數值分析 SOR Method and Heat Equation

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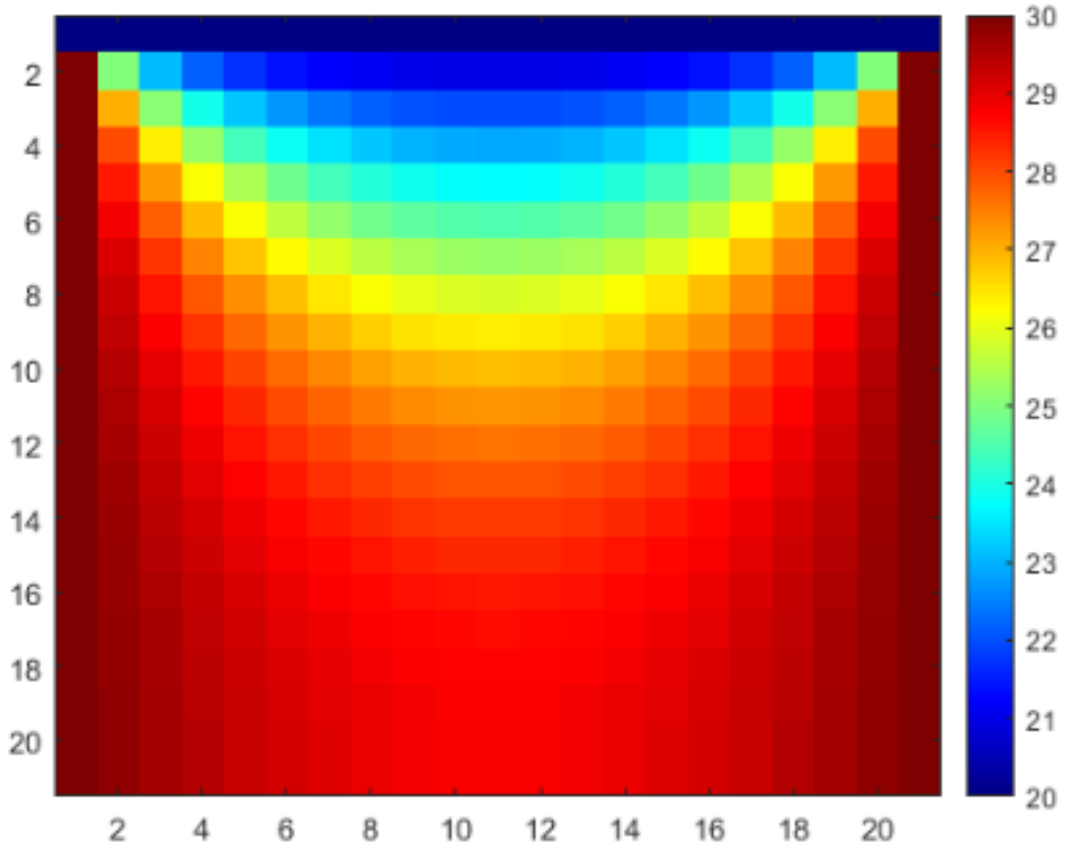
1.

Gauss-Seidel method : w = 1 , Source = 5 , times = 898

Boundary : top= d = 0 , bottom = 20 , right = 30 , left = 30

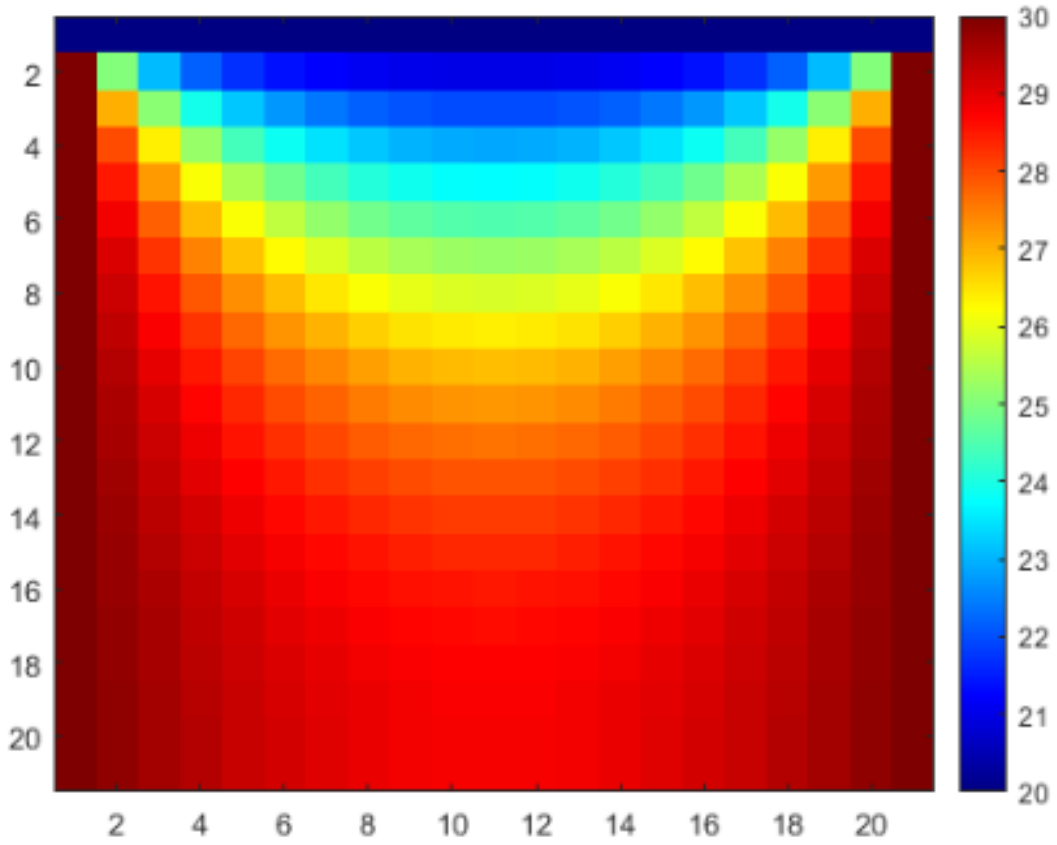
20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000
30.00000	25.02483	23.07563	22.17039	21.68936	21.40579	21.22796	21.11387	21.04261	21.00334	20.99078	21.00334	21.04261	21.11387	21.22796	21.40580	21.68936	22.17039	23.07363	25.02483
30.00000	27.02570	25.09932	23.91856	23.18125	22.70586	22.39217	22.18492	22.05324	21.97997	21.95643	21.97997	22.05324	22.18492	22.39217	22.70586	23.18125	23.91856	25.09932	27.02570
30.00000	27.97867	26.37937	25.22328	24.41123	23.84424	23.44993	23.18041	23.00545	22.90687	22.87501	22.90687	23.00545	23.18041	23.44993	23.84424	24.41123	25.22328	26.37937	27.97867
30.00000	28.50960	27.21620	26.18396	25.39614	24.80993	24.38290	24.08135	23.88128	23.76703	23.72988	23.76703	23.88128	24.08135	24.38290	24.80993	25.39614	26.18396	27.21620	28.50960
30.00000	28.84355	27.79187	26.90024	26.17943	25.61645	25.19038	24.88082	24.67128	24.55010	24.51046	24.55011	24.67128	24.88082	25.19038	25.61645	26.17943	26.90024	27.79187	28.84355
30.00000	29.07272	28.20749	27.44568	26.80491	26.28605	25.88134	25.58027	25.37292	25.25165	25.21175	25.25165	25.37292	25.58027	25.88135	26.28605	26.80491	27.44568	28.20749	29.07272
30.00000	29.23983	28.51971	27.87008	27.30847	26.84151	26.46866	26.18599	25.98848	25.87182	25.83323	25.87182	25.98848	26.18599	26.46868	26.84151	27.30847	27.87008	28.51971	29.23983
30.00000	29.36889	28.76144	28.20644	27.71740	27.30282	26.96589	26.70654	26.52318	26.41393	26.37755	26.41393	26.52318	26.70655	26.96589	27.30282	27.71740	28.20645	28.76144	29.36889
30.00000	29.46628	28.95273	28.47686	28.05187	27.68647	27.38551	27.15112	26.98376	26.88316	26.84911	26.88316	26.98376	27.15112	27.38551	27.68647	28.05188	28.47686	28.95273	29.46628
30.00000	29.54549	29.10635	28.69638	28.32676	28.00568	27.73857	27.52866	27.37759	27.28583	27.25257	27.28583	27.37759	27.52867	27.73857	28.00568	28.32677	28.69638	29.10635	29.54549
30.00000	29.60932	29.23079	28.87556	28.55312	28.27092	28.03443	27.84737	27.71211	27.63002	27.60201	27.63002	27.71211	27.84737	28.03443	28.27093	28.55312	28.87556	29.23079	29.60932
30.00000	29.66102	29.33192	29.02196	28.73923	28.49046	28.28086	28.11429	27.99345	27.92012	27.89544	27.92012	27.99345	28.11429	28.28086	28.49046	28.73924	29.02196	29.33192	29.66102
30.00000	29.70283	29.41392	29.14111	28.89140	28.67082	28.48425	28.33548	28.22728	28.16157	28.13952	28.16157	28.22728	28.33548	28.48425	28.67083	28.89141	29.14111	29.41393	29.70283
30.00000	29.73638	29.47984	29.23714	29.01445	28.81718	28.64965	28.51609	28.41862	28.35937	28.33949	28.35937	28.41862	28.51609	28.64986	28.81718	29.01445	29.23714	29.47984	29.73638
30.00000	29.76286	29.53192	29.31316	29.11208	28.93360	28.78190	28.66040	28.57174	28.51780	28.49970	28.51780	28.57174	28.66040	28.78190	28.93360	29.11208	29.31316	29.53192	29.76286
30.00000	29.78313	29.57183	29.37149	29.18712	29.02323	28.88374	28.77187	28.69015	28.64040	28.62369	28.64040	28.69016	28.77187	28.88374	29.02323	29.18712	29.37149	29.57183	29.78313
30.00000	29.79783	29.60078	29.41384	29.24167	29.08847	28.95795	28.85319	28.77661	28.72995	28.71428	28.72995	28.77661	28.85319	28.95796	29.08848	29.24167	29.41385	29.60079	29.79783
30.00000	29.80739	29.61964	29.44144	29.27723	29.13105	29.00642	28.90633	28.83313	28.78852	28.77354	28.78852	28.83313	28.90633	29.00642	29.13105	29.27724	29.44144	29.61964	29.80739
30.00000	29.81211	29.62893	29.45505	29.29478	29.15206	29.03035	28.93258	28.86106	28.81747	28.80282	28.81747	28.86106	28.93258	29.03036	29.15206	29.29478	29.45505	29.62893	29.81211
30.00000	29.81211	29.62893	29.45505	29.29478	29.15206	29.03035	28.93258	28.86106	28.81747	28.80282	28.81747	28.86106	28.93258	29.03036	29.15206	29.29478	29.45505	29.62893	29.81211	30.00000



SOR Method : w = 1.2 , Source = 5 , times = 614

Boundary : top= d = 0 , bottom = 20 , right = 30 , left = 30

30.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000	20.00000
30.00000	25.02484	23.07363	22.17039	21.68936	21.40580	21.22796	21.11387	21.04261	21.00334	20.99078	21.00334	21.04261	21.11368	21.22796	21.40580	21.68936	22.17039	23.07364	25.02484
30.00000	27.02571	25.09932	23.91856	23.18125	22.70586	22.39217	22.18493	22.05324	21.97997	21.95643	21.97997	22.05324	22.18493	22.39217	22.70587	23.18125	23.91856	25.09932	27.02571
30.00000	27.97867	26.37937	25.22328	24.41123	23.84424	23.44993	23.18042	23.00545	22.90687	22.87502	22.90687	23.00545	23.18042	23.44993	23.84424	24.41123	25.22328	26.37937	27.97867
30.00000	28.50960	27.21620	26.18397	25.39614	24.80993	24.38290	24.08136	23.88128	23.76704	23.72989	23.76704	23.88128	24.08136	24.38290	24.80993	25.39614	26.18397	27.21620	28.50961
30.00000	28.84355	27.79187	26.90024	26.17944	25.61645	25.19038	24.88082	24.67129	24.55011	24.51047	24.55011	24.67129	24.88083	25.19038	25.61645	26.17944	26.90024	27.79187	28.84355
30.00000	29.07272	28.20750	27.44568	26.80491	26.28606	25.88135	25.58028	25.37293	25.25166	25.21176	25.25166	25.37293	25.58028	25.88135	26.28606	26.80491	27.44568	28.20750	29.07272
30.00000	29.23983	28.51971	27.87008	27.30848	26.84151	26.46869	26.18600	25.98849	25.87183	25.83324	25.87183	25.98849	26.18600	26.46869	26.84151	27.30848	27.87008	28.51971	29.23983
30.00000	29.36689	28.76145	28.20645	27.71741	27.30282	26.96590	26.70655	26.52119	26.41394	26.37756	26.41394	26.52119	26.70656	26.96590	27.30283	27.71741	28.20645	28.76145	29.36689
30.00000	29.46628	28.95273	28.47686	28.05188	27.66648	27.38552	27.15113	26.98377	26.88317	26.84912	26.88317	26.98377	27.15113	27.38552	27.66648	28.05188	28.47686	28.95274	29.46628
30.00000	29.54549	29.10635	28.69639	28.32677	28.00569	27.73858	27.52867	27.37760	27.28585	27.25258	27.28585	27.37760	27.52868	27.73858	28.00569	28.32677	28.69639	29.10635	29.54549
30.00000	29.60933	29.23079	28.87557	28.55313	28.27093	28.03444	27.84738	27.71212	27.63003	27.60203	27.63003	27.71212	27.84739	28.03444	28.27093	28.55313	28.87557	29.23079	29.60933
30.00000	29.66102	29.33193	29.02196	28.73924	28.49047	28.28087	28.11430	27.99346	27.92013	27.89546	27.92013	27.99346	28.11430	28.28087	28.49047	28.73925	29.02196	29.33193	29.66102
30.00000	29.70283	29.41393	29.14111	28.89141	28.67083	28.48426	28.33549	28.22729	28.16159	28.13953	28.16159	28.22729	28.33549	28.48427	28.67084	28.89141	29.14111	29.41393	29.70283
30.00000	29.73639	29.47985	29.23715	29.01446	28.81719	28.64987	28.51610	28.41863	28.35938	28.33950	28.35939	28.41863	28.51610	28.64987	28.81719	29.01446	29.23715	29.47985	29.73639
30.00000	29.76286	29.53193	29.31315	29.11209	28.95361	28.78191	28.66041	28.57176	28.51782	28.49971	28.51782	28.57176	28.66041	28.78191	28.95361	29.11209	29.31317	29.53193	29.76286
30.00000	29.78313	29.57184	29.37149	29.18713	29.02324	28.88375	28.77188	28.69017	28.64042	28.62371	28.64042	28.69017	28.77189	28.88375	29.02325	29.18713	29.37150	29.57184	29.78313
30.00000	29.79783	29.60079	29.41385	29.24168	29.08849	28.95797	28.85320	28.77662	28.72997	28.71430	28.72997	28.77662	28.85321	28.95797	29.08849	29.24168	29.41385	29.60079	29.79783
30.00000	29.80740	29.61964	29.44145	29.27724	29.13106	29.00643	28.90634	28.83314	28.78854	28.77355	28.78854	28.83315	28.90635	29.00644	29.13106	29.27725	29.44145	29.61965	29.80740
30.00000	29.81211	29.62894	29.45506	29.29479	29.15207	29.03037	28.93259	28.86107	28.81748	28.80284	28.81748	28.86107	28.93260	29.03037	29.15207	29.29479	29.45506	29.62894	29.81211
30.00000	29.81211	29.62894	29.45506	29.29479	29.15207	29.03037	28.93259	28.86107	28.81748	28.80284	28.81748	28.86107	28.93260	29.03037	29.15207	29.29479	29.45506	29.62894	29.81211

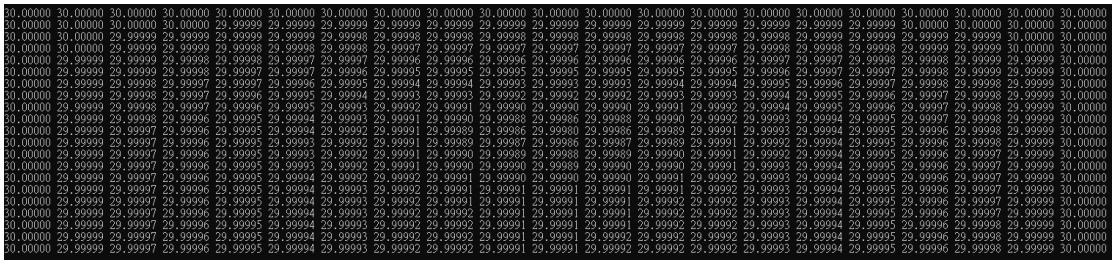


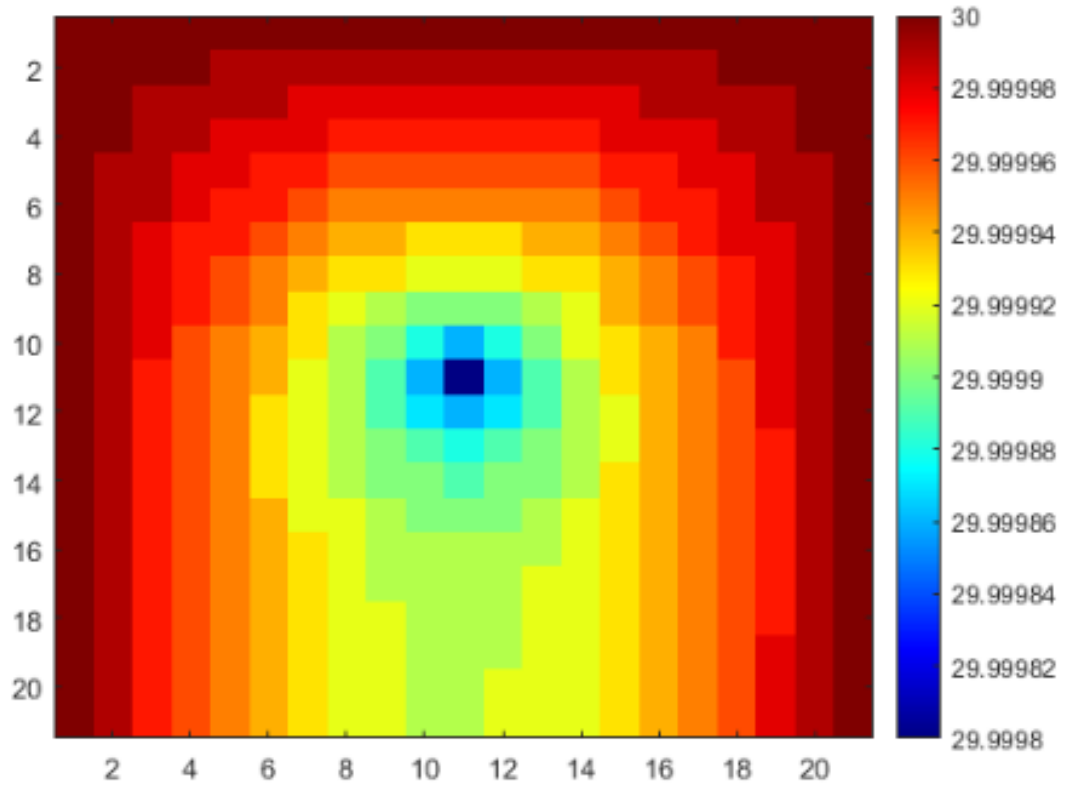
2.

Condition A : w = 1 , Source = 5 , times = 903

Boundary : top= d = 0 , bottom = 30 , right = 30 , left = 30

Result : 改變 bottom boundary，溫度更為均勻，但收斂變慢了。

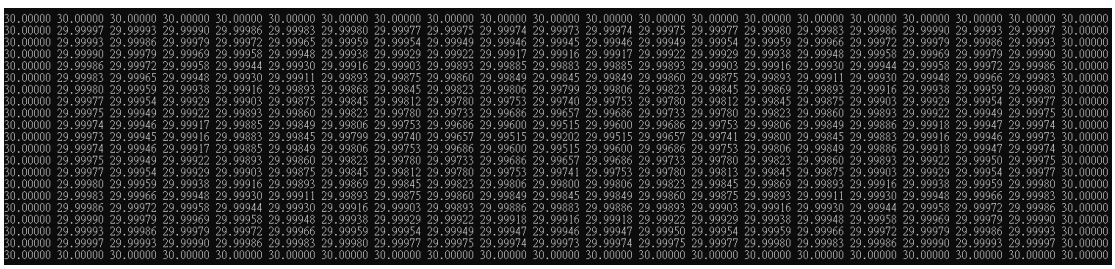


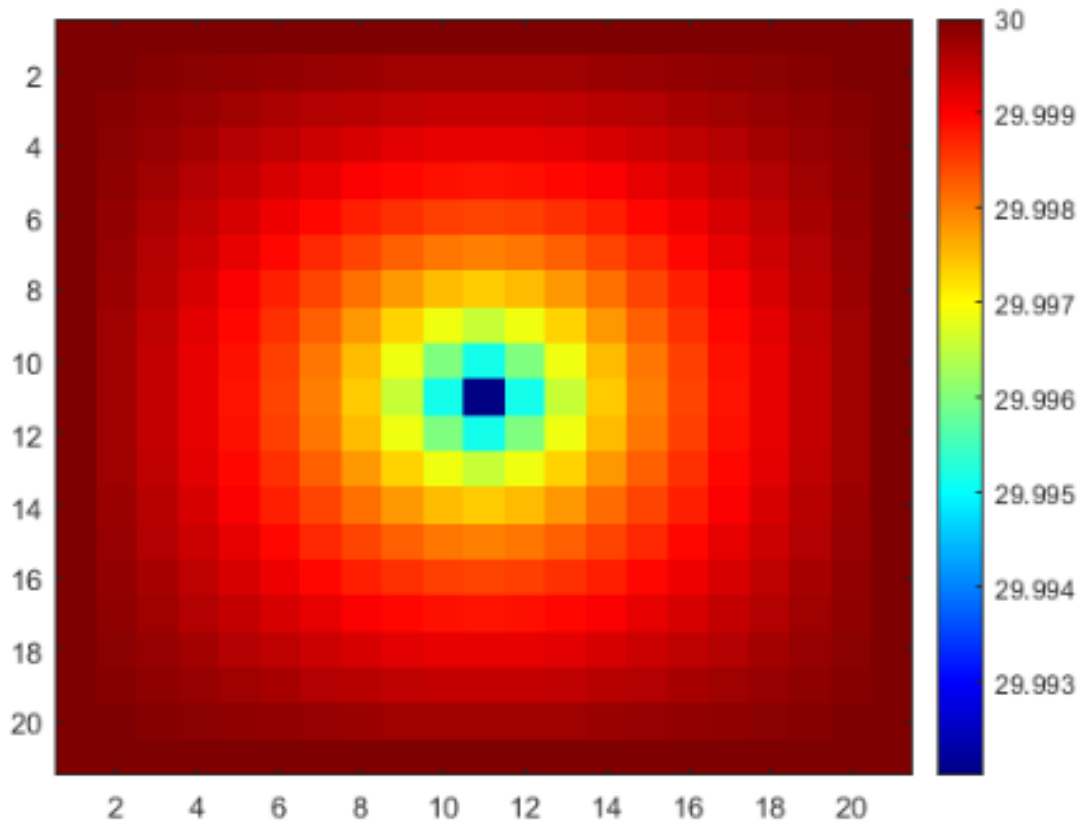


Condition B : w = 1 , Source = 5 , times = 577

Boundary : top= 30 , bottom = 30 , right = 30 , left = 30

Result : 改變 top , bottom boundary，收斂得更快。

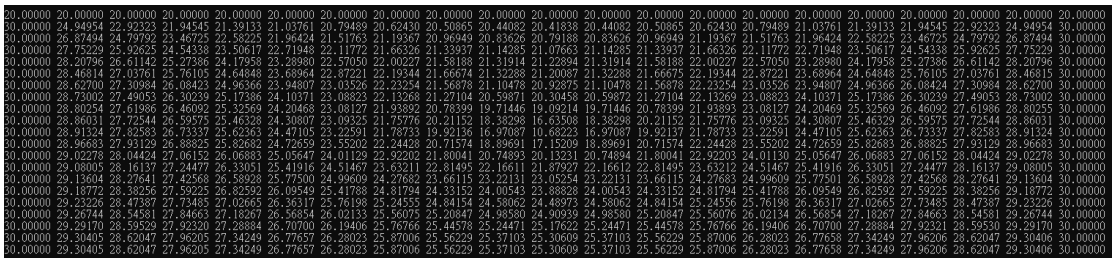


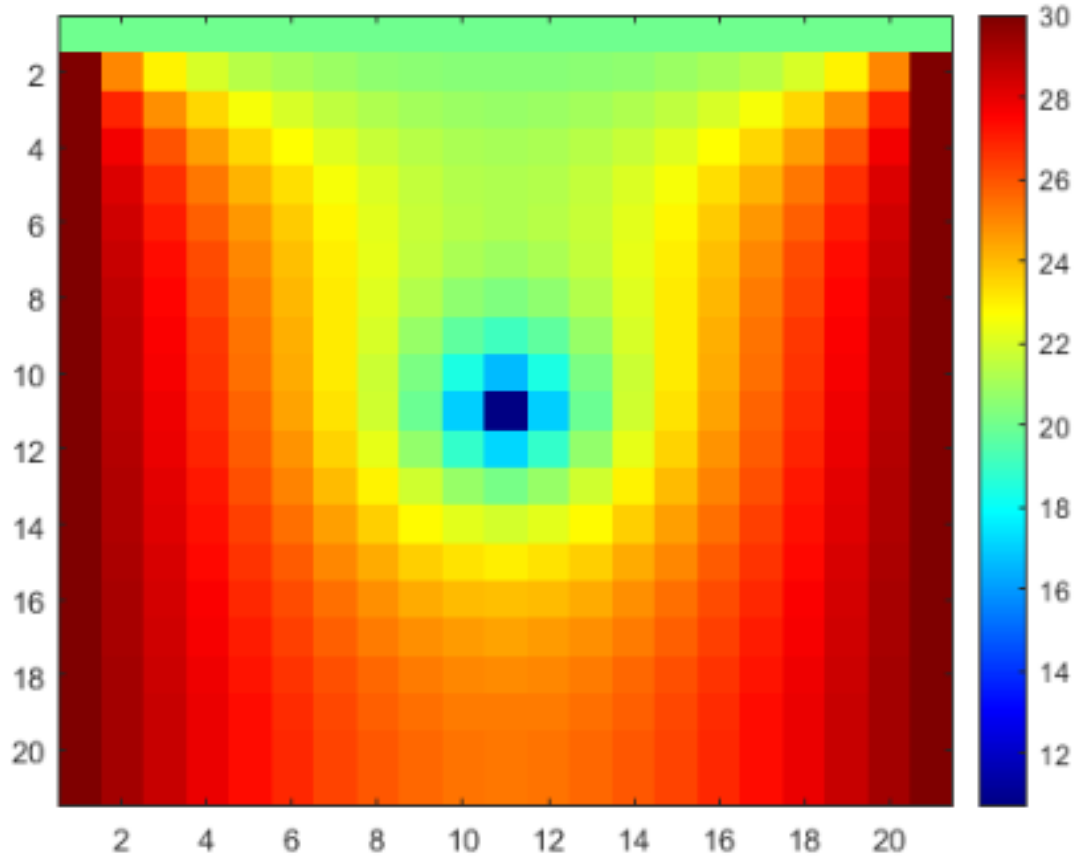


Condition C : w = 1 , Source = 10000 , times = 889

Boundary : top= d = 0 , bottom = 20 , right = 30 , left = 30

Result : 加大熱源 2000 倍，溫度分布與 Gauss 差別很大，但收斂次數差不多。

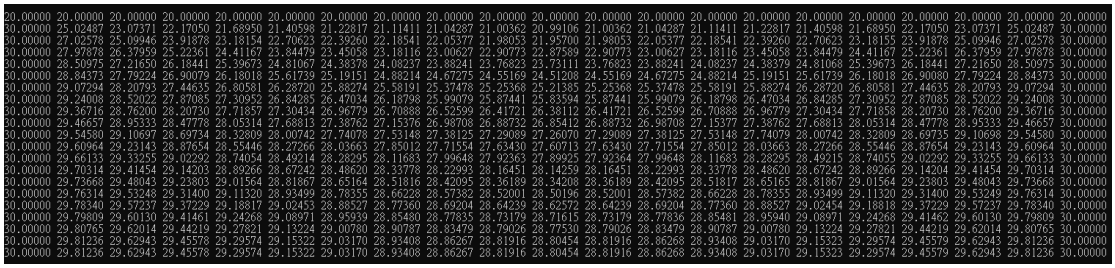


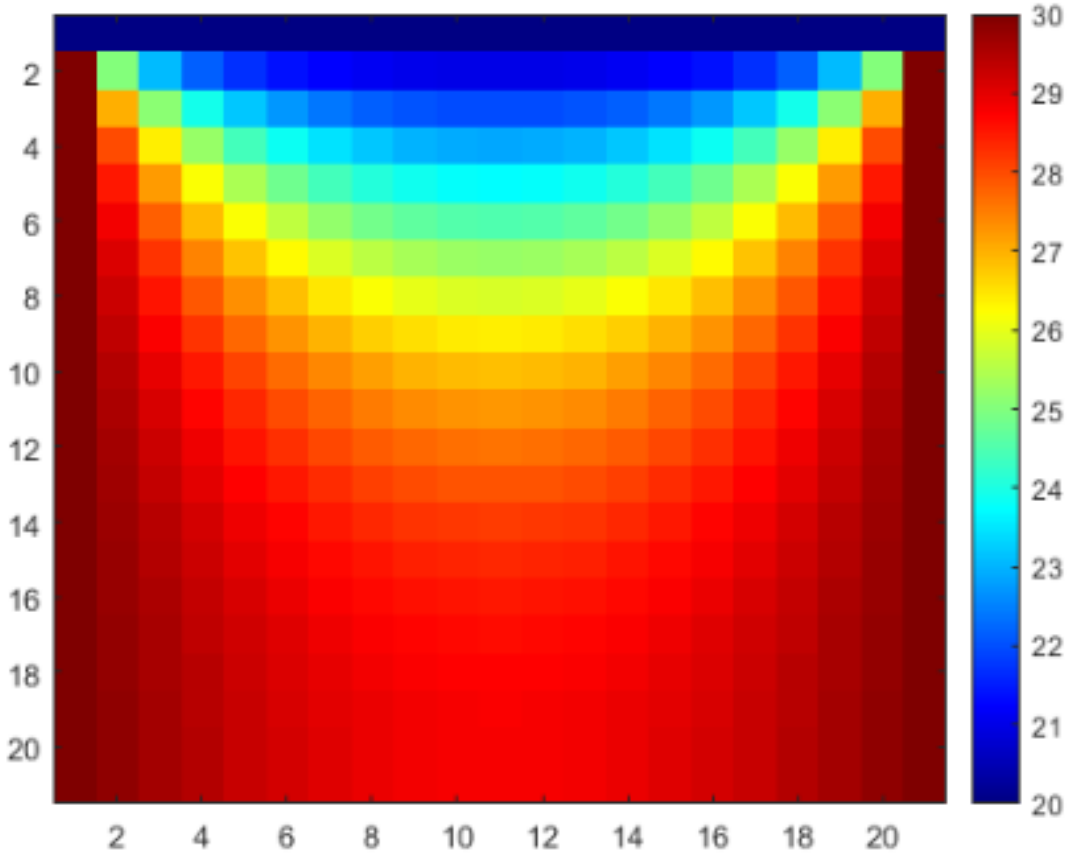


Condition D : w = 1 , Source = 0.05 , times = 898

Boundary : top= d = 0 , bottom = 20 , right = 30 , left = 30

Result : 減少熱源 100 倍，數值與 Gauss 只有些微的差距，但收斂次數不變。





3.

w	times	w	times	w	times	w	times
1.00	898	1.25	556	1.50	314	1.75	118
1.05	818	1.30	501	1.55	274	1.80	83
1.10	744	1.35	450	1.60	234	1.85	107
1.15	677	1.40	402	1.65	196	1.90	165
1.20	614	1.45	357	1.70	158	1.95	343

w = 1.05 is the worst choice for the SOR method

w = 1.80 is the best choice for the SOR method

Condition E : w = 1.80 , Source = 5 , times = 83

Boundary : top= d = 0 , bottom = 20 , right = 30 , left = 30

Result : 改變 w，數值與 Gauss 有些微的差距，但收斂次數變快 10 倍。