Intro CompPhysics

Ex11 – Report

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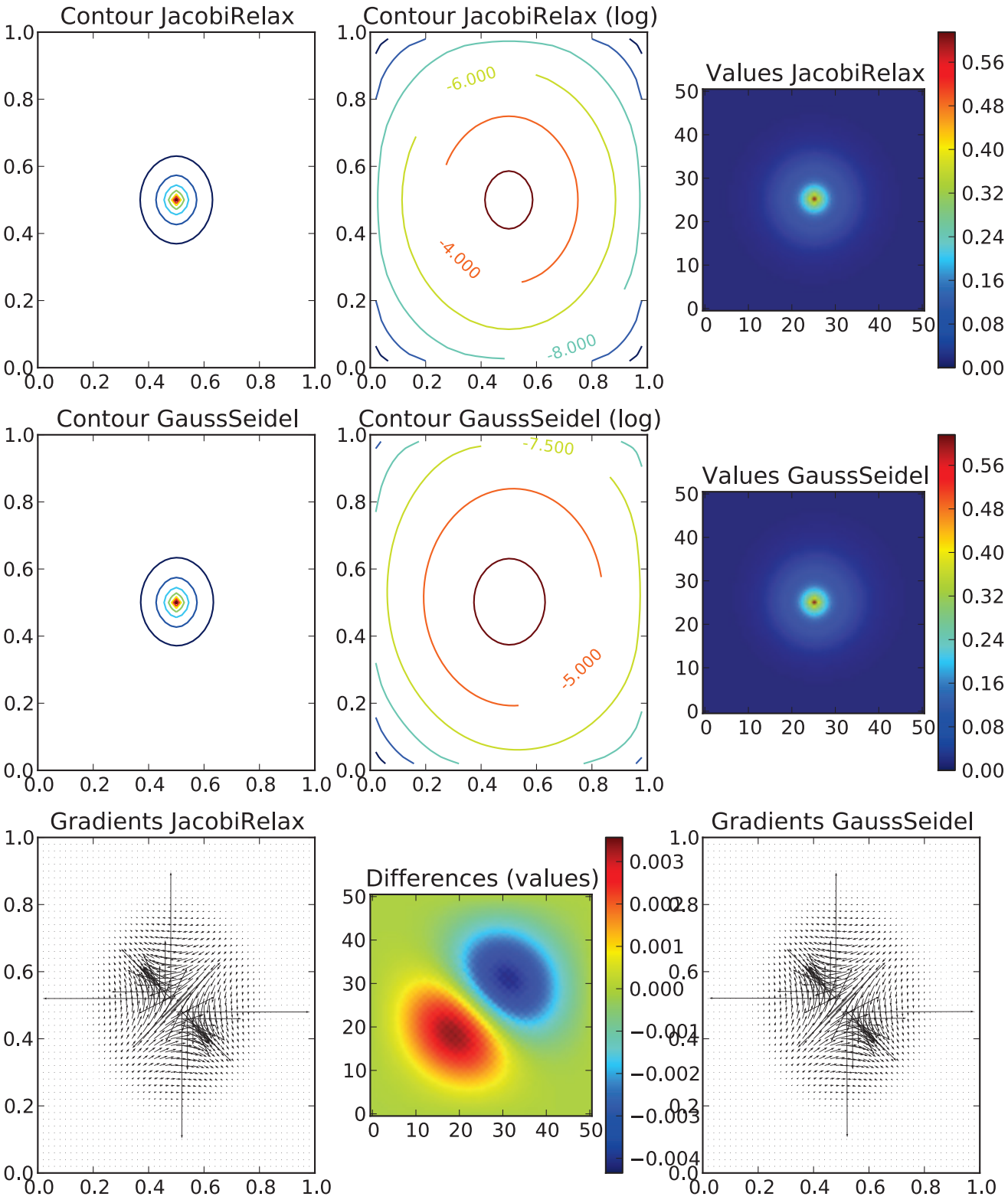
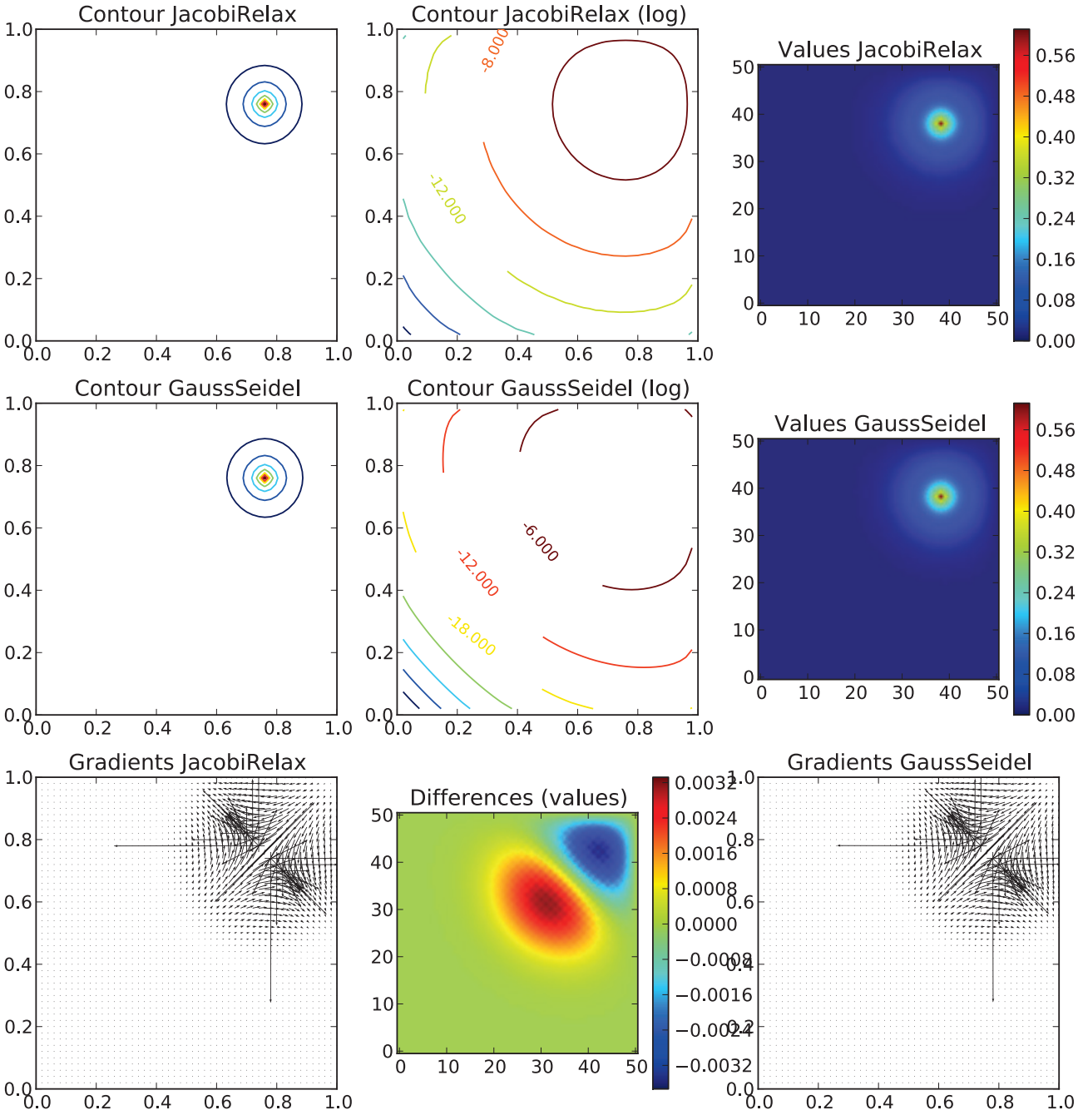
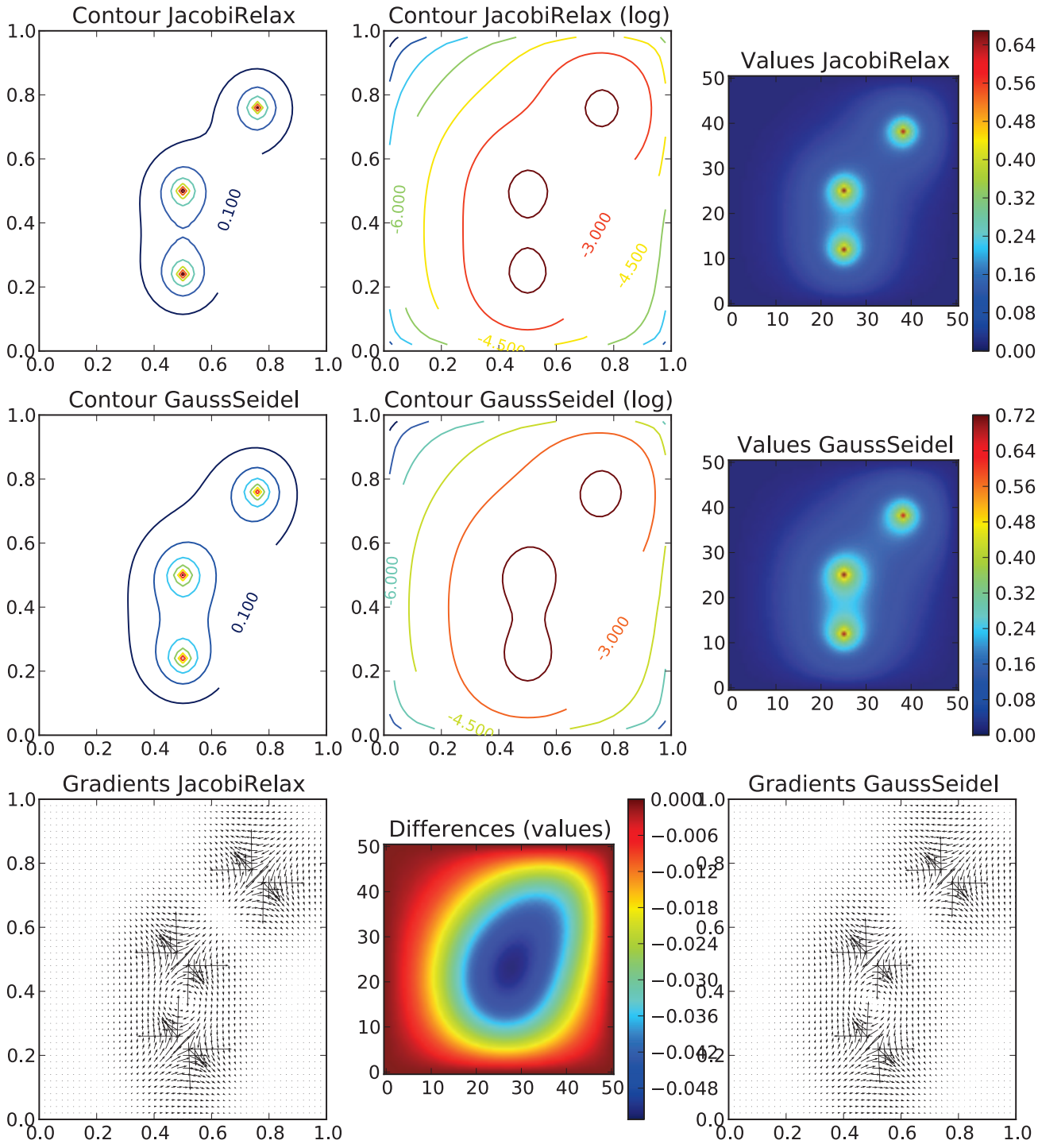
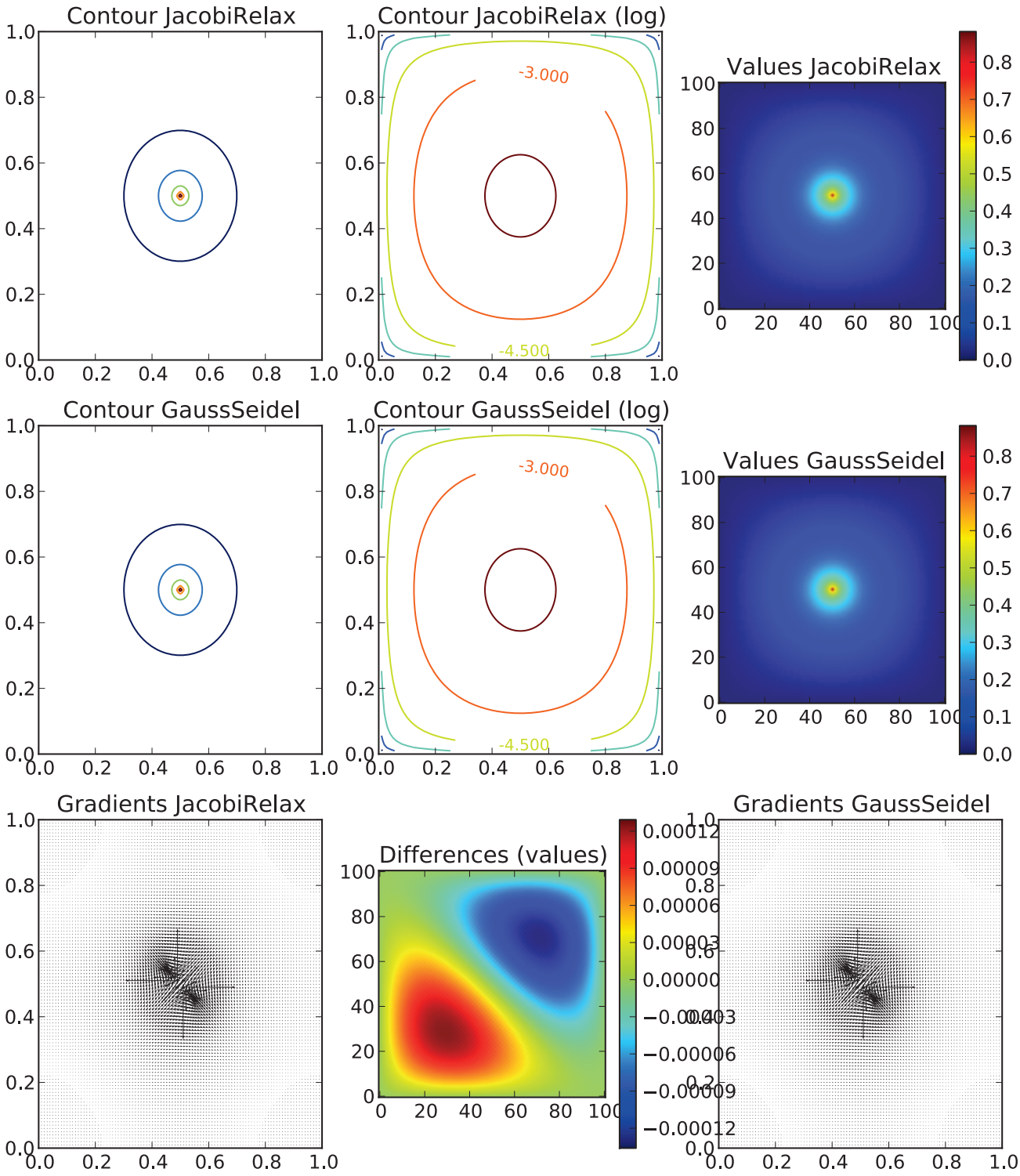
Some remarks:

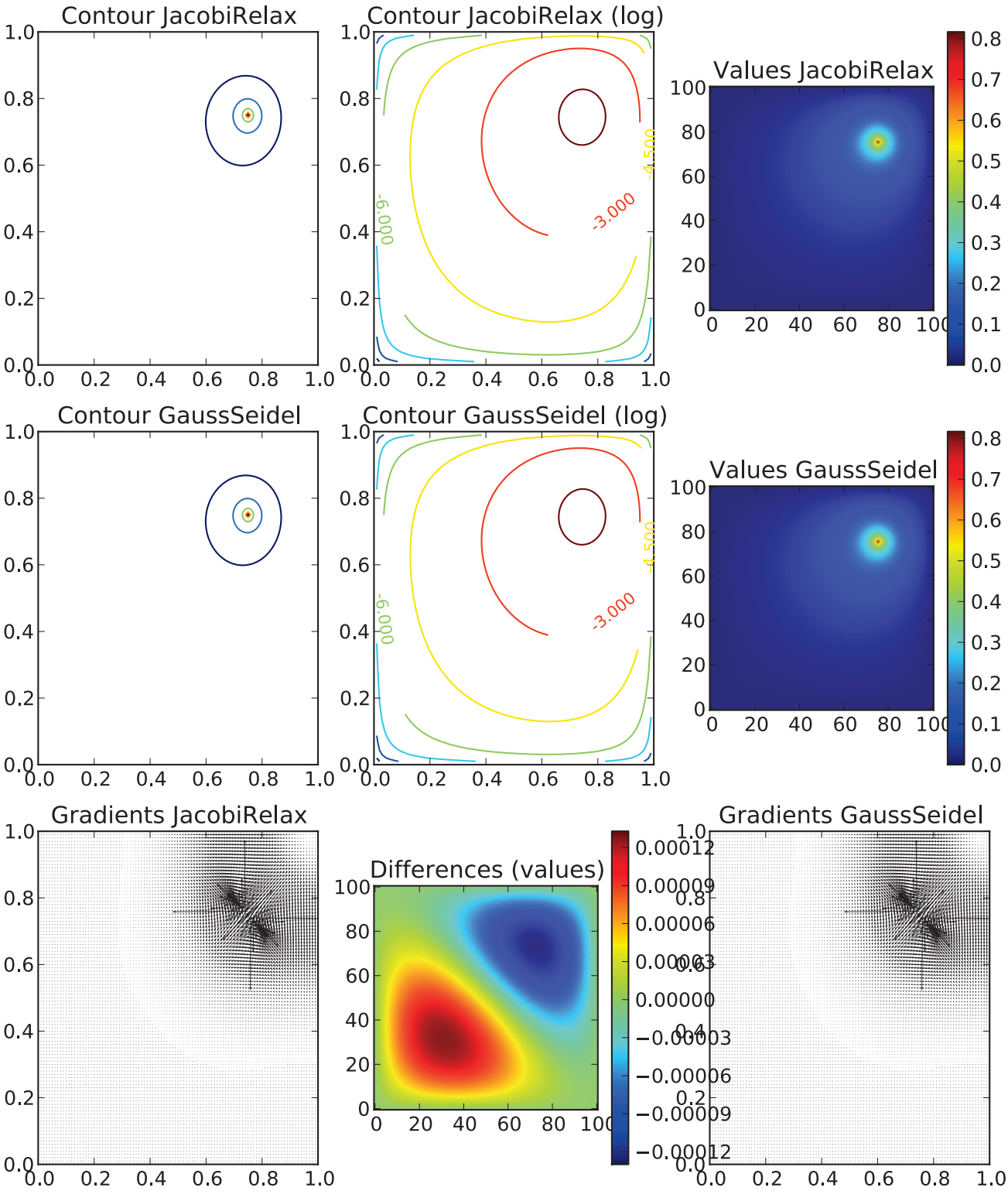
- The first three plots are solutions for task1, 2 and 3; with N = 51, i.e. 51 x 51 = 2601 grid points, and left run until the max change epsilon of a node in one run was <10e-4. (run A)
- The 4th, 5th and 6th plots are with N=101, 10201 grid points, epsilon < 10e-6 (run B)
- Plots 7,8 and 9 are done with low resolution (N = 21, 441 grid points) but high epsilon = 10e-10.
- It seems like the numpy python gradient function has got a bug, as they look quite strange, whereas the values and the contours look ok.
- Statistics:
  - Run A: (runtime ~3min)
    - task1: Jacobi: 160, Seidel 81 steps
    - task2: Jacobi: 153, Seidel 78 steps
    - task2: Jacobi: 212, Seidel 153 steps
  - Run B: (runtime ~15min)
    - task1: Jacobi: 6070, Seidel 3036 steps
    - task2: Jacobi: 4682, Seidel 2364 steps
    - task2: Jacobi: 6892, Seidel 3840 steps
  - Run C: (runtime ~1min)
    - task1: Jacobi: 1246, Seidel 624 steps
    - task2: Jacobi: 1190, Seidel 601 steps
    - task2: Jacobi: 1278, Seidel 656 steps
- Comparing the results, one can say, for this problem, the resolution is not as important as the epsilon, but costs heavily CPU-time. (O^2). Also for some reason the Gauss-Seidel algorithm takes around half as many steps to reach a certain precession as does Jacobi relaxation.

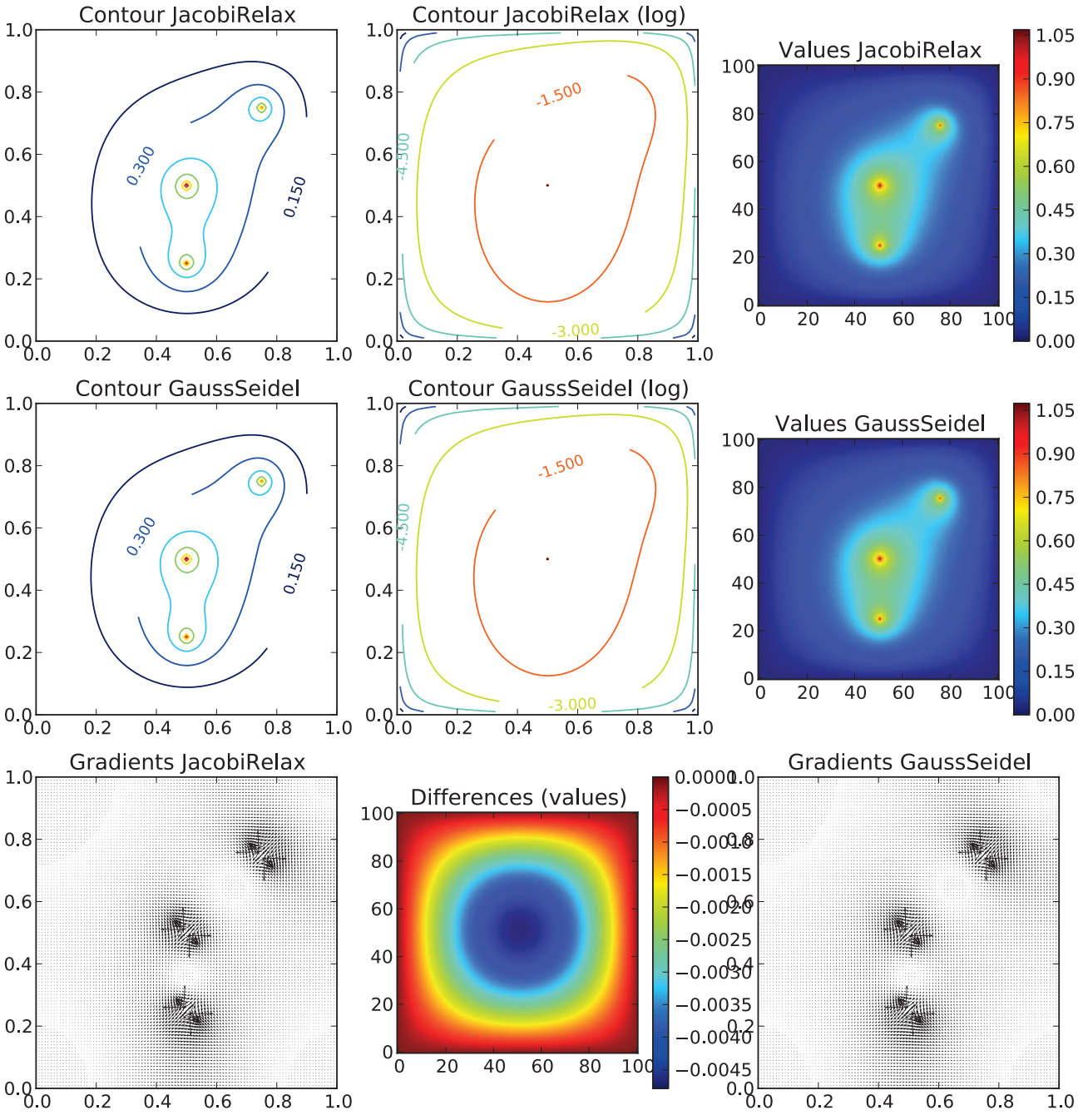

Contour JacobiRelax
Contour JacobiRelax (log)
-6.000
-4.000
-8.000
Values JacobiRelax
Contour GaussSeidel
Contour GaussSeidel (log)
-7.500
-5.000
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
Gradients GaussSeidel

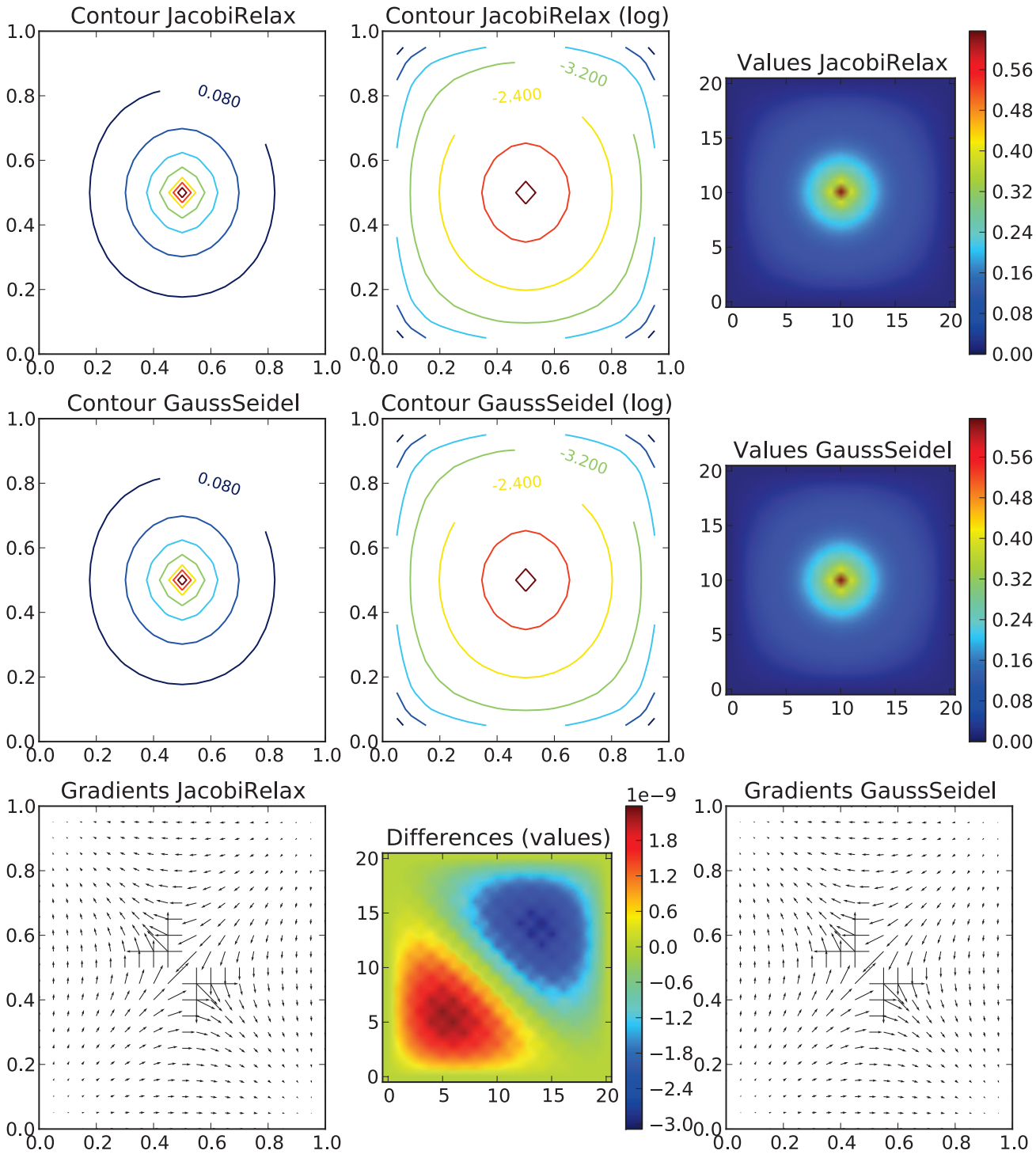

Contour JacobiRelax
Contour JacobiRelax (log)
Values JacobiRelax
Contour GaussSeidel
Contour GaussSeidel (log)
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
Gradients GaussSeidel
-8.000
-12.000
-6.000
-12.000
-18.000

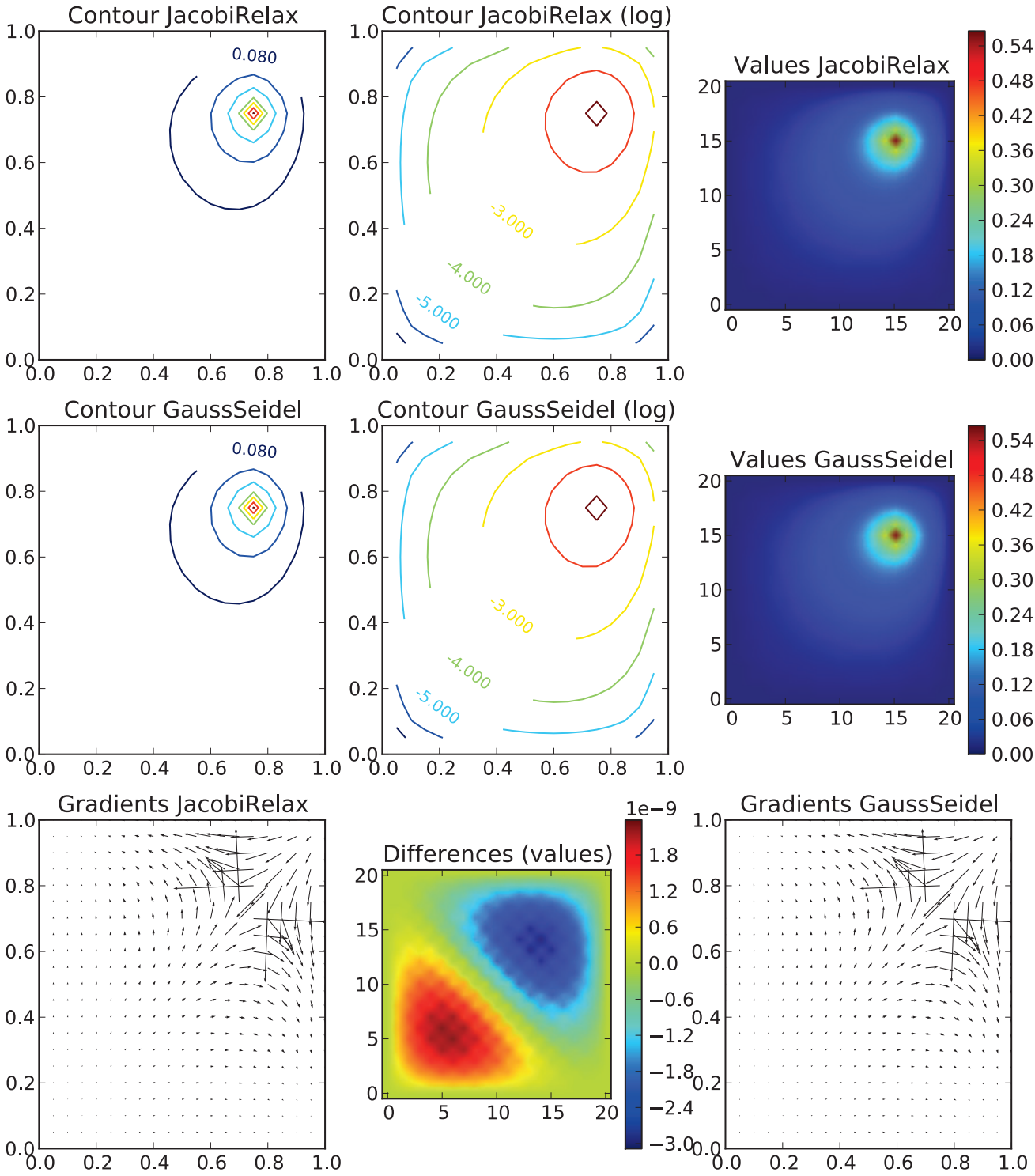

Contour JacobiRelax
Contour JacobiRelax (log)
Values JacobiRelax
Contour GaussSeidel
Contour GaussSeidel (log)
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
Gradients GaussSeidel
0.100
-6.000
-3.000
-4.500

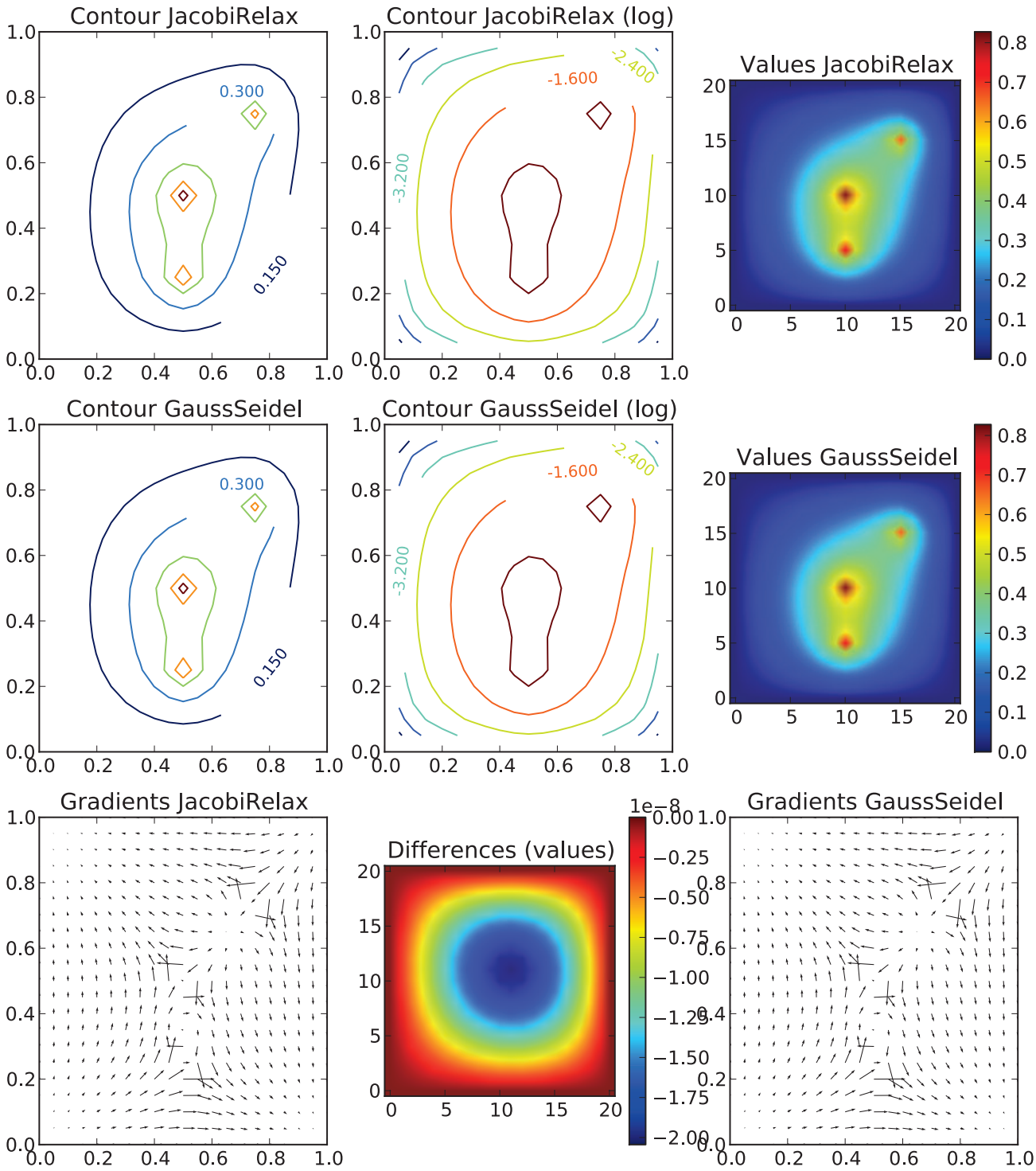

Contour JacobiRelax
Contour JacobiRelax (log)
-3.000
-4.500
Values JacobiRelax
Contour GaussSeidel
Contour GaussSeidel (log)
-3.000
-4.500
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
Gradients GaussSeidel


Contour JacobiRelax
Contour JacobiRelax (log)
Values JacobiRelax
Contour GaussSeidel
Contour GaussSeidel (log)
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
Gradients GaussSeidel
-6.000
-4.500
-3.000


Contour JacobiRelax
Contour JacobiRelax (log)
Values JacobiRelax
Contour GaussSeidel
Contour GaussSeidel (log)
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
Gradients GaussSeidel
0.300
0.150
-1.500
-4.300
-3.000


Contour JacobiRelax
0.080
Contour JacobiRelax (log)
-3.200
-2.400
Values JacobiRelax
Contour GaussSeidel
0.080
Contour GaussSeidel (log)
-3.200
-2.400
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
1e−9
Gradients GaussSeidel


Contour JacobiRelax
0.080
Contour JacobiRelax (log)
-3.000
-4.000
-5.000
Values JacobiRelax
Contour GaussSeidel
0.080
Contour GaussSeidel (log)
-3.000
-4.000
-5.000
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
1e−9
Gradients GaussSeidel


Contour JacobiRelax
0.300
0.150
Contour JacobiRelax (log)
-1.600
-2.400
-3.200
Values JacobiRelax
Contour GaussSeidel
0.300
0.150
Contour GaussSeidel (log)
-1.600
-2.400
-3.200
Values GaussSeidel
Gradients JacobiRelax
Differences (values)
1e−8
Gradients GaussSeidel