Stream Function Contour Plots

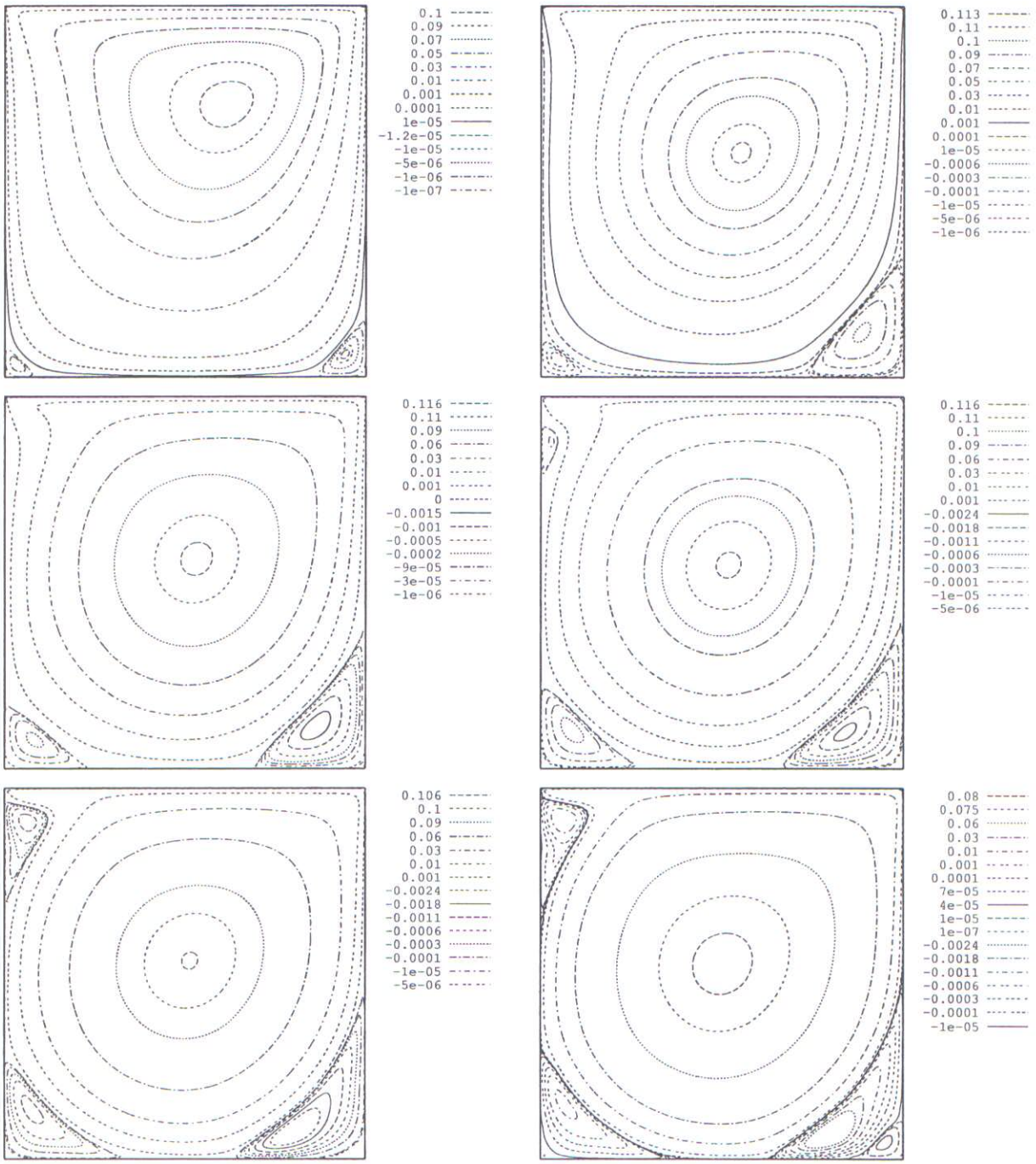

Figure 1: Stream function contours of the cavity flow. (a) $Re = 100$, (b) $Re = 400$, (c) $Re = 1000$, (d) $Re = 2000$, (e) $Re = 5000$, (f) $Re = 7500$. Top nondimensional velocity $U = 1$.

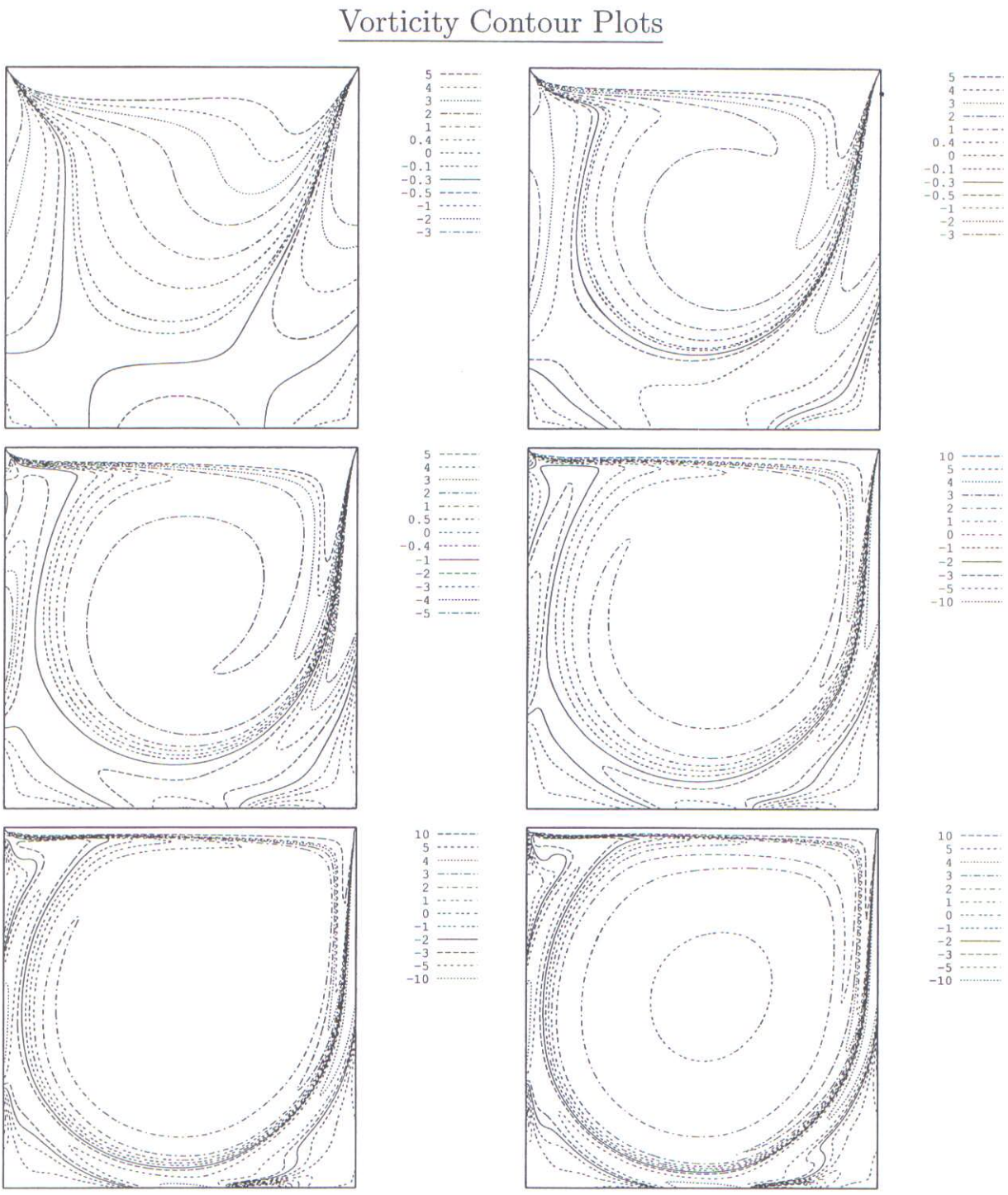

Figure 2: Vorticity contours of the cavity flow. (a) $Re = 100$, (b) $Re = 400$, (c) $Re = 1000$, (d) $Re = 2000$, (e) $Re = 5000$, (f) $Re = 7500$. Top nondimensional velocity $U = 1$.

Velocity Profiles

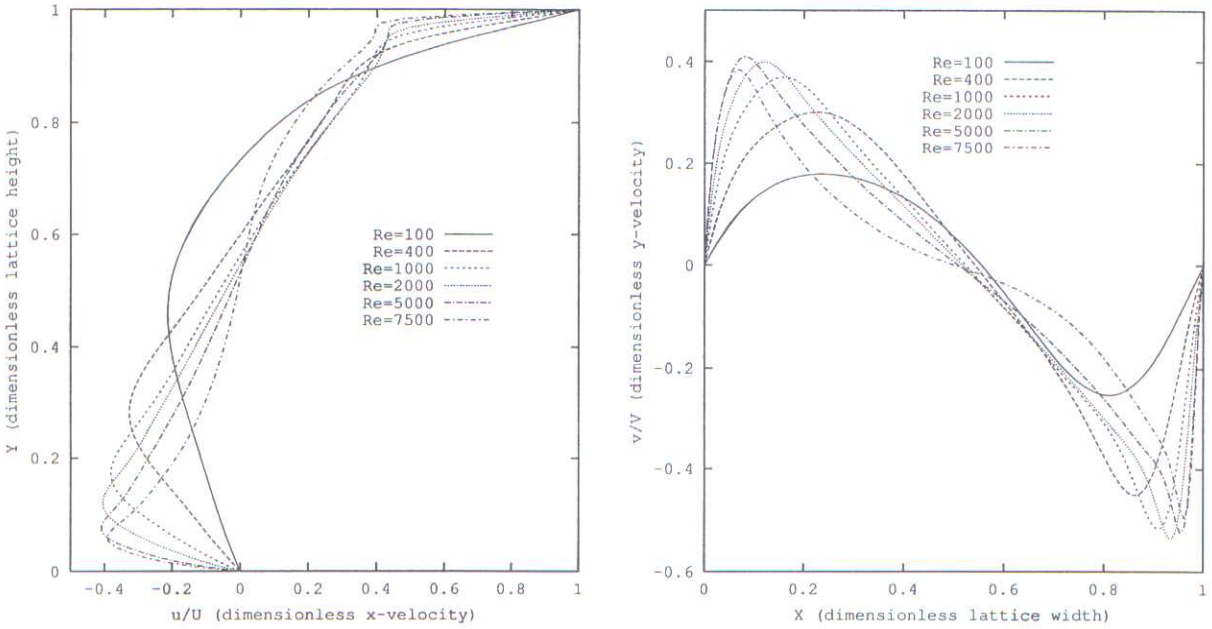

Figure 3: Velocity profiles for u (left) and v (right) through the geometric center of the cavity.

Vortex Centers: Stream Function and Location

Re	Primary Vortex			Lower Left Vortex			Lower Right Vortex		
	Ψ_{max}	x	y	Ψ_{min}	x	y	Ψ_{min}	x	y
100	0.1034	0.6201	0.7364	-2.000e-6	0.0387	0.0465	-1.310e-5	0.9457	0.0697
400	0.1134	0.5581	0.6124	-1.470e-5	0.0620	0.0542	-6.495e-4	0.8837	0.1318
1000	0.1170	0.5349	0.5659	-2.285e-4	0.0930	0.0852	-1.759e-3	0.8604	0.1162
2000	0.1166	0.5271	0.5504	-7.314e-4	0.093	0.1085	-2.561e-3	0.8372	0.1008
5000	0.106	0.5194	0.53488	-1.284e-4	0.0775	0.1473	3.33e-4	0.7984	0.0775
7500	0.081	0.5116	0.5271	-1.275e-3	0.0698	0.1628	-3.65e-3	0.8062	0.0775

Re	Grid		Upper Left Vortex		
	NX	NY	Ψ_{max}	x	y
5000	101	X 101	-1.35e-3	0.0693	0.9109
5000	129	X 129	-1.36e-3	0.0697	0.9147
7500	129	X 129	-1.61e-3	0.0698	0.9147

Effect of Grid Resolution

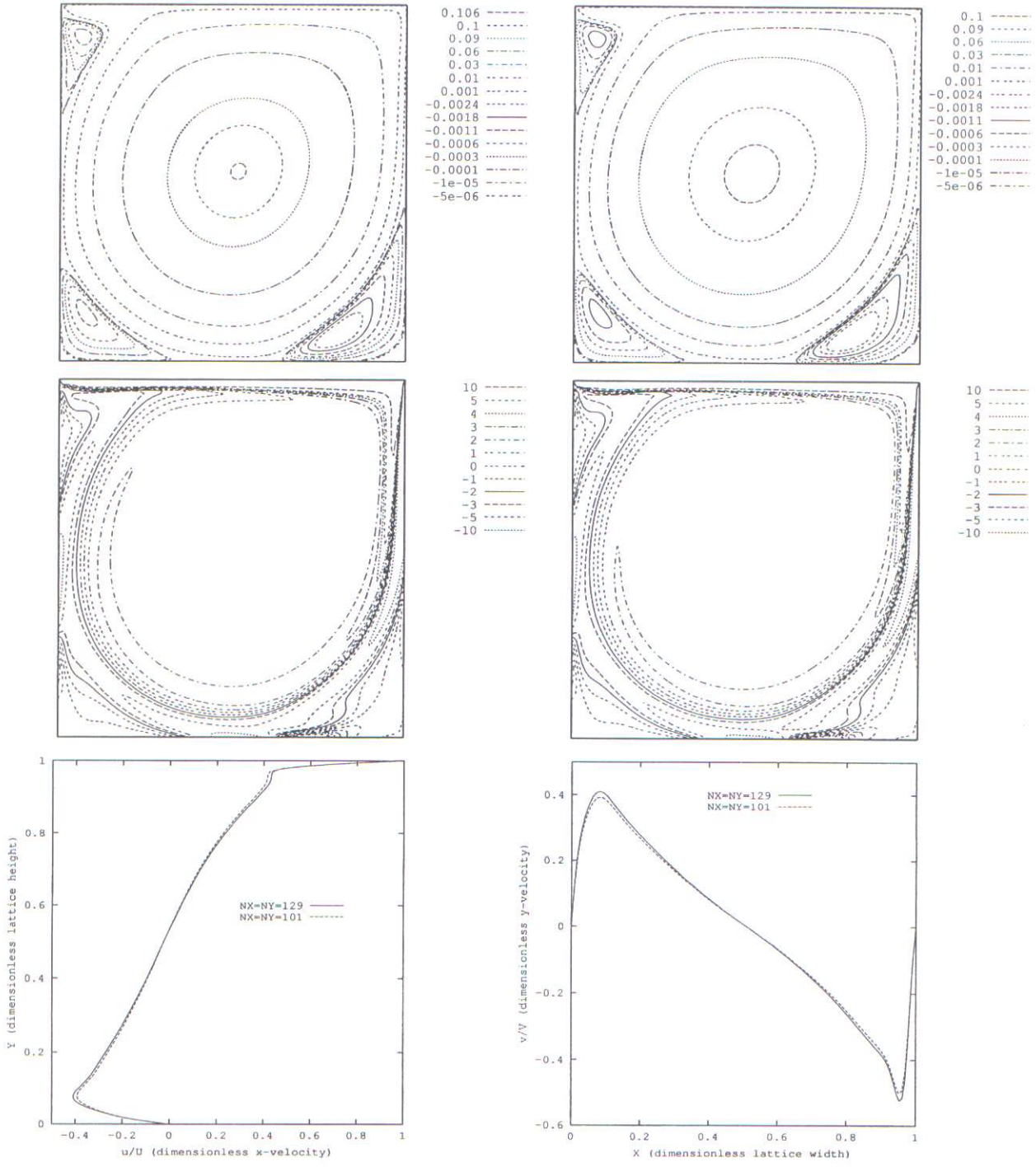

Figure 4: Stream function contours (top) and vorticity contours (center) of the cavity flow at $Re = 5000$ for two different grids: $NX = NY = 129$ (left) and $NX = NY = 101$ (right). Velocity profiles for u (bottom-left) and v (bottom-right) through the geometric center of the cavity at $Re = 5000$ for the two different grids adopted.

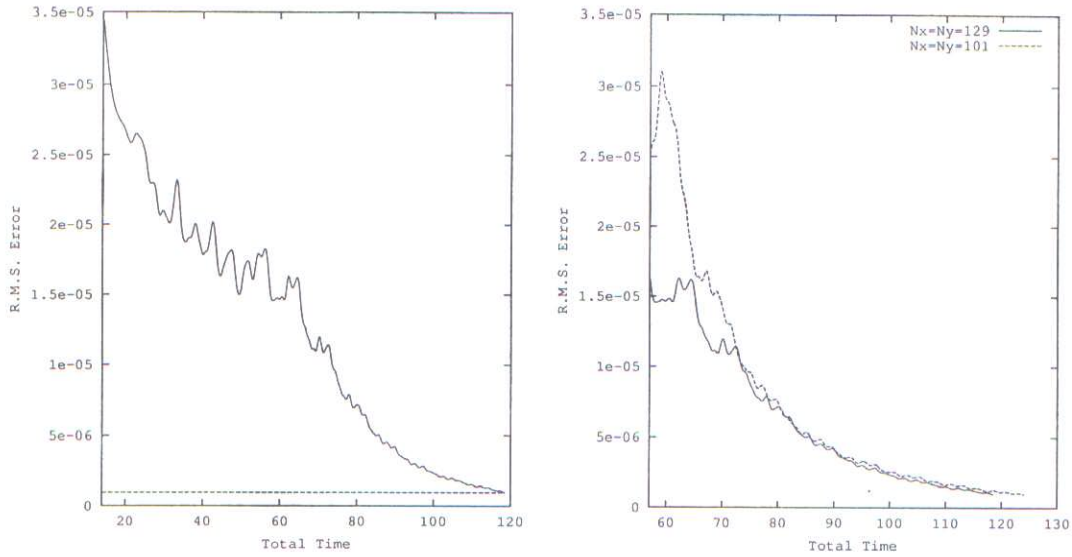

Figure 5: Time behaviour of R.M.S. error for cavity flow at $Re = 5000$ for $NX = NY = 129$ and comparison with R.M.S. error for $NX = NY = 101$.

Details of the Simulation

Re	Grid Resolution	OR Constant (C1)	Time Step	Total Time	Number of Time Steps
100	129 x 129	1.56666	1.0e-3	12.090	12,090
400	129 x 129	1.56666	1.0e-3	29.351	29,351
1000	129 x 129	1.56666	1.0e-3	41.750	41,750
2000	129 x 129	1.56666	1.0e-3	70.140	70,140
5000	129 x 129	1.56666	1.0e-4	118.53	1.1853e+6
5000	101 x 101	1.52369	1.0e-4	124.01	1.2401e+6
7500	129 x 129	1.56666	1.0e-4	155.853	1.5585e+6