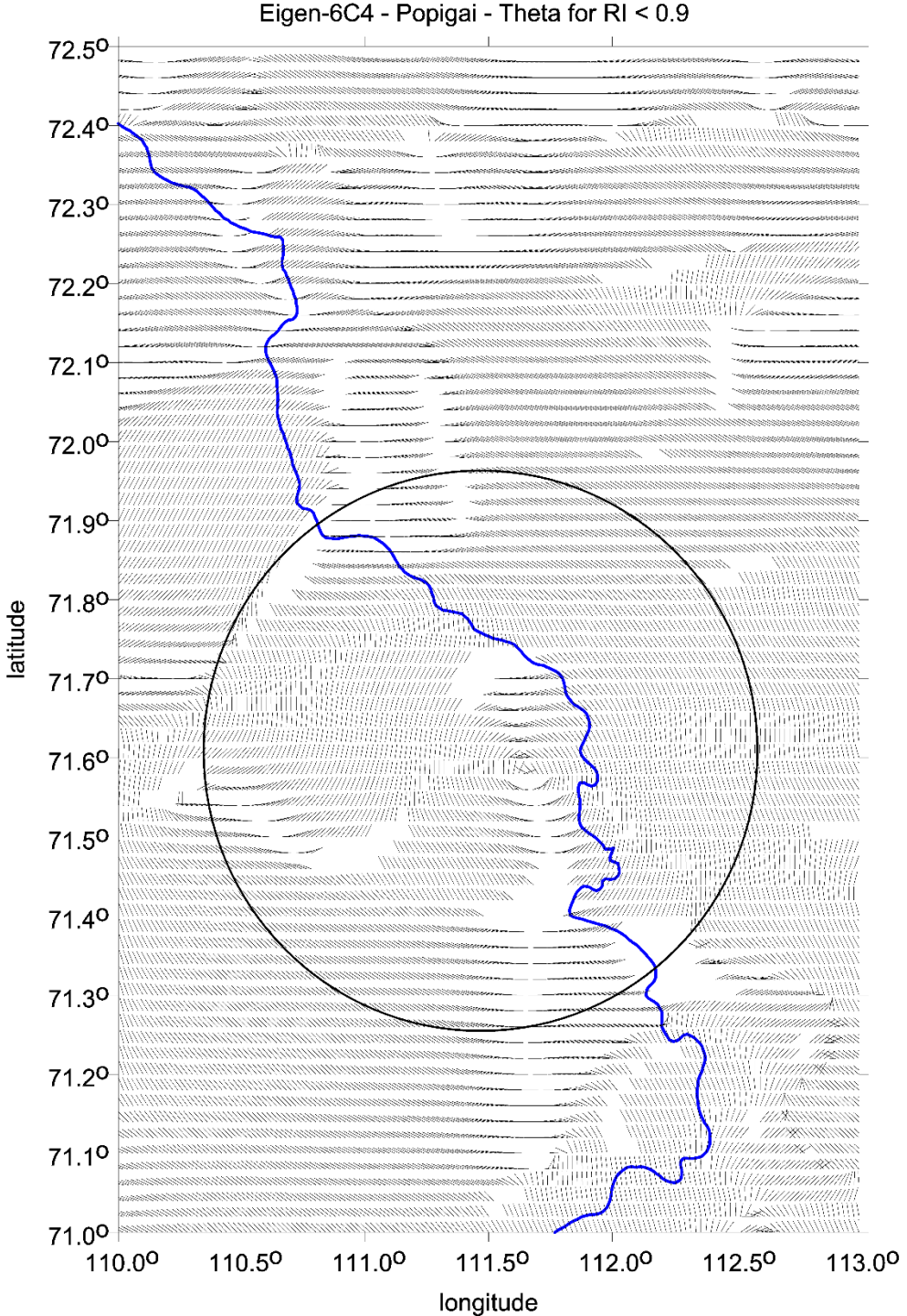

Eigen 6C4 - Popigai - Theta for RI < 0.9
74.5°
74.0°
73.5°
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
108.0°
110.0°
112.0°
114.0°
116.0°
118.0°
longitude


Eigen 6C4 - Popigai - Theta for RI < 0.9 + comb
74.5°
74.0°
73.5°
73.0°
72.5°
72.0°
71.5°
71.0°
70.5°
70.0°
69.5°
69.0°
latitude
108.0°
110.0°
112.0°
114.0°
116.0°
118.0°
longitude
0 to 0.3
0.3 to 0.6
0.6 to 0.8
0.8 to 0.9
0.9 to 0.95
0.95 to 0.99
0.99 to 0.999

Popigai main crater:

zoom with
the strike angles [deg]

Popigai/Daldyn river (in blue colour)
flowing tru the crater
exposes the impact features

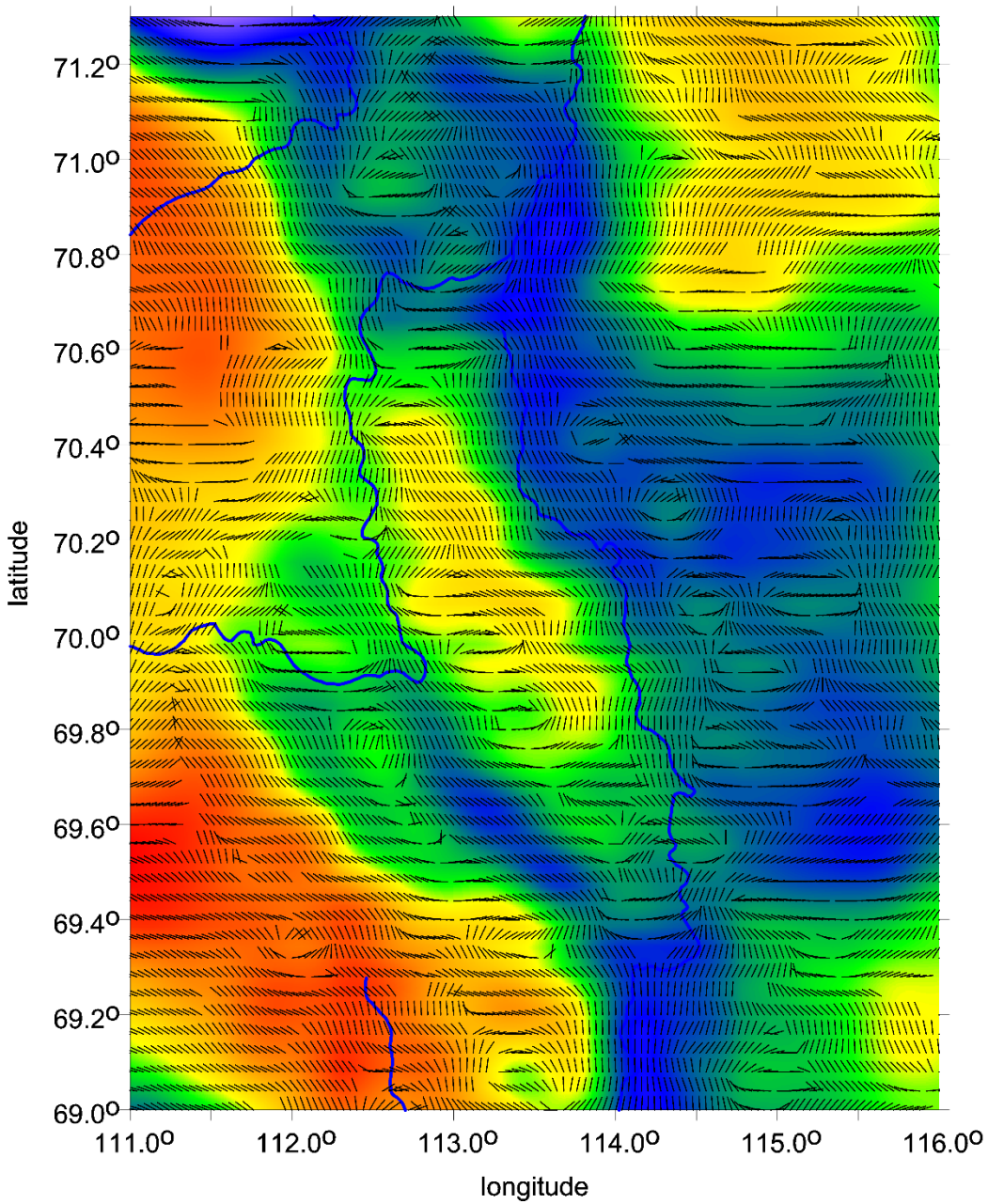


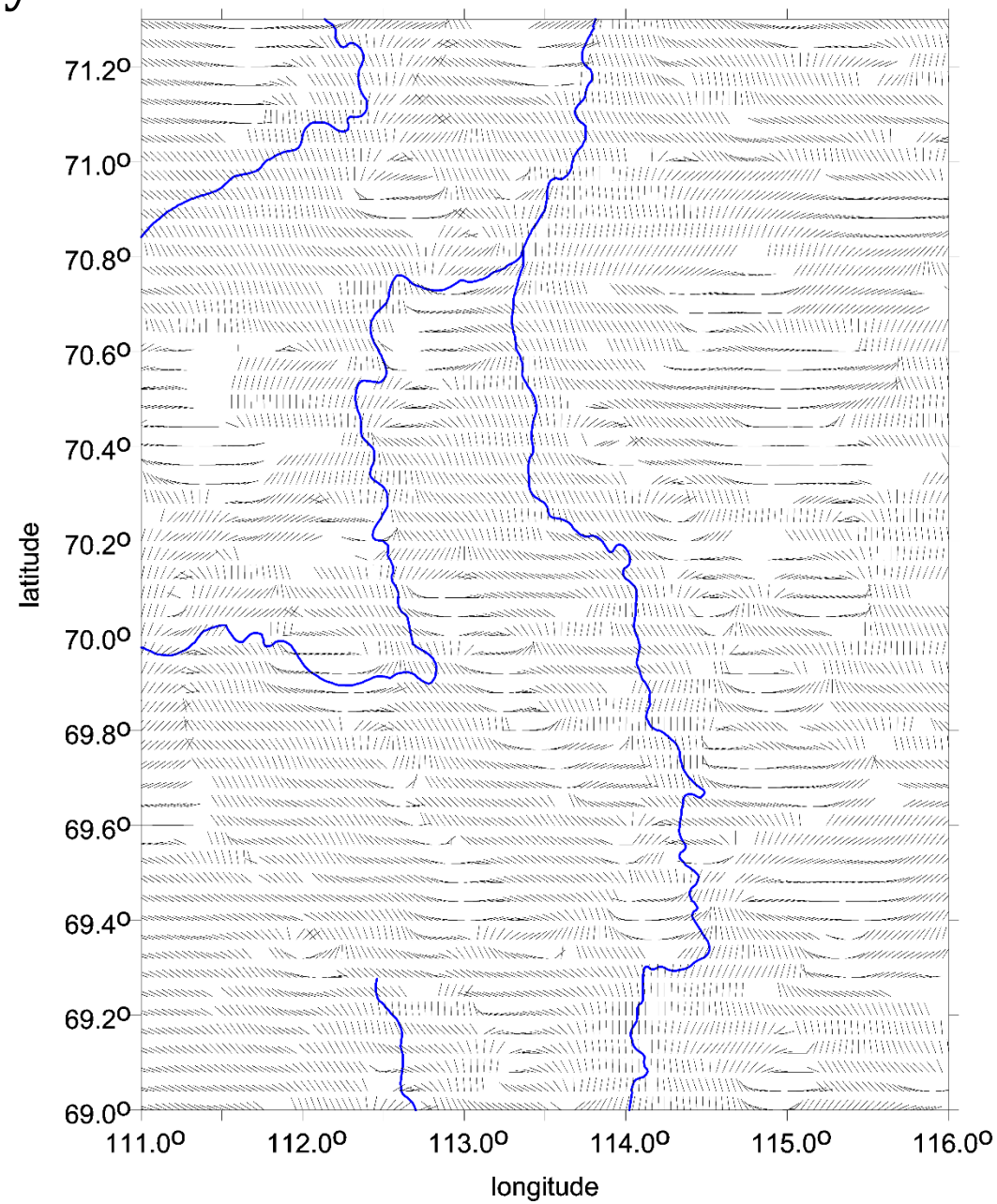
Popigai family

SE part

strike angles

[deg]

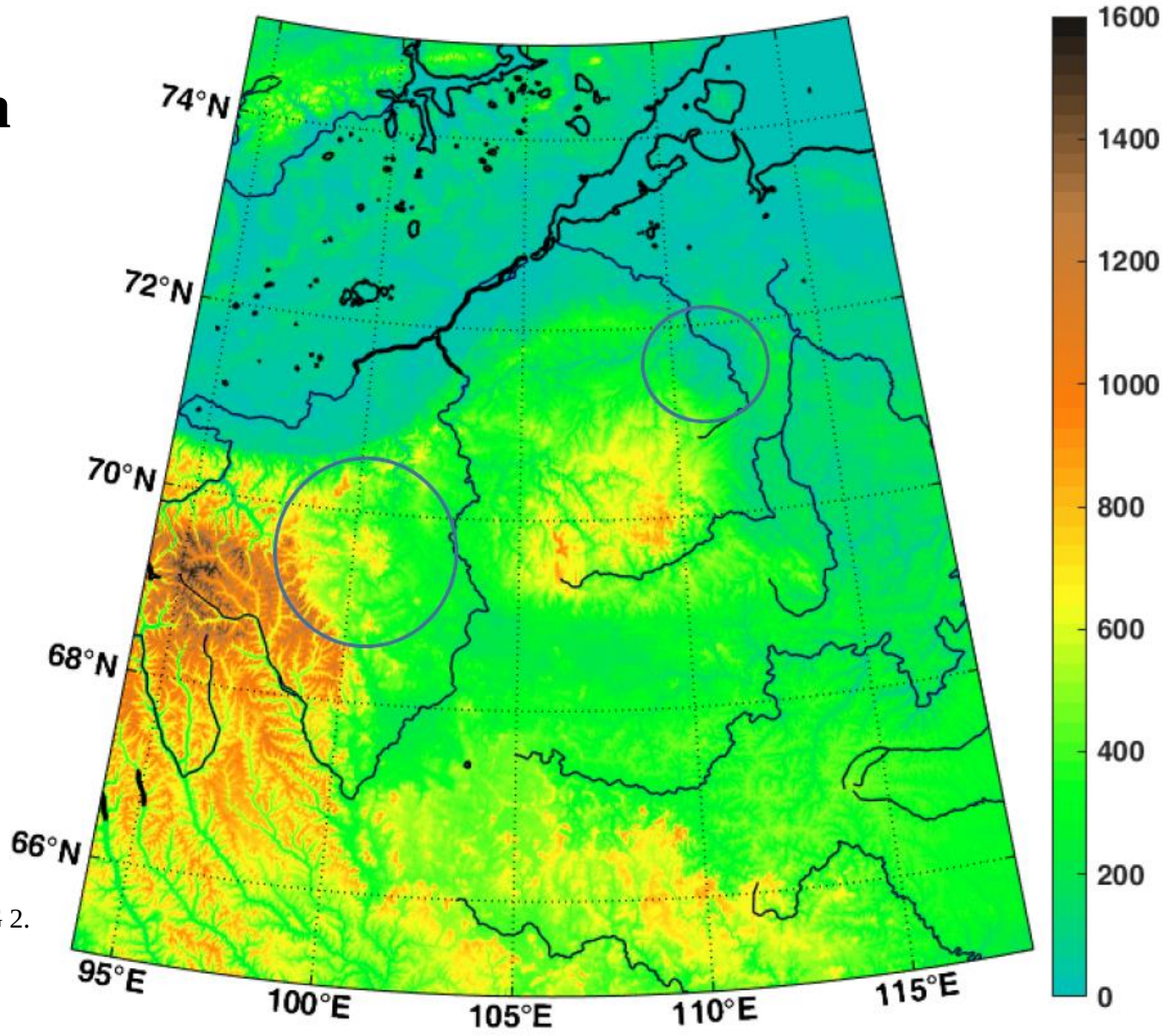




Kotuyakanskaya series, Siberia

near Popigai family

ETOPO 1 topography [m]

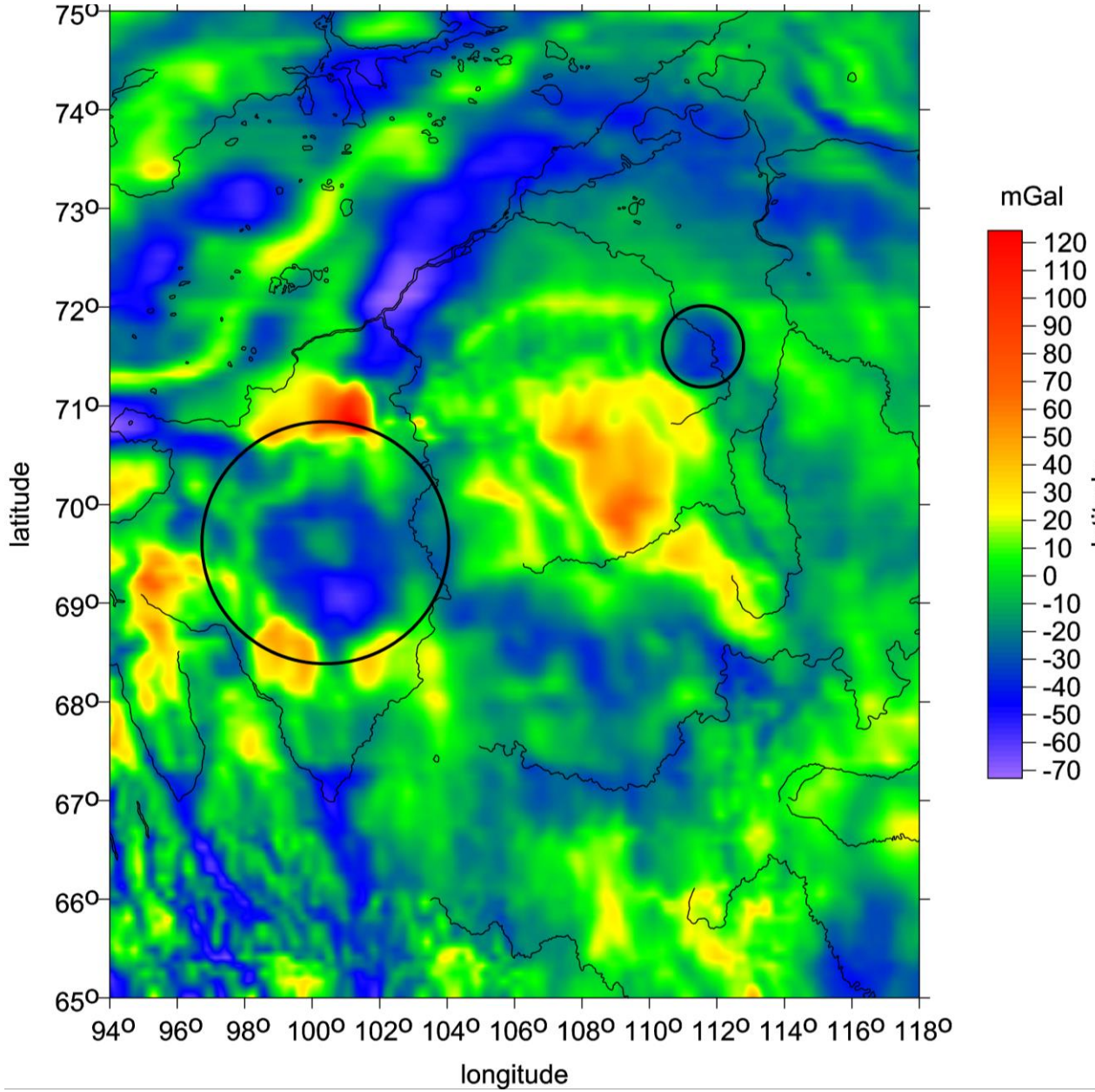


References:

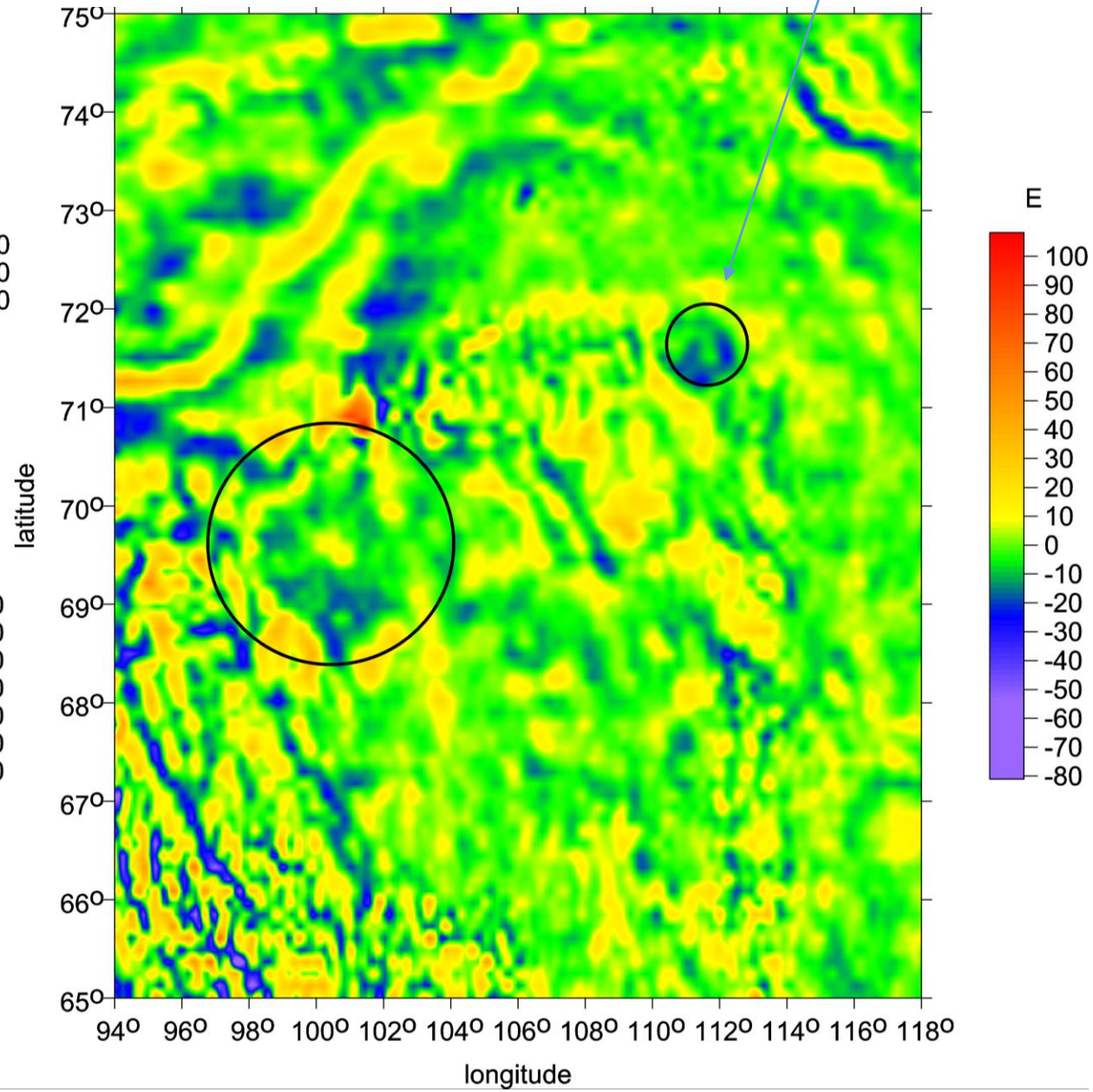
Klokočník J, Kostelecký J, Bezděk A, Kletetschka G, Staňková H, 2020.
A 200 km suspected impact crater Kotuykanskaya near Popigai, Siberia,
in the light of new gravity aspects from EIGEN 6C4, and other data.
Scientific Reports (*Nature*) 10, 6093. https://doi.org/10.1038/s41598-020-62998-6.

Presentace:
Klokočník J, Kostelecký J, Bezděk A, Kletetschka G, Staňková H, 2020.
Detection of 200 km suspected impact crater Kotuykanskaya near Popigai,
Siberia, by new gravity aspects from EIGEN 6C4, and magnetic data from EMAG 2.
11th Planetary Crater Consortium, Honolulu, Hawaii.

Kotuyakanskaya



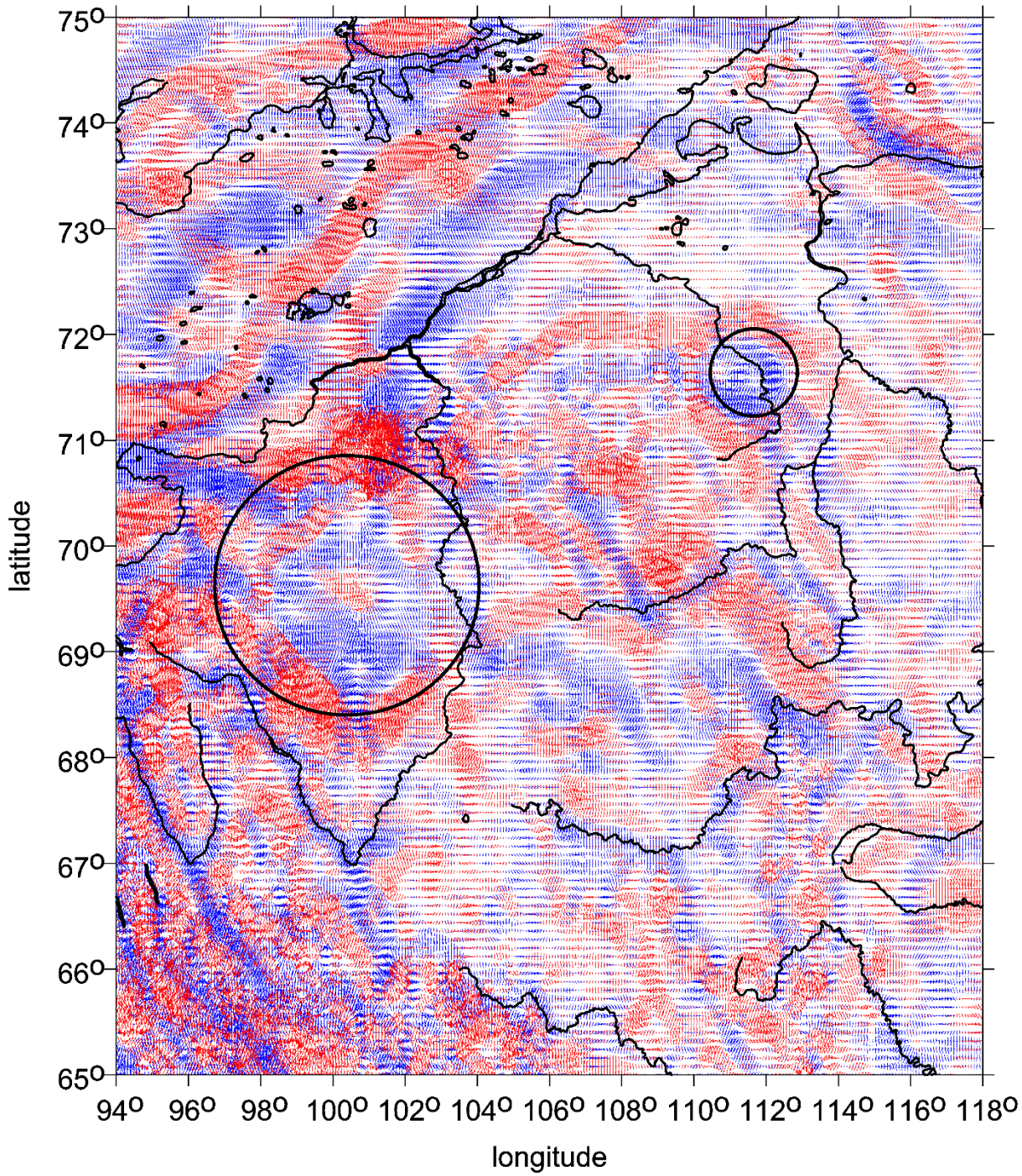
Popigai



Kotuyakanskaya series

near Popigai family

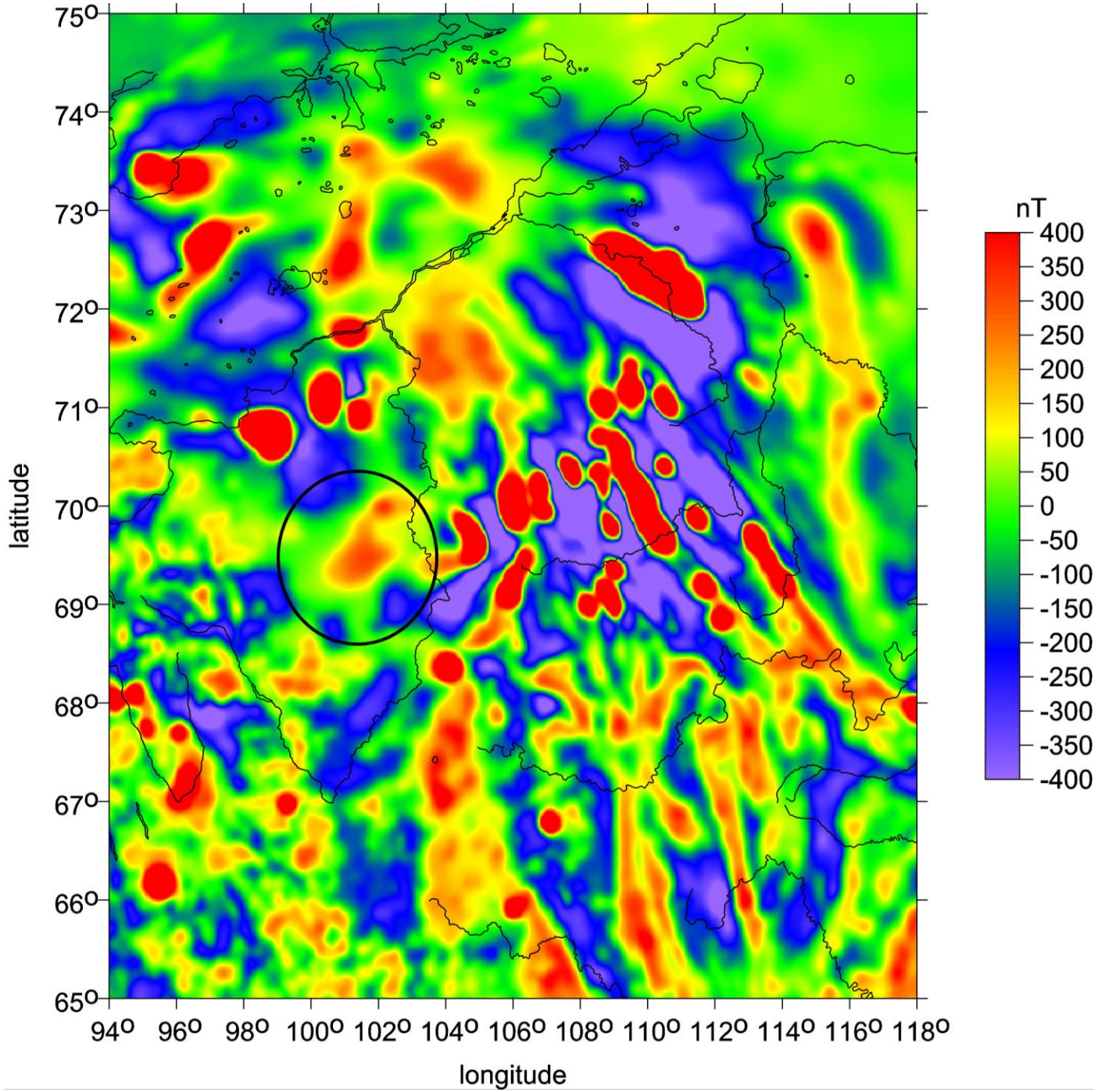
virtual deformations



Kotuyakanskaya

near Popigai family

magnetic intensities [nT]



www/asu.cas.cz/~jklokocn
jklokocn@asu.cas.cz

The End of S3