

Analysis of GCP per Capita Data

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1 The issue

If we calculate the GCP per capita with the data provided by the ISIMIP project, the GPC per capita will be lower in big cities than in rural areas. Examples of this phenomenon can be seen in the maps of Japan (e.g. Fig. 2 on page 3), or in the map of Germany, see for instance Fig 11 (page 11). This is not obvious, because when you look at the GCP (page 25) and population (page 39) data separately, they both look fine at first glance.

To make a comparison, I also calculated the GCP per capita with the LitPop GDP data and ISIMI population, as well as with the ISIMIP GCP and the GPWv4 population data set. Unfortunately this approach has its own problems, namely that grid cells with only a small land fraction tend to have really high GCP per capita, which distorts the scale quite a bit. If you look at Fig 17 (page 16) you can see that Berlin has a higher GCP per capita than the surrounding rural areas, while the scale in the plot of Japan (Fig. 8 on page 8) has a rather distorted scale due to very high values on 徳之島 (Tokunoshima) and 北海道 (Hokkaidō). If you zoom into the 関東 (Kantō) area, the grid cells representing 東京 (Tōkyō) at least are not lower in their GCP per capita values than the surroundings (not plotted). If, however, the GCP per capita is calculated with ISIMIP GCP and GPWv4 population data, the issue of a lower GCP per capita in big cities reappears (e.g. Fig. 3 on page 4 or Fig. 12 on page 12.)

Because of this I suppose that the issue is due to the GCP data.

To investigate the issue further, I have also plotted comparisons between the ISIMIP GDP and LitPop (page 53) data, as well as the difference between the ISIMIP population and GPWv4 (page 53).

One can clearly see, that the GCP provided by LitPop in urban areas is much larger than in the ISIMIP data. See, for instance 東京 (Tōkyō, Fig. 64 on page 53) or Berlin (Fig. 66 on page 54). Also, the population in the big cities is in the GPWv4 data less than in the ISIMIP data set, see for instance Fig. 70 (page 57) for 東京 (Tōkyō) or Fig. 72 (page 58) for Berlin.

For the record, for the year 2030 I used LitPop SSP2 data, as this is the scenario used in ISIMIP2b as well.

2 GCP per capita data

2.1 Japan

2.1.1 ISIMIP2a

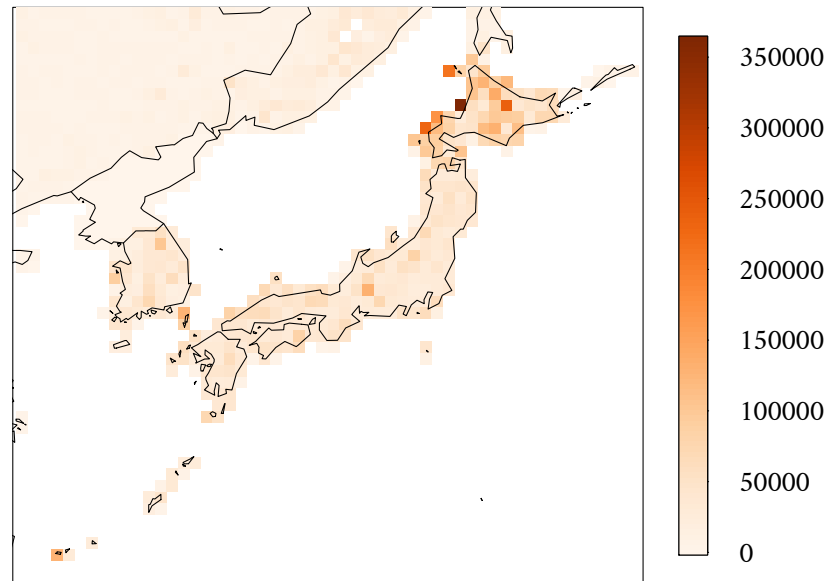


Figure 1: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a, 日本 (Japan), 2000.

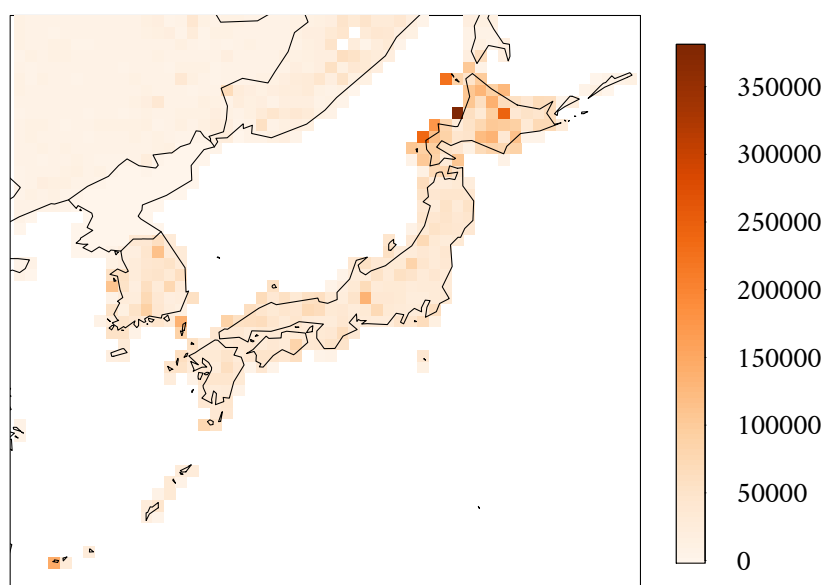


Figure 2: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a, 日本 (Japan), 2005.

2.1.2 ISIMIP2a/GPWv4

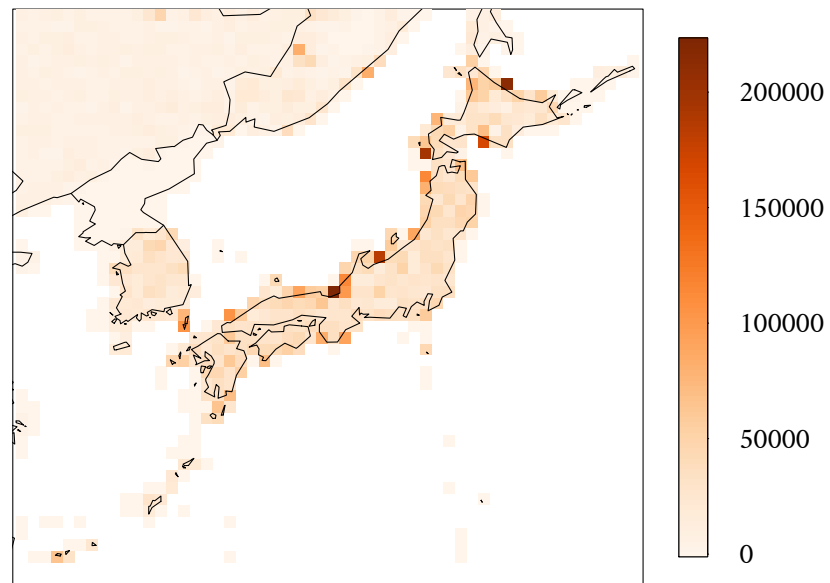


Figure 3: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a/GPWv4, 日本 (Japan), 2000.

2.1.3 ISIMIP2b

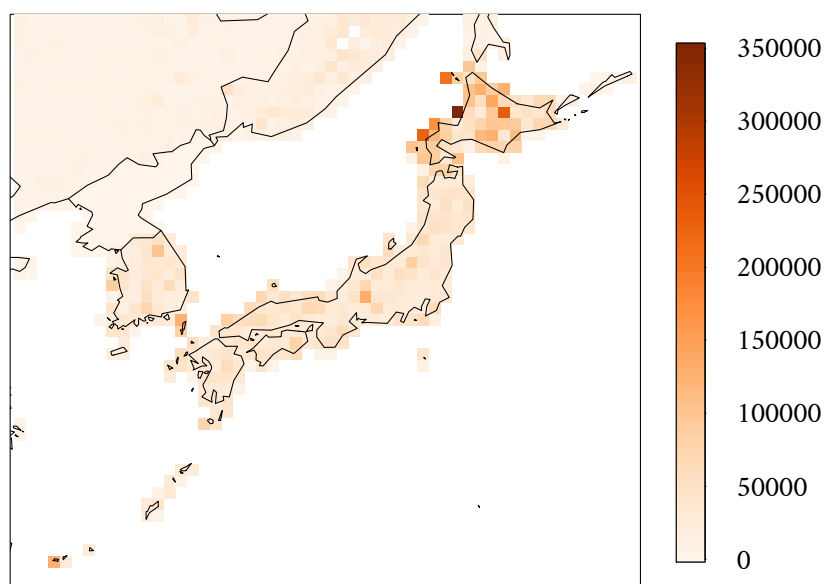


Figure 4: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, 日本 (Japan), 2000.

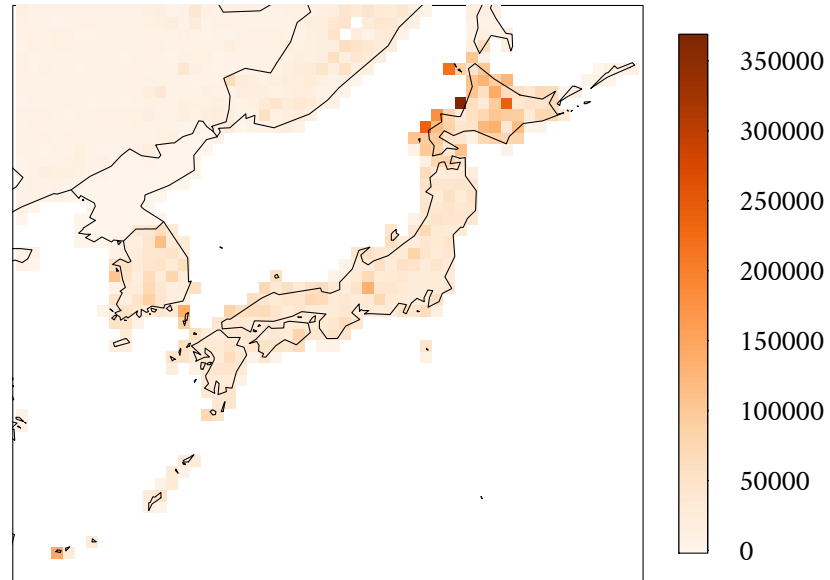


Figure 5: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, 日本 (Japan), 2005.

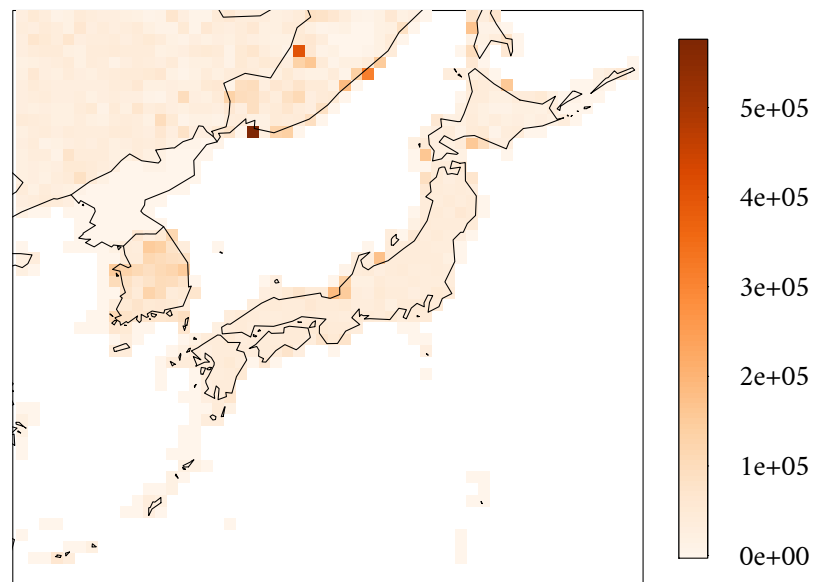


Figure 6: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, 日本 (Japan), 2030.

2.1.4 ISIMIP2b/GPWv4

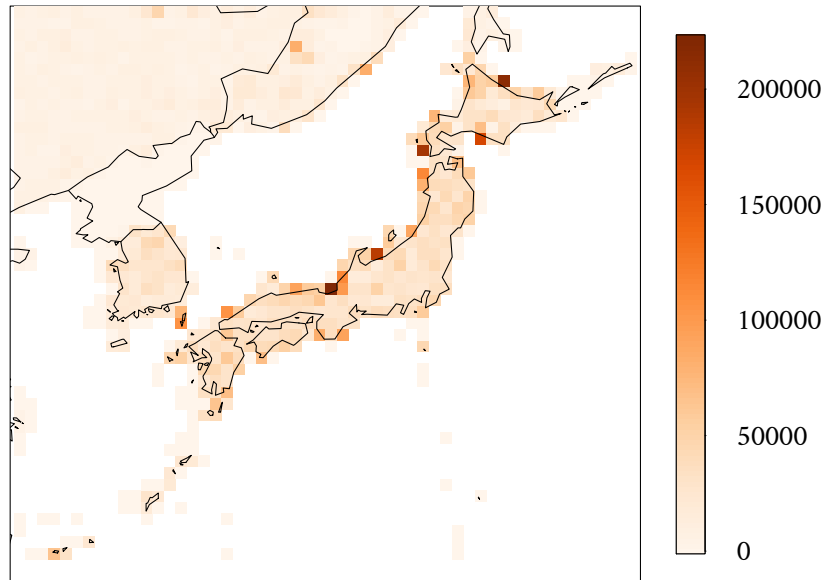


Figure 7: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b/GPWv4, 日本 (Japan), 2000.

2.1.5 LitPop/ISIMIP2a

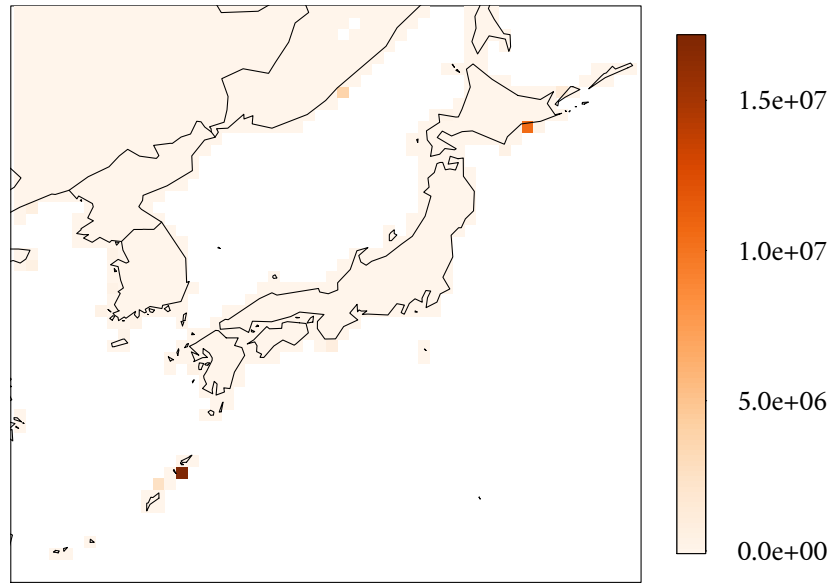


Figure 8: GCP per capita [2005 PPP US\$ per capita], LitPop/ISIMIP2a, 日本 (Japan), 2005.

2.1.6 LitPop/ISIMIP2b

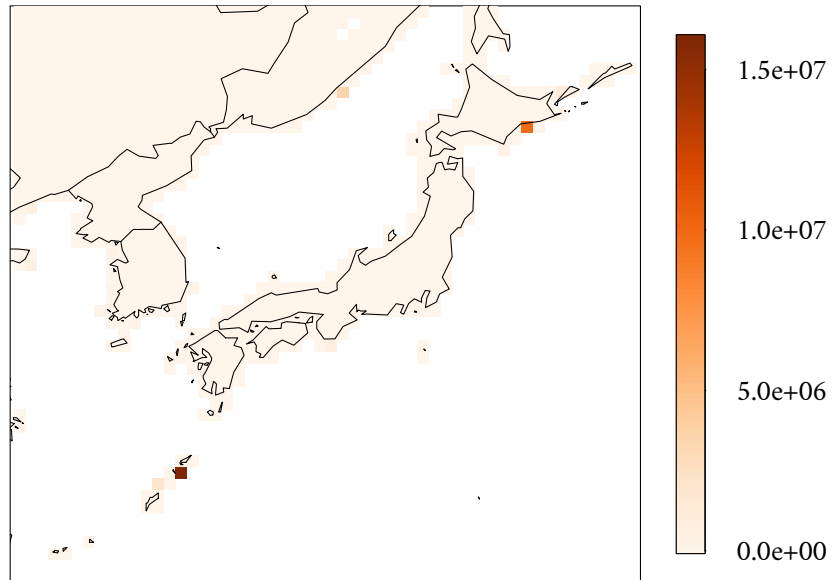


Figure 9: GCP per capita [2005 PPP US\$ per capita], LitPop/ISIMIP2b, 日本 (Japan), 2005.

2.2 Germany

2.2.1 ISIMIP2a

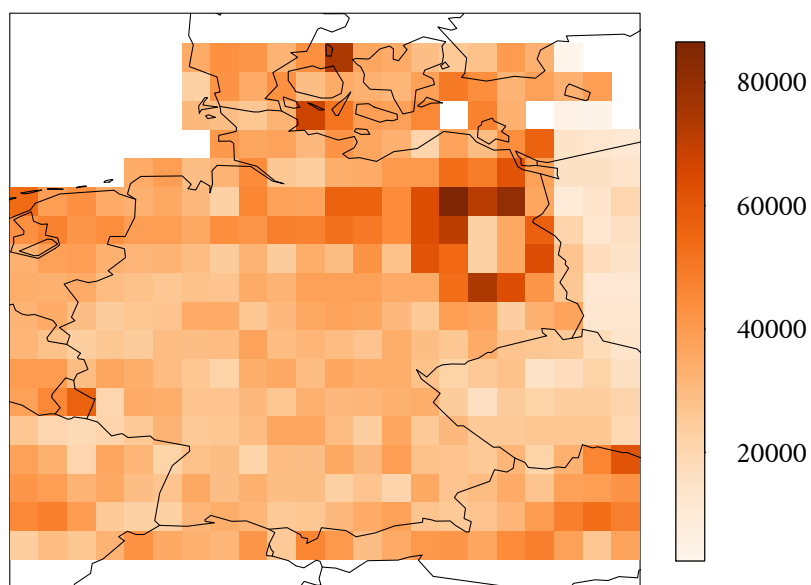


Figure 10: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a, Deutschland (Germany), 2000.

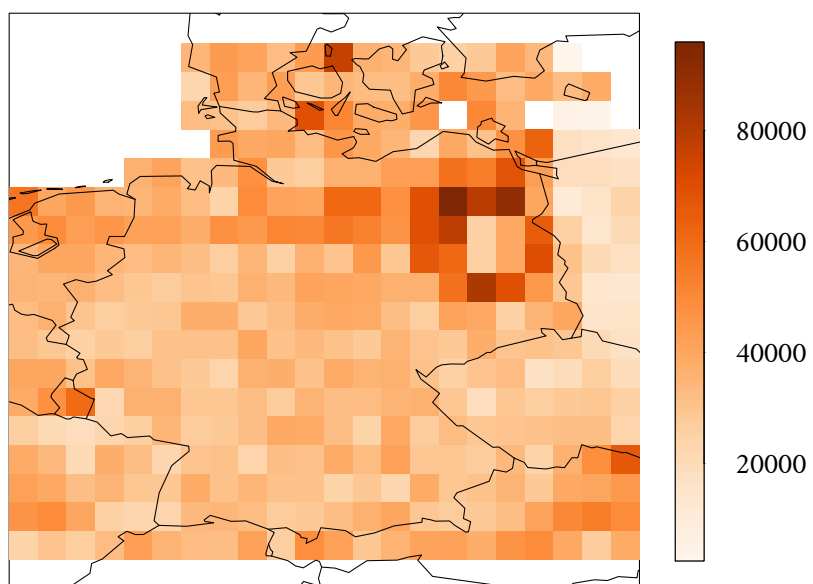


Figure 11: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a, Deutschland (Germany), 2005.

2.2.2 ISIMIP2a/GPWv4

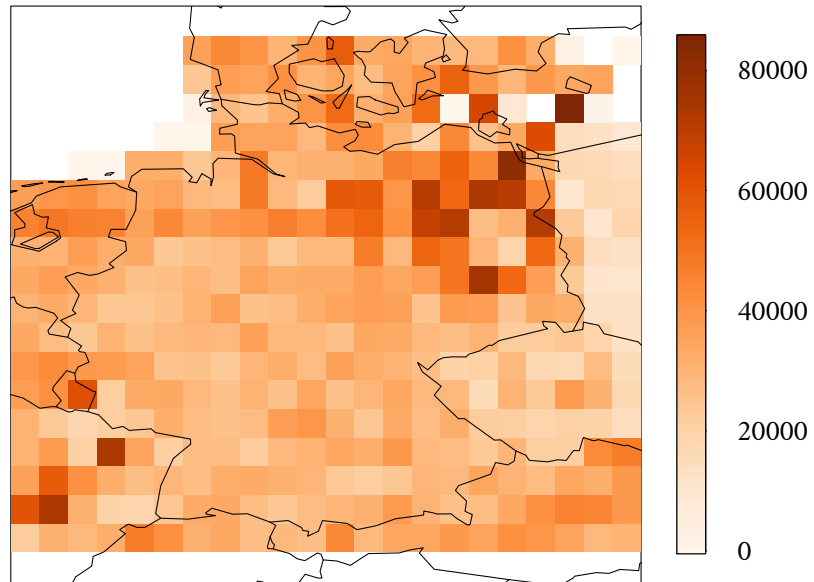


Figure 12: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a/GPWv4, Deutschland (Germany), 2000.

2.2.3 ISIMIP2b

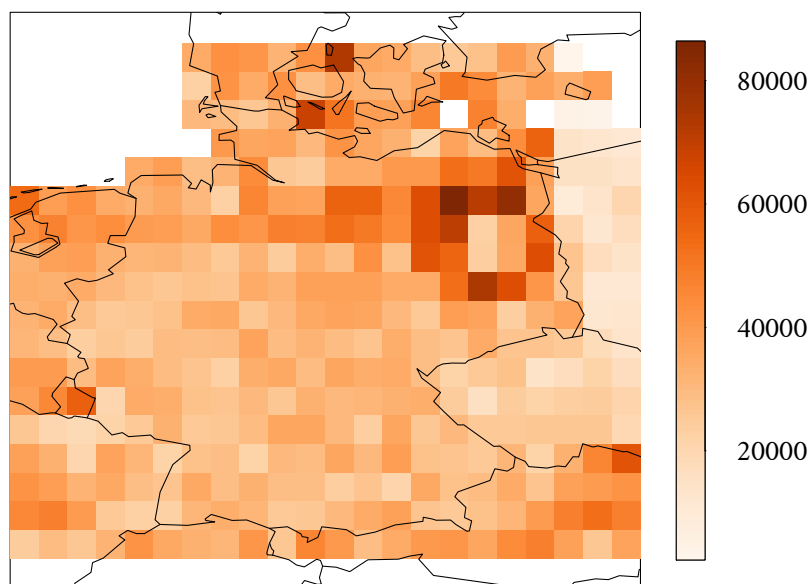


Figure 13: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, Deutschland (Germany), 2000.

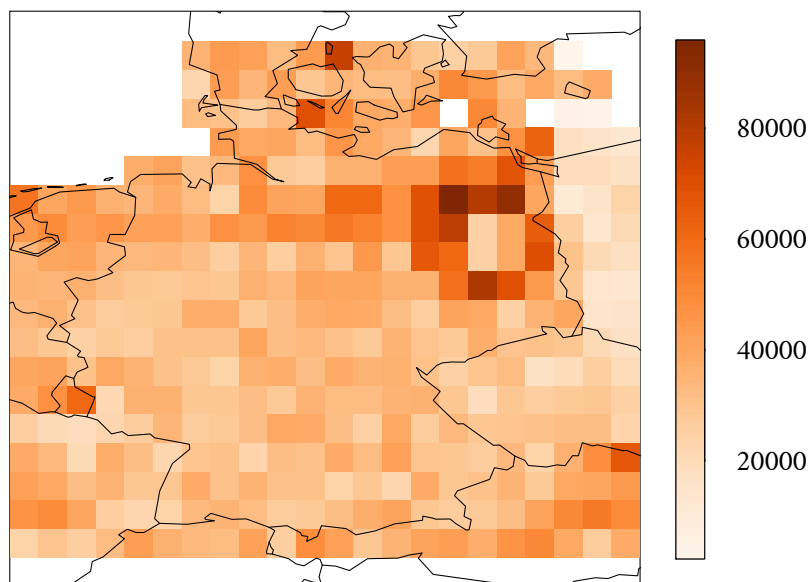


Figure 14: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, Deutschland (Germany), 2005.

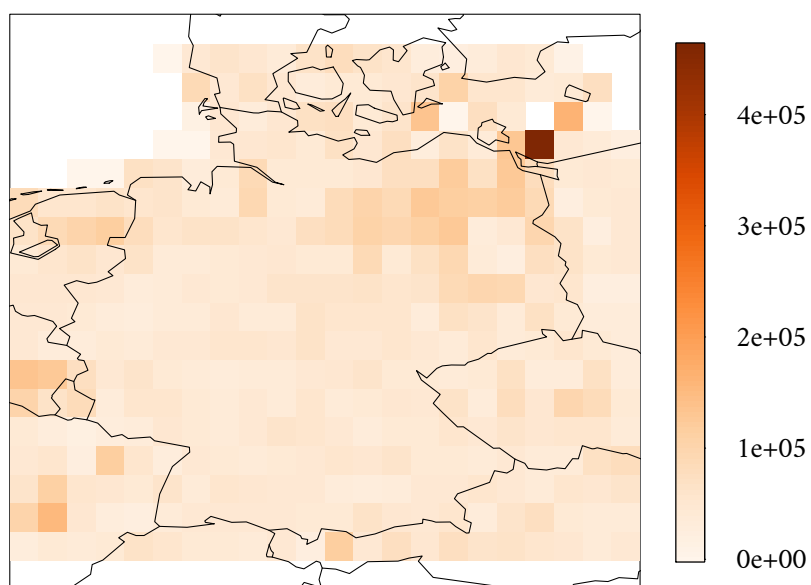


Figure 15: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, Deutschland (Germany), 2030.

2.2.4 ISIMIP2b/GPWv4

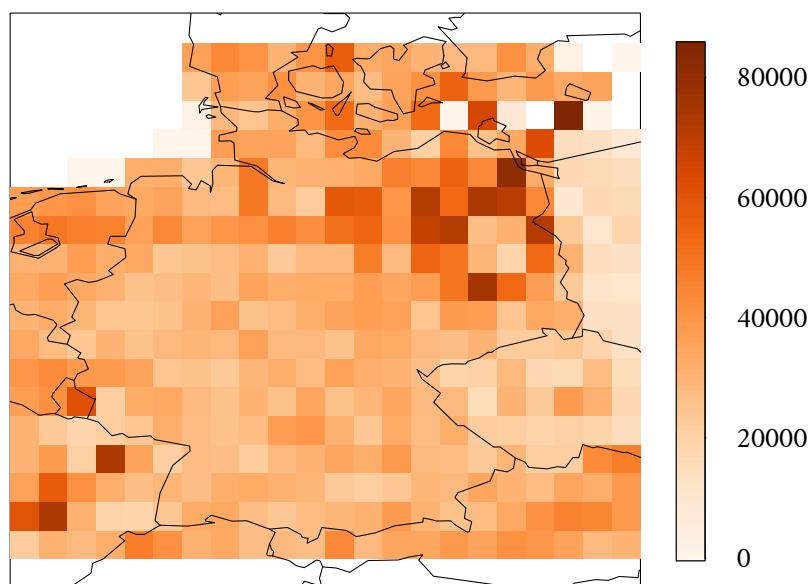


Figure 16: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b/GPWv4, Deutschland (Germany), 2000.

2.2.5 LitPop/ISIMIP2a

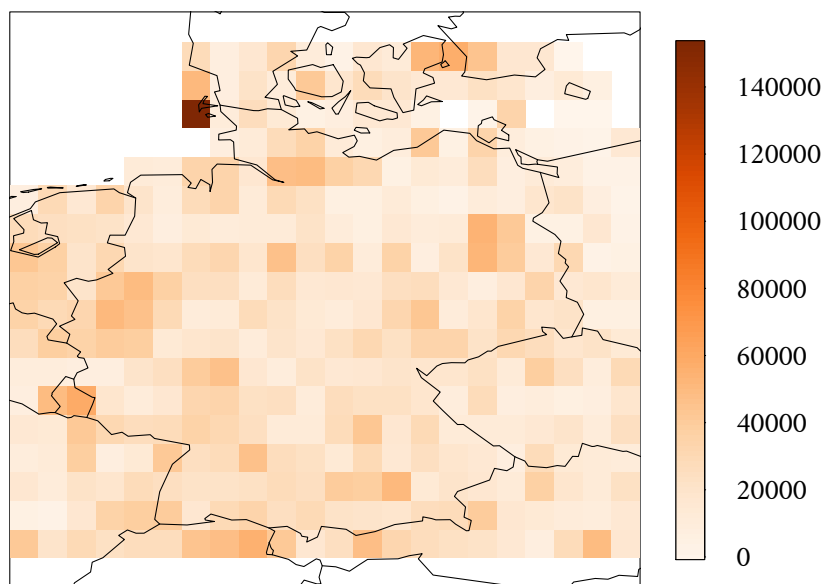


Figure 17: GCP per capita [2005 PPP US\$ per capita], LitPop/ISIMIP2a, Deutschland (Germany), 2005.

2.2.6 LitPop/ISIMIP2b

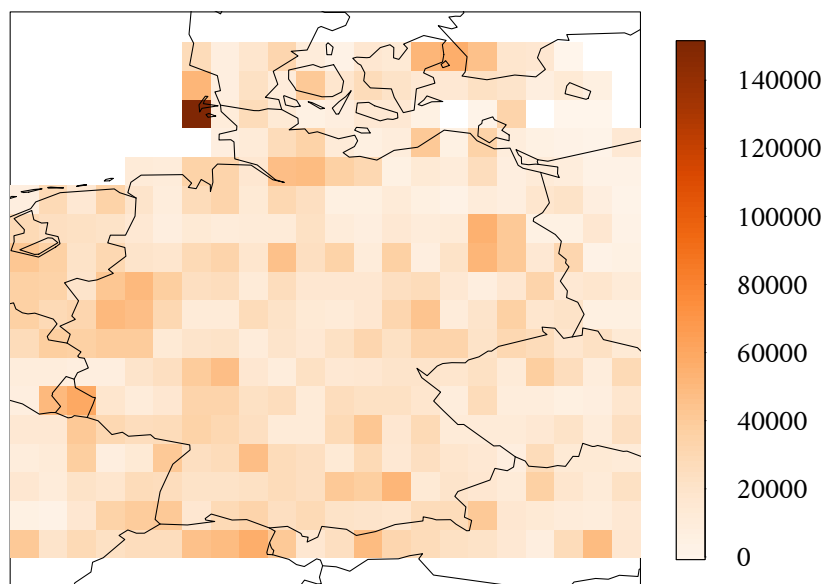


Figure 18: GCP per capita [2005 PPP US\$ per capita], LitPop/ISIMIP2b, Deutschland (Germany), 2005.

2.3 USA

2.3.1 ISIMIP2a

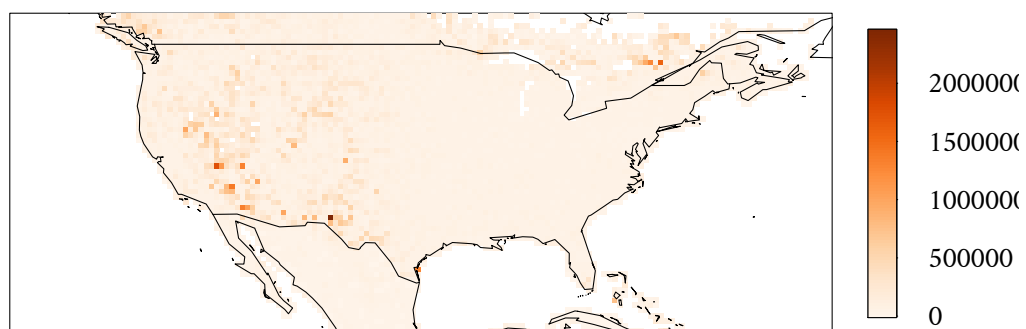


Figure 19: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a, USA, 2000.

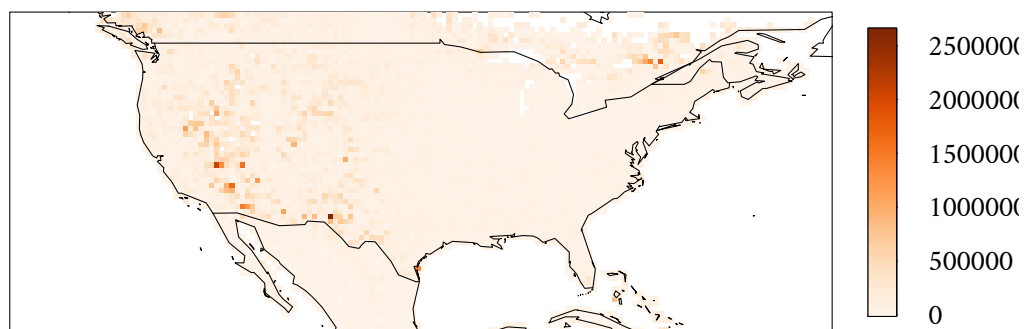


Figure 20: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a, USA, 2005.

2.3.2 ISIMIP2a/GPWv4

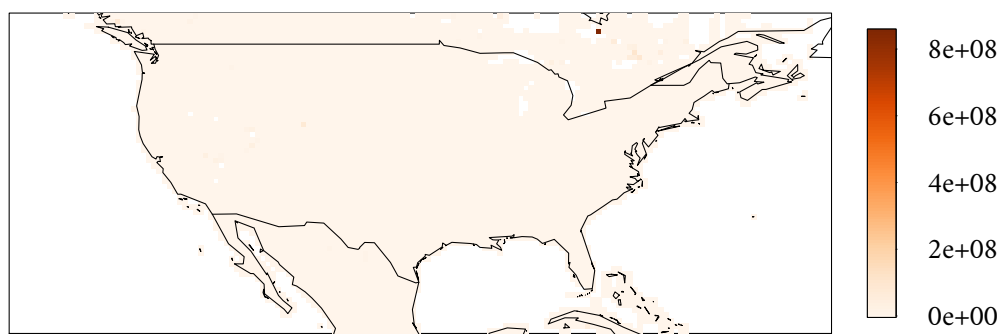


Figure 21: GCP per capita [2005 PPP US\$ per capita], ISIMIP2a/GPWv4, USA, 2000.

2.3.3 ISIMIP2b

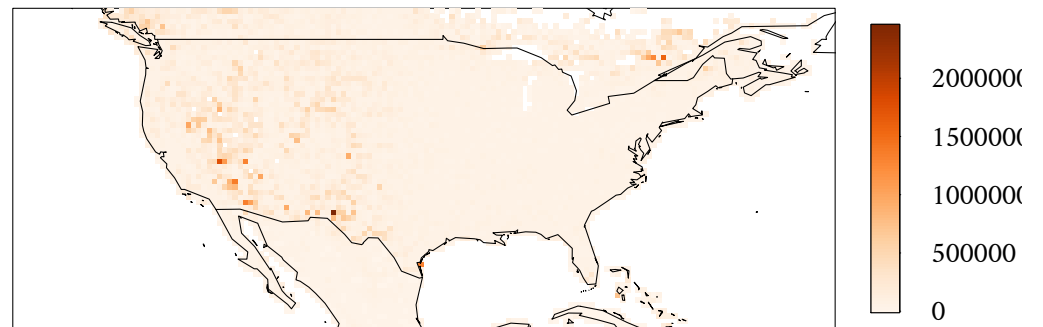


Figure 22: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, USA, 2000.

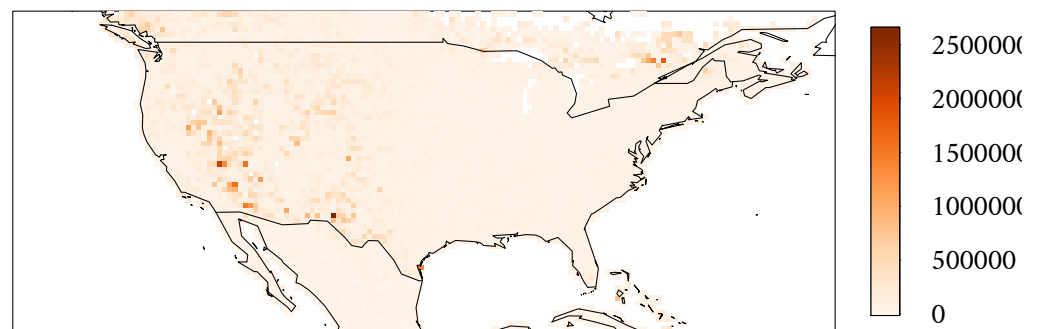


Figure 23: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, USA, 2005.

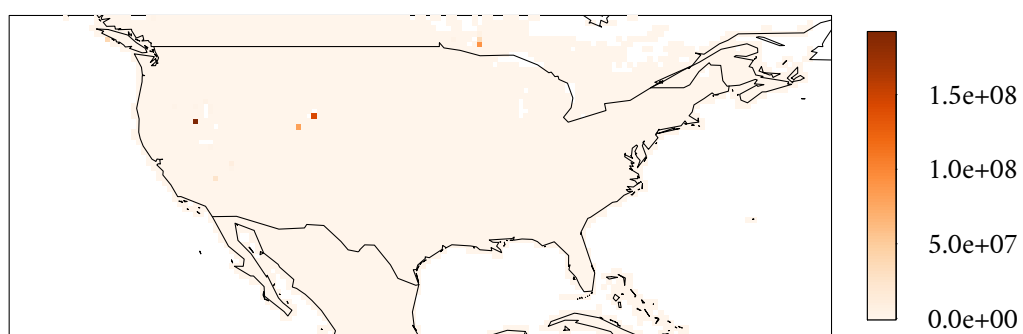


Figure 24: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b, USA, 2030.

2.3.4 ISIMIP2b/GPWv4

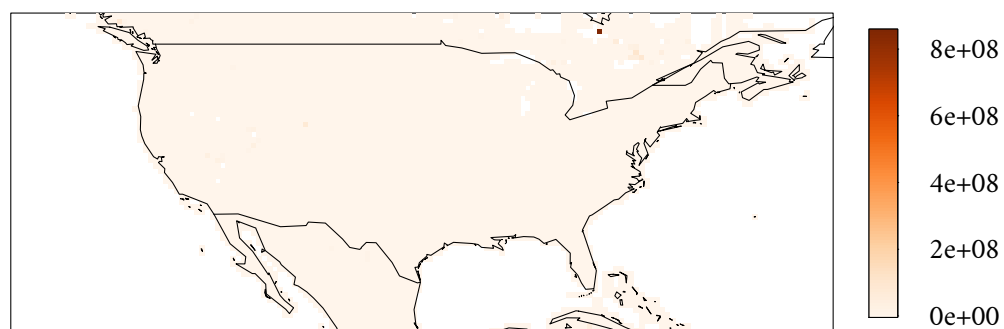


Figure 25: GCP per capita [2005 PPP US\$ per capita], ISIMIP2b/GPWv4, USA, 2000.

2.3.5 LitPop/ISIMIP2a

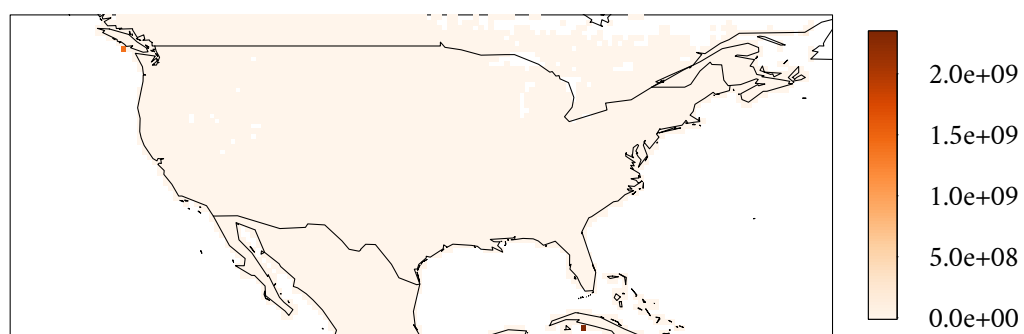


Figure 26: GCP per capita [2005 PPP US\$ per capita], LitPop/ISIMIP2a, USA, 2005.

2.3.6 LitPop/ISIMIP2b

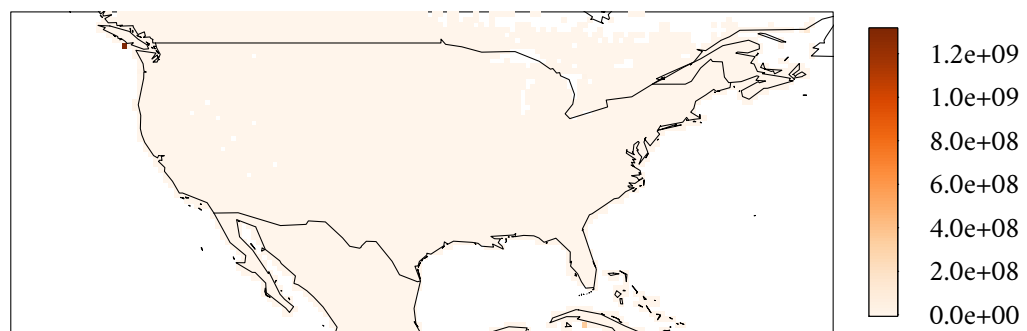


Figure 27: GCP per capita [2005 PPP US\$ per capita], LitPop/ISIMIP2b, USA, 2005.

3 GCP data

3.1 Japan

3.1.1 ISIMIP2a

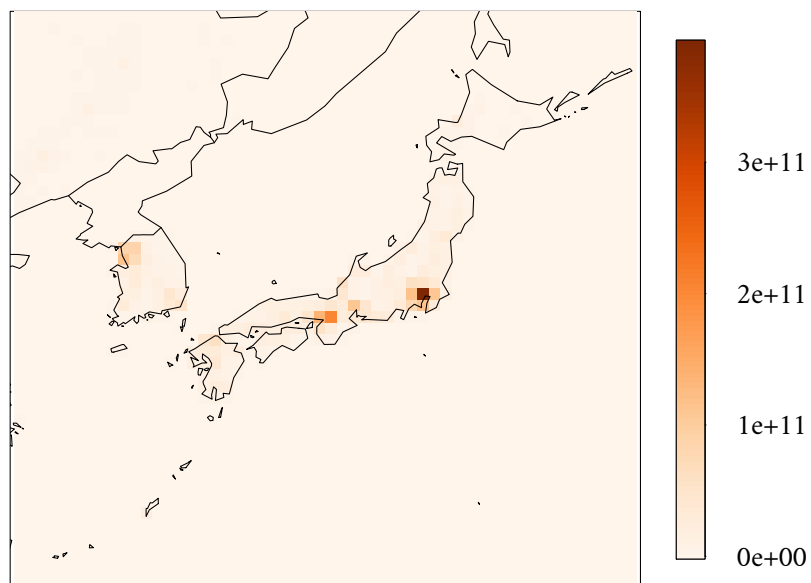


Figure 28: GCP [2005 PPP US\$], ISIMIP2a, 日本 (Japan), 2000.

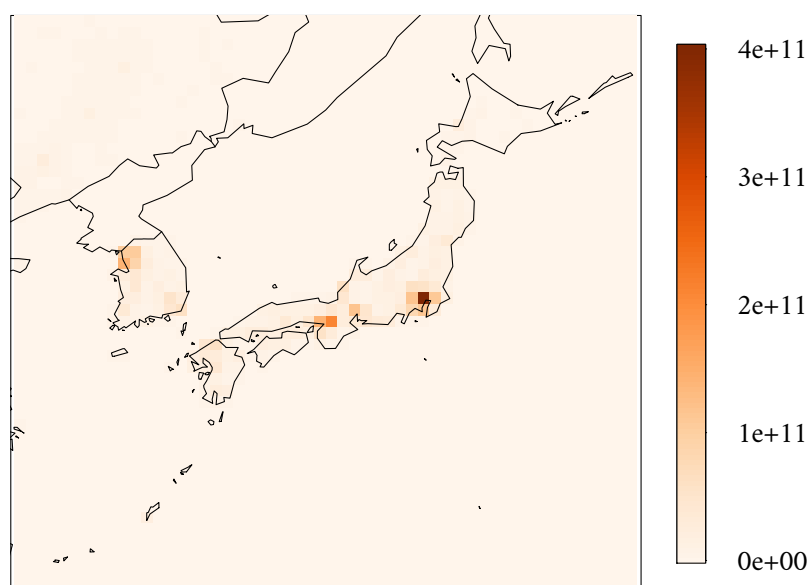


Figure 29: GCP [2005 PPP US\$], ISIMIP2a, 日本 (Japan), 2005.

3.1.2 ISIMIP2b

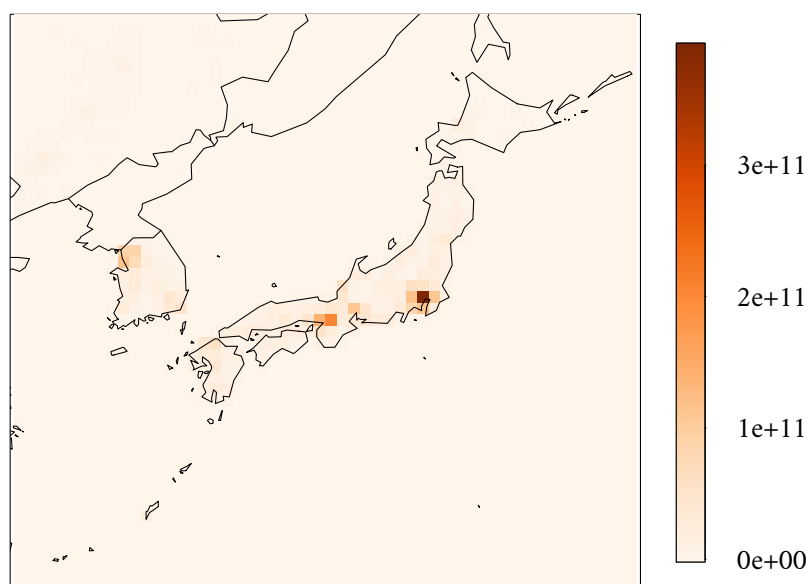


Figure 30: GCP [2005 PPP US\$], ISIMIP2b, 日本 (Japan), 2000.

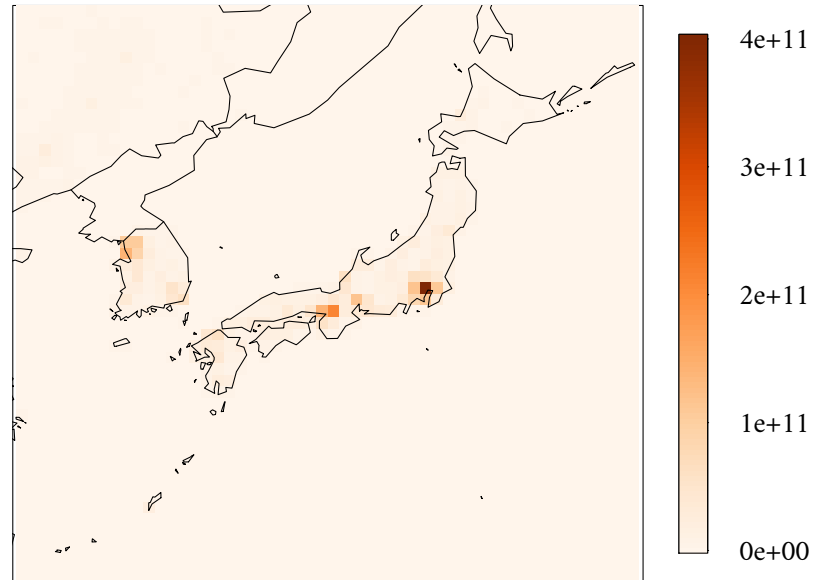


Figure 31: GCP [2005 PPP US\$], ISIMIP2b, 日本 (Japan), 2005.

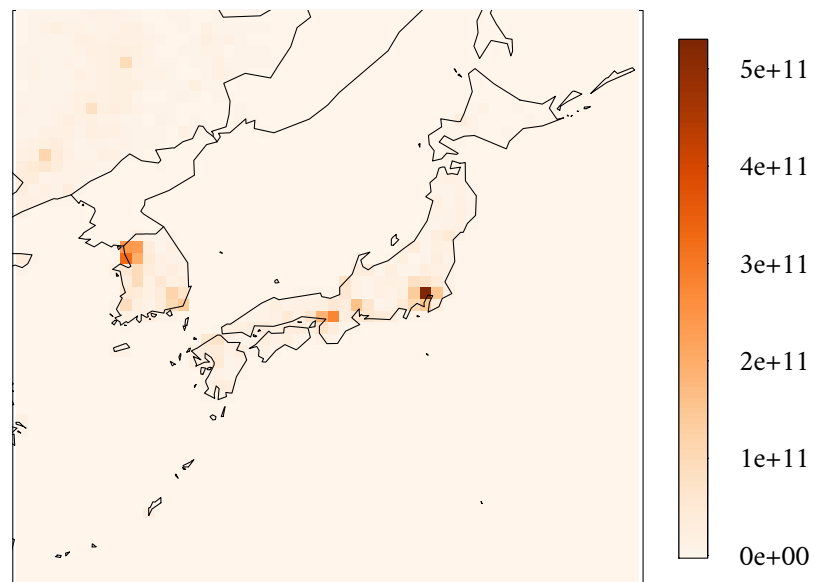


Figure 32: GCP [2005 PPP US\$], ISIMIP2b, 日本 (Japan), 2030.

3.1.3 LitPop

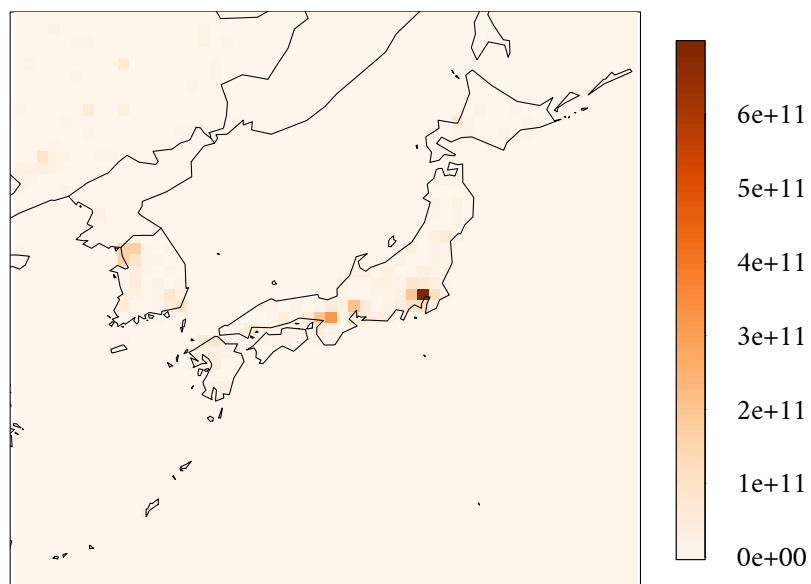


Figure 33: GCP [2005 PPP US\$], LitPop, 日本 (Japan), 2005.

3.2 Germany

3.2.1 ISIMIP2a

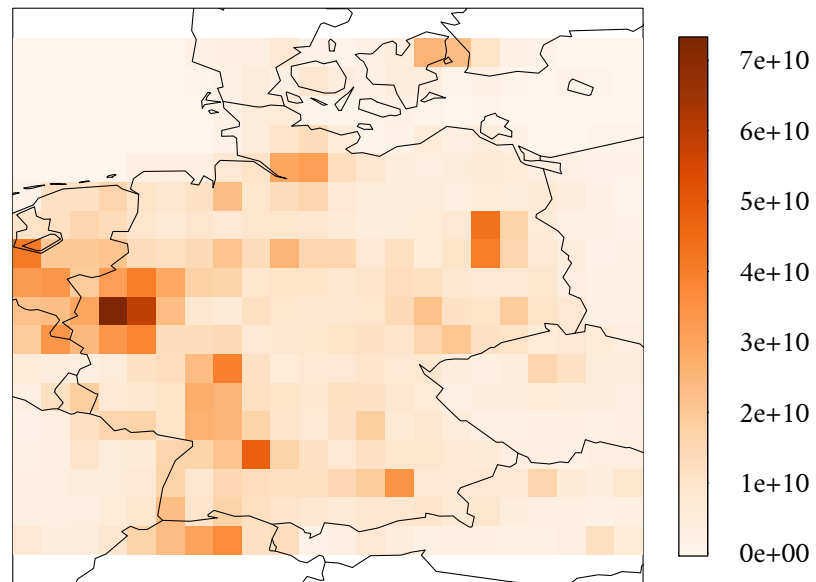


Figure 34: GCP [2005 PPP US\$], ISIMIP2a, Deutschland (Germany), 2000.

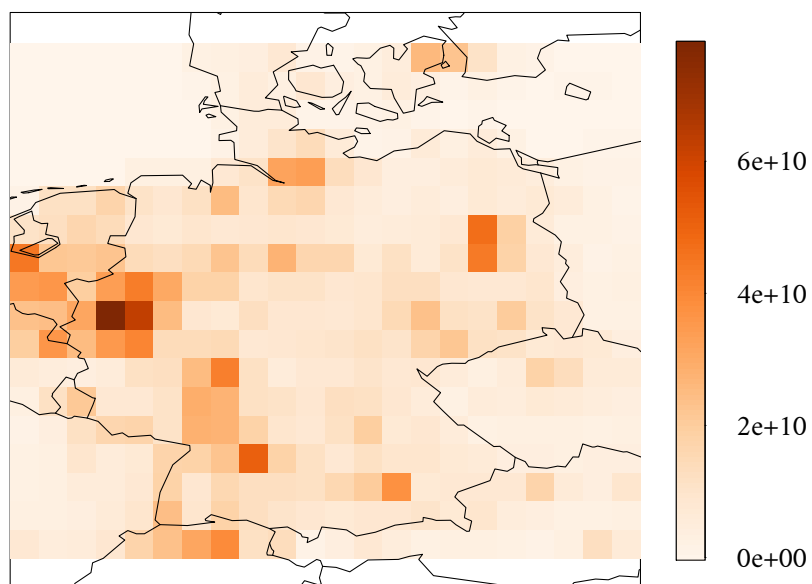


Figure 35: GCP [2005 PPP US\$], ISIMIP2a, Deutschland (Germany), 2005.

3.2.2 ISIMIP2b

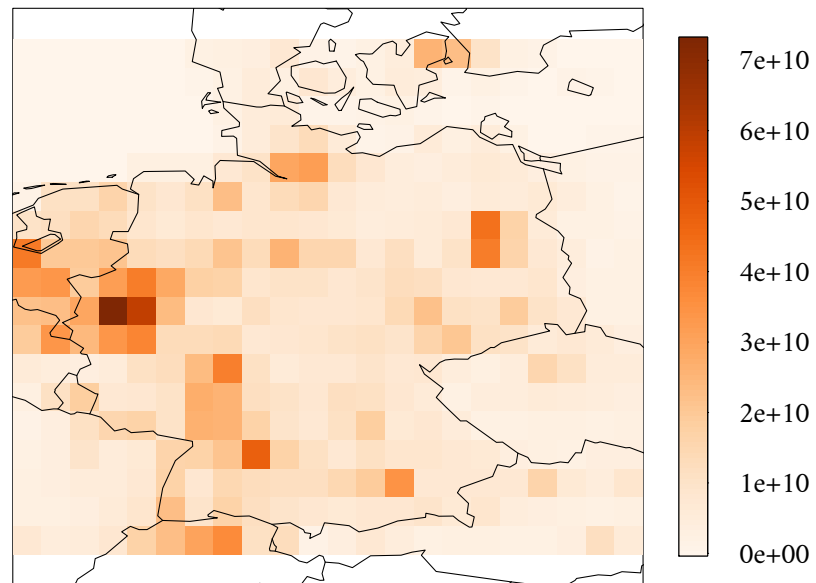


Figure 36: GCP [2005 PPP US\$], ISIMIP2b, Deutschland (Germany), 2000.

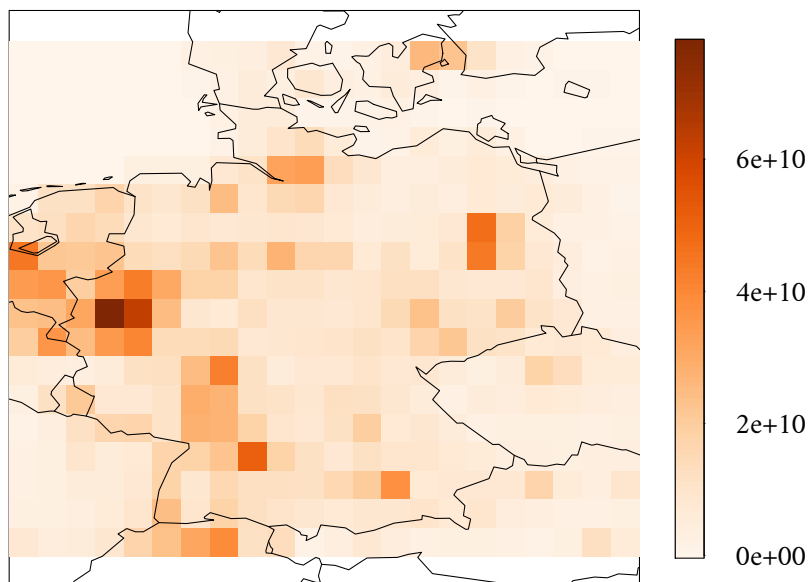


Figure 37: GCP [2005 PPP US\$], ISIMIP2b, Deutschland (Germany), 2005.

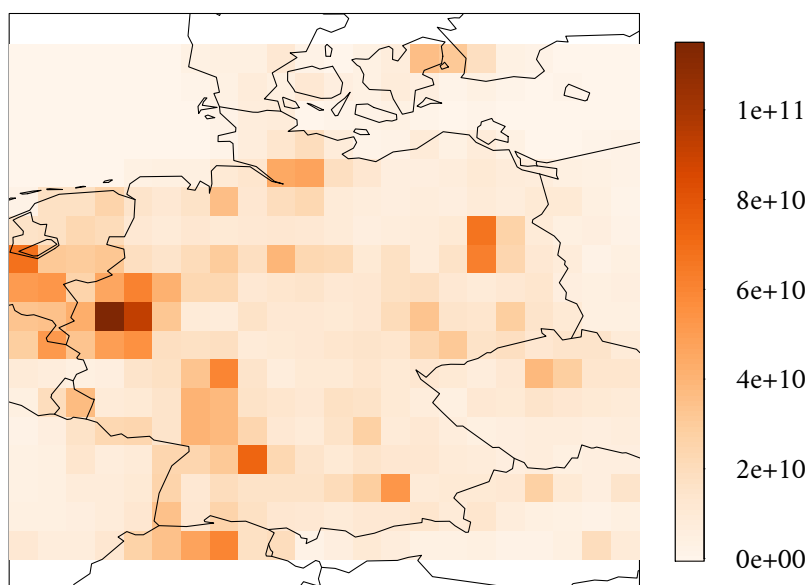


Figure 38: GCP [2005 PPP US\$], ISIMIP2b, Deutschland (Germany), 2030.

3.2.3 LitPop

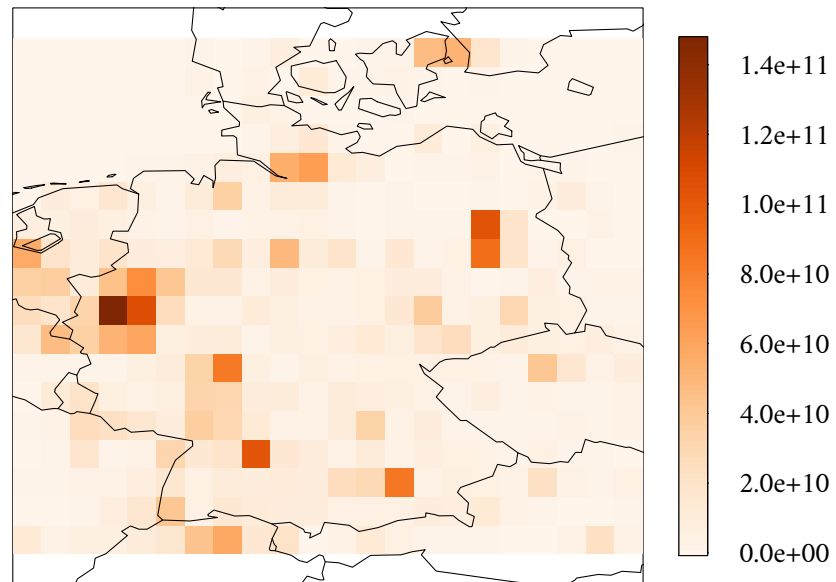


Figure 39: GCP [2005 PPP US\$], LitPop, Deutschland (Germany), 2005.

3.3 USA

3.3.1 ISIMIP2a

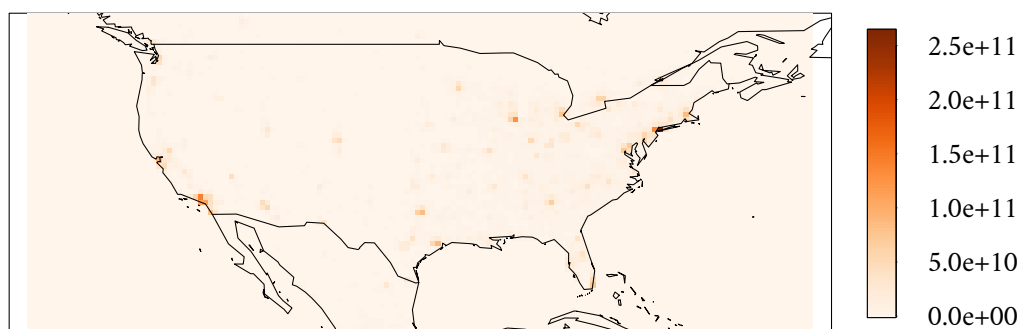


Figure 40: GCP [2005 PPP US\$], ISIMIP2a, USA, 2000.

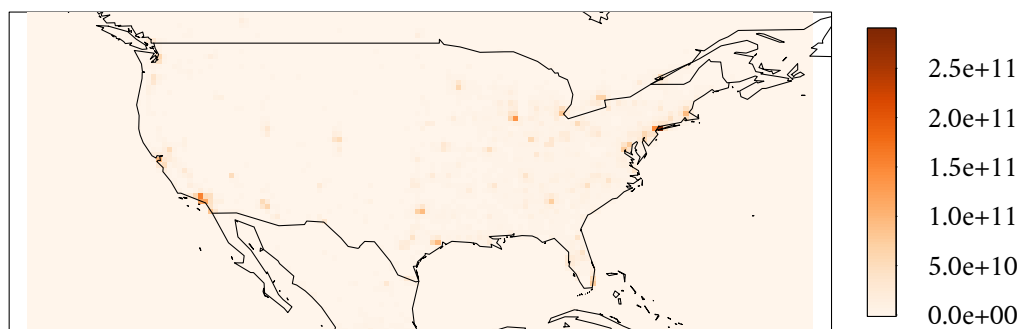


Figure 41: GCP [2005 PPP US\$], ISIMIP2a, USA, 2005.

3.3.2 ISIMIP2b

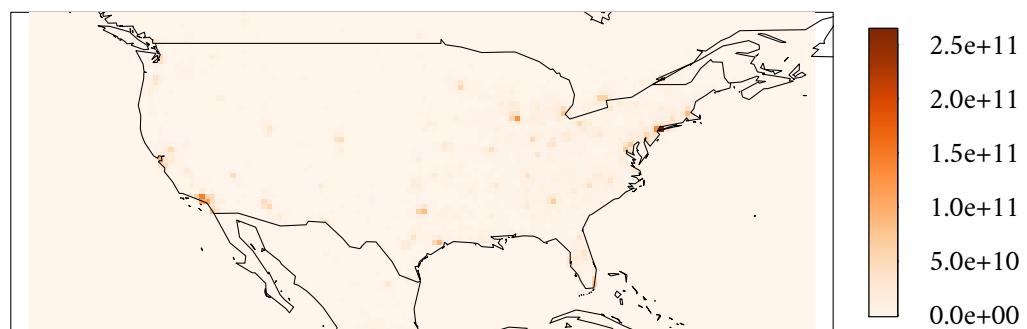


Figure 42: GCP [2005 PPP US\$], ISIMIP2b, USA, 2000.

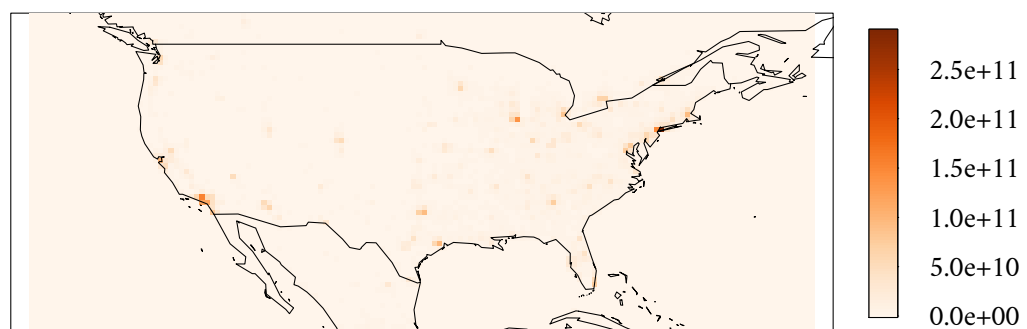


Figure 43: GCP [2005 PPP US\$], ISIMIP2b, USA, 2005.

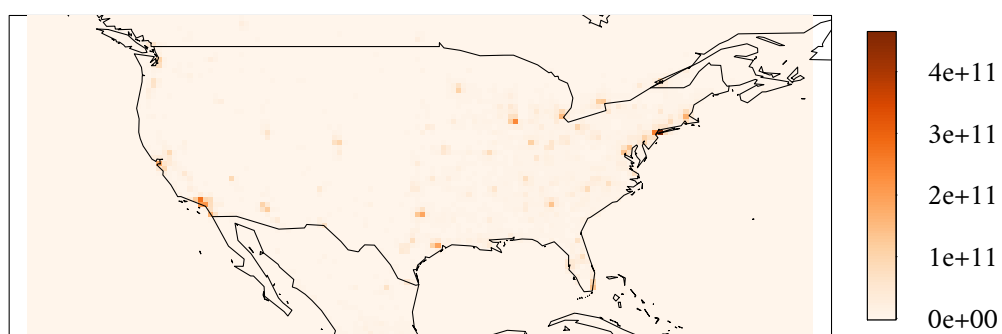


Figure 44: GCP [2005 PPP US\$], ISIMIP2b, USA, 2030.

3.3.3 LitPop

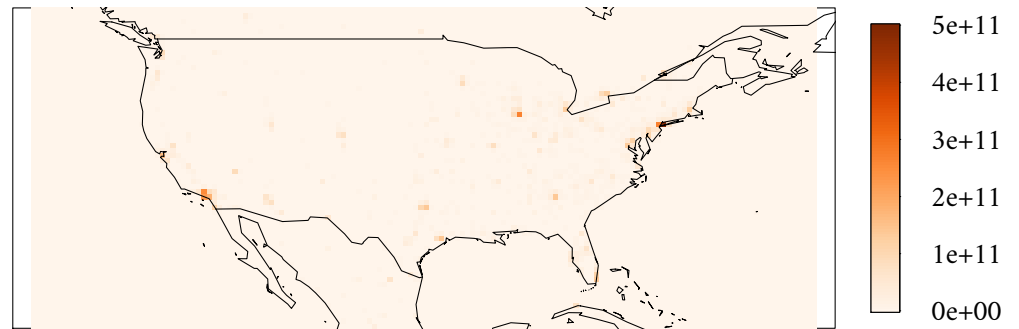


Figure 45: GCP [2005 PPP US\$], LitPop, USA, 2005.

4 Population data

4.1 Japan

4.1.1 GPWv4

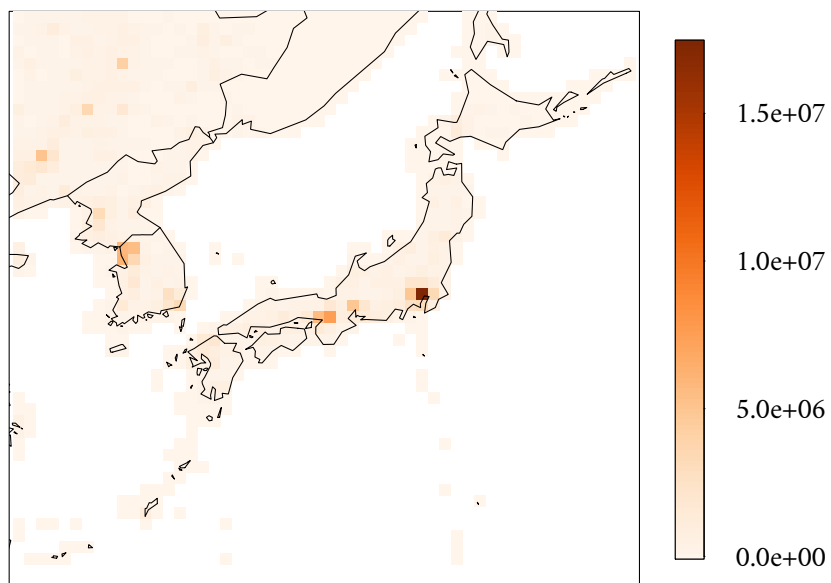


Figure 46: population [number of people], GPWv4, 日本 (Japan), 2000.

4.1.2 ISIMIP2a

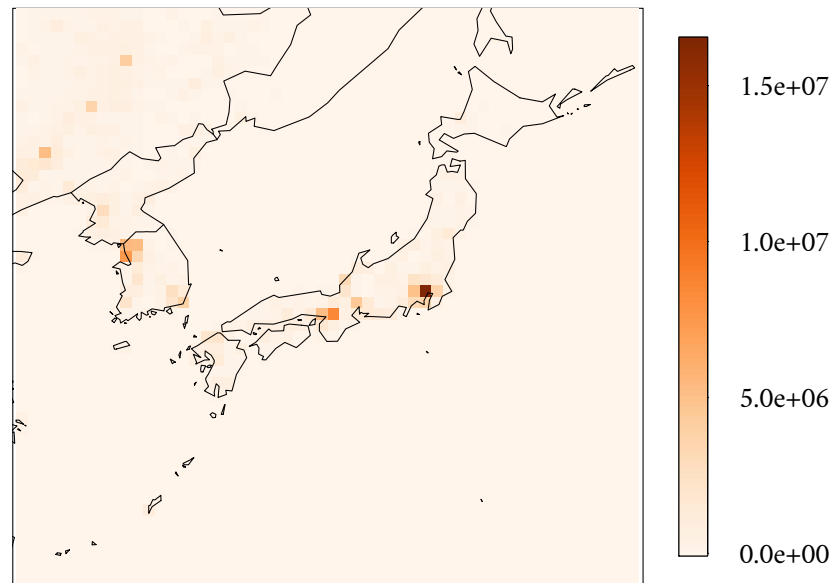


Figure 47: population [number of people], ISIMIP2a, 日本 (Japan), 2000.

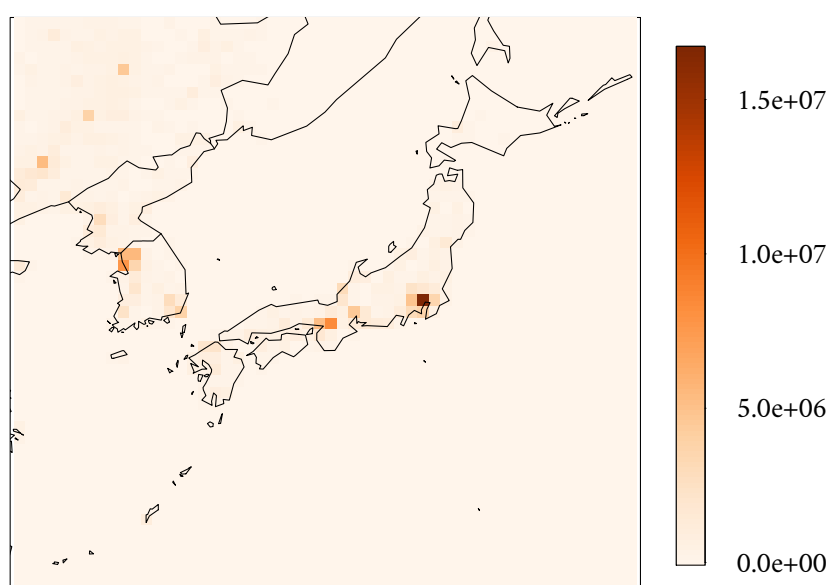


Figure 48: population [number of people], ISIMIP2a, 日本 (Japan), 2005.

4.1.3 ISIMIP2b

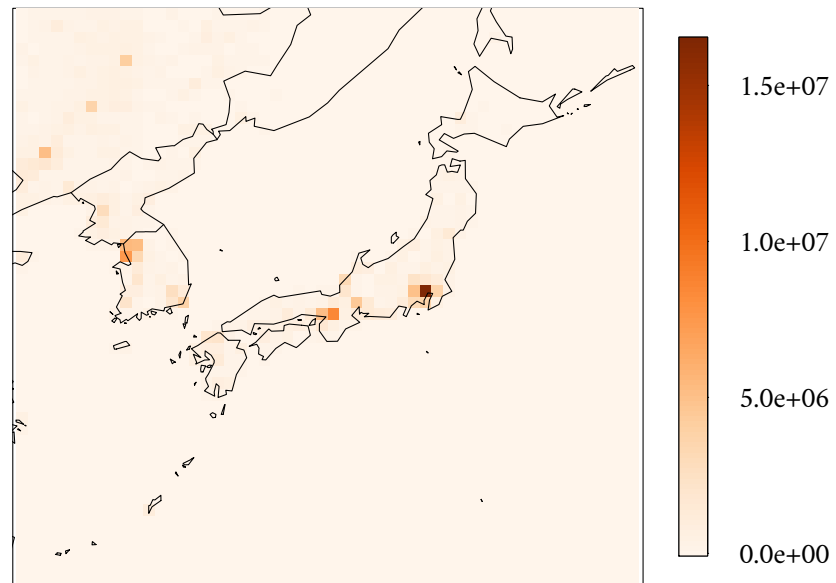


Figure 49: population [number of people], ISIMIP2b, 日本 (Japan), 2000.

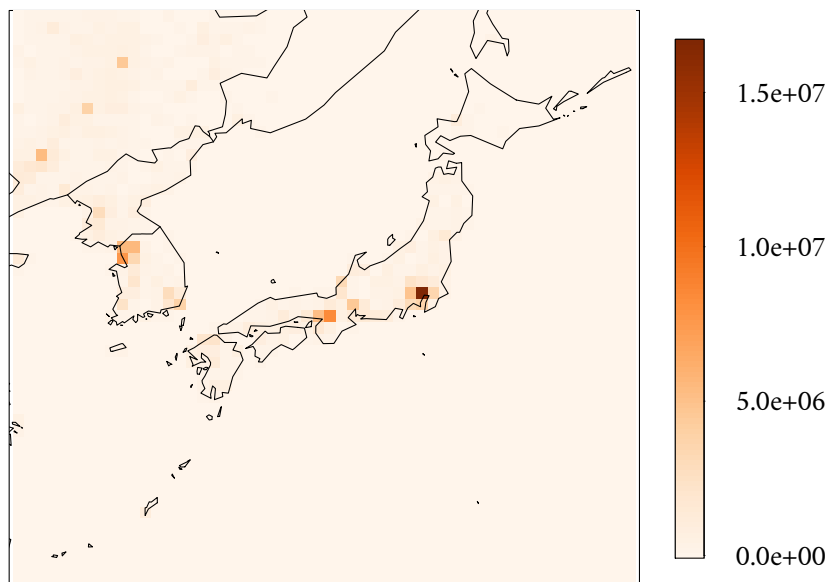


Figure 50: population [number of people], ISIMIP2b, 日本 (Japan), 2005.

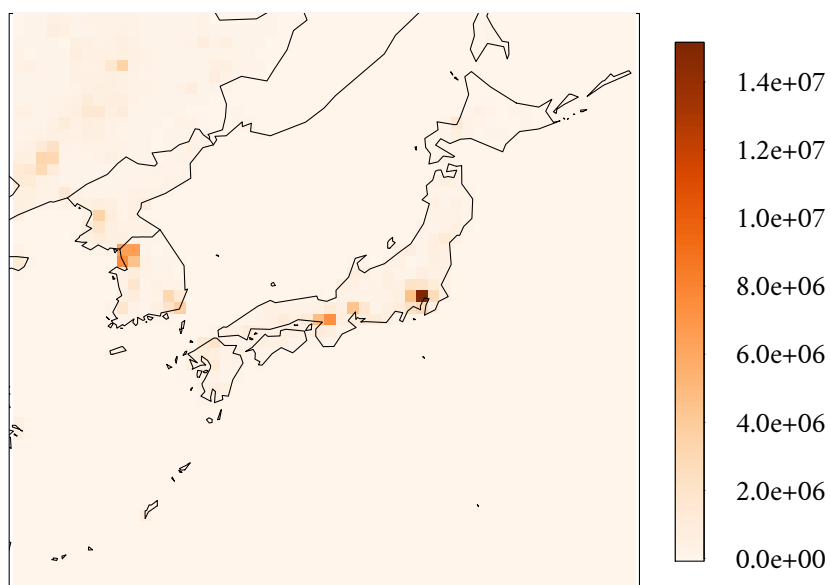


Figure 51: population [number of people], ISIMIP2b, 日本 (Japan), 2030.

4.2 Germany

4.2.1 GPWv4

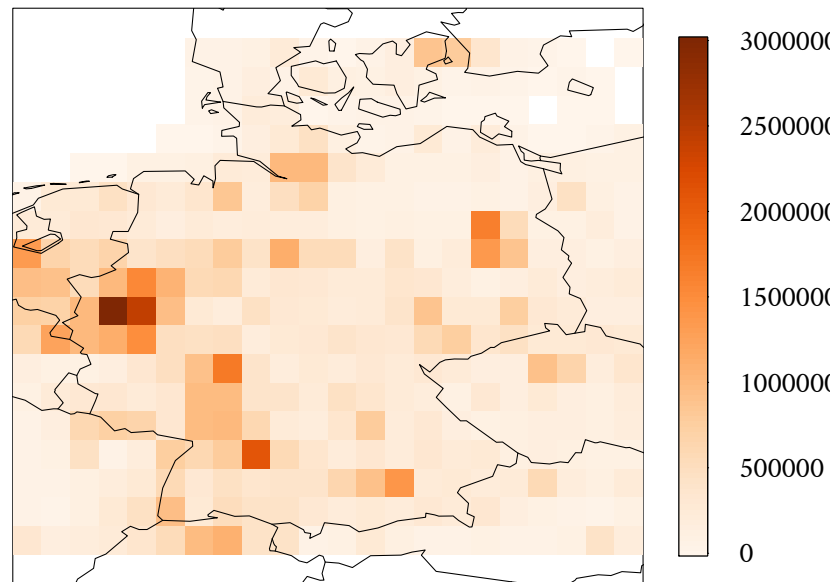


Figure 52: population [number of people], GPWv4, Deutschland (Germany), 2000.

4.2.2 ISIMIP2a

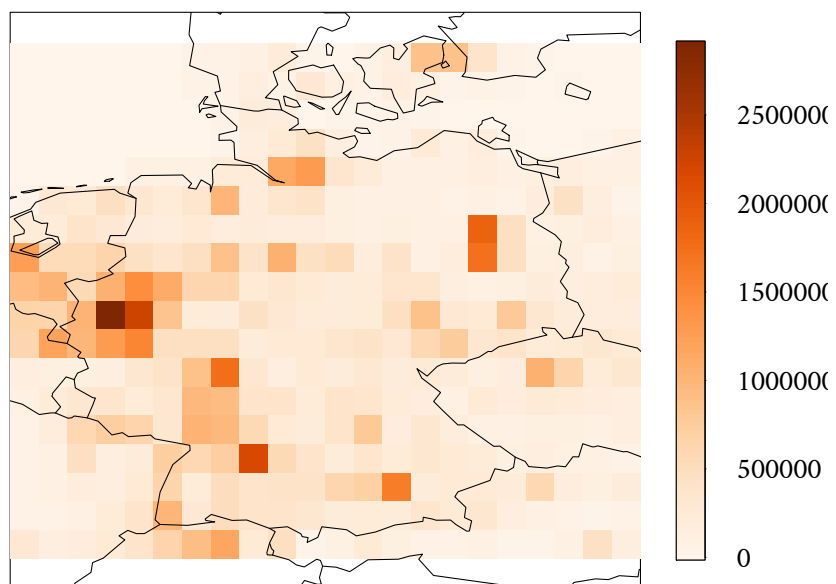


Figure 53: population [number of people], ISIMIP2a, Deutschland (Germany), 2000.

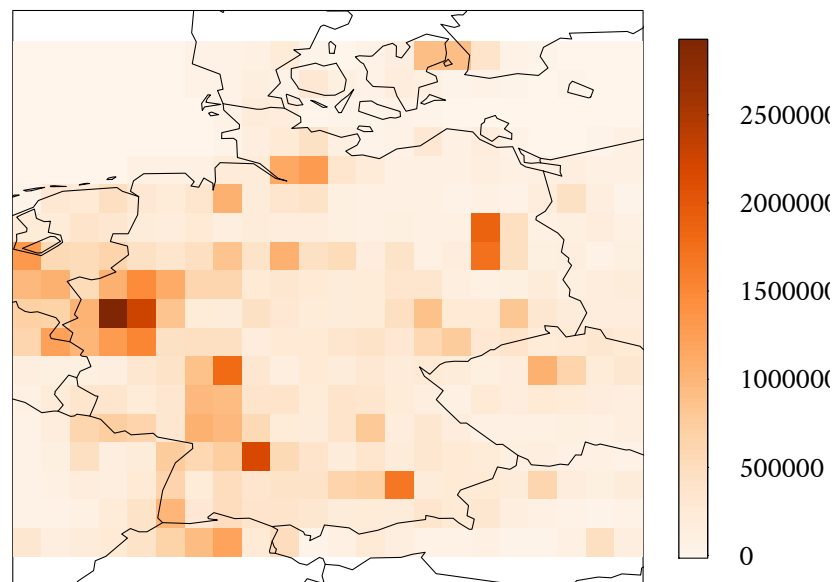


Figure 54: population [number of people], ISIMIP2a, Deutschland (Germany), 2005.

4.2.3 ISIMIP2b

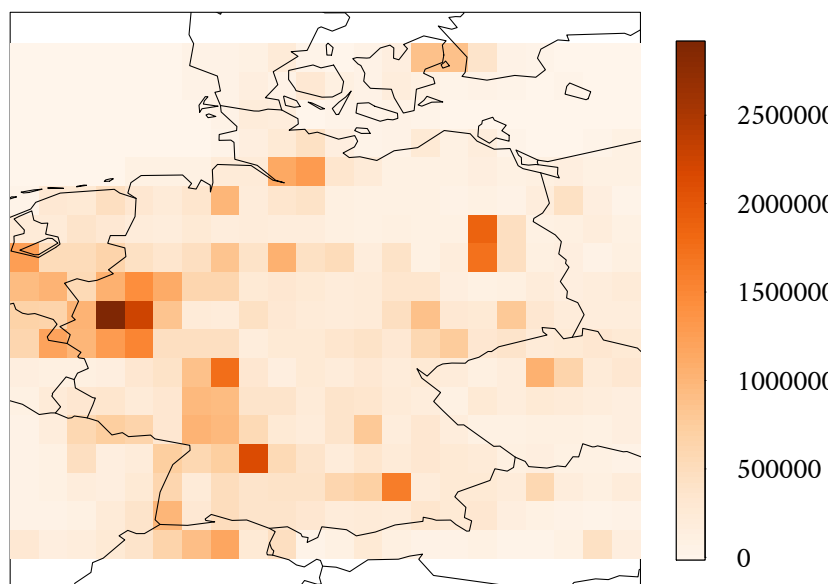


Figure 55: population [number of people], ISIMIP2b, Deutschland (Germany), 2000.

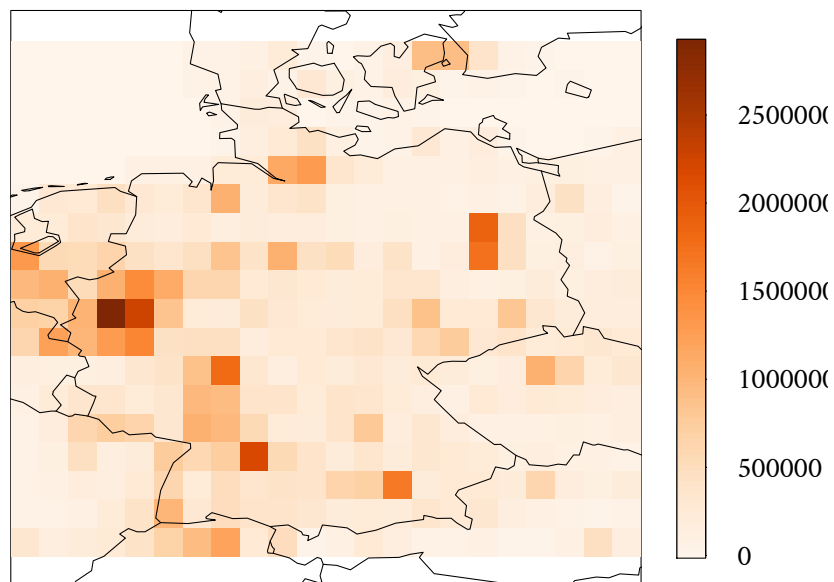


Figure 56: population [number of people], ISIMIP2b, Deutschland (Germany), 2005.

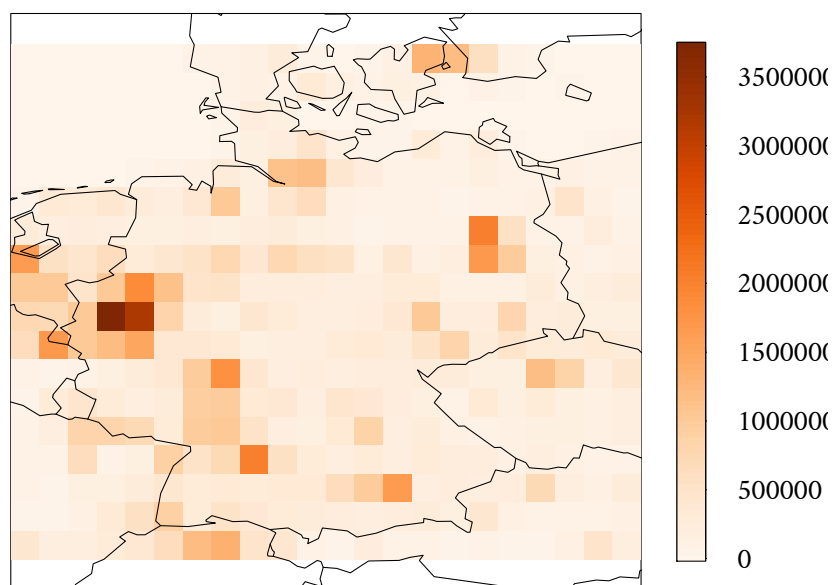


Figure 57: population [number of people], ISIMIP2b, Deutschland (Germany), 2030.

4.3 USA

4.3.1 GPWv4

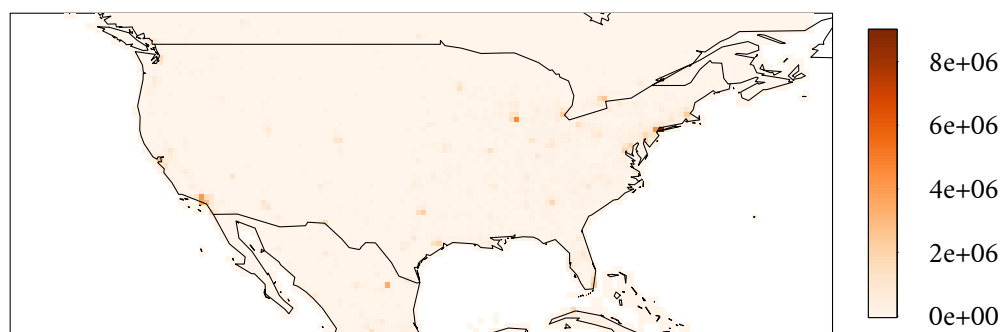


Figure 58: population [number of people], GPWv4, USA, 2000.

4.3.2 ISIMIP2a

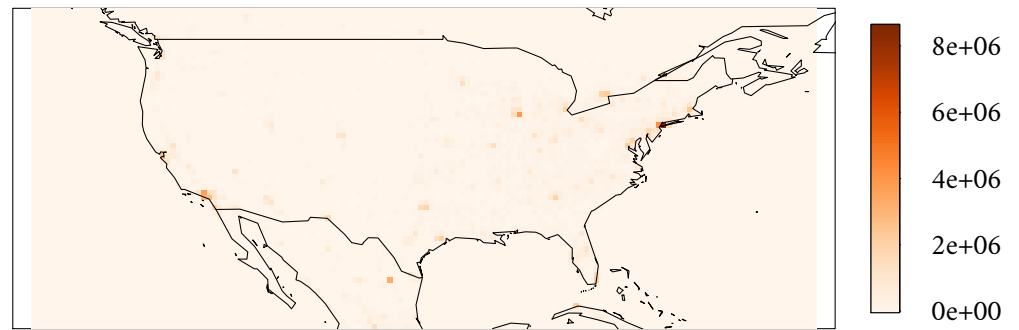


Figure 59: population [number of people], ISIMIP2a, USA, 2000.

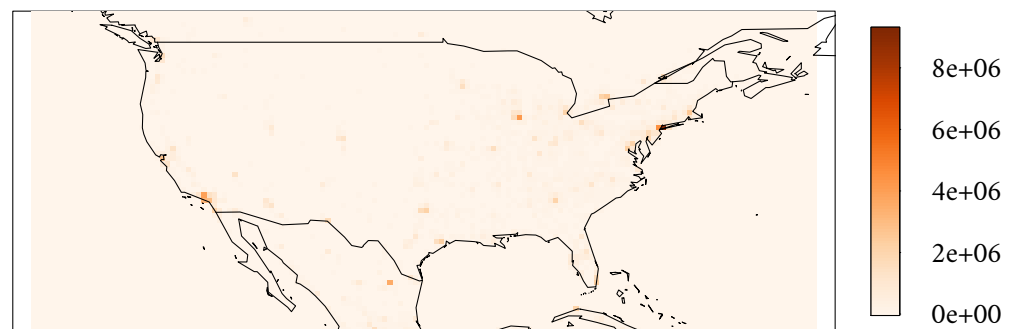


Figure 60: population [number of people], ISIMIP2a, USA, 2005.

4.3.3 ISIMIP2b

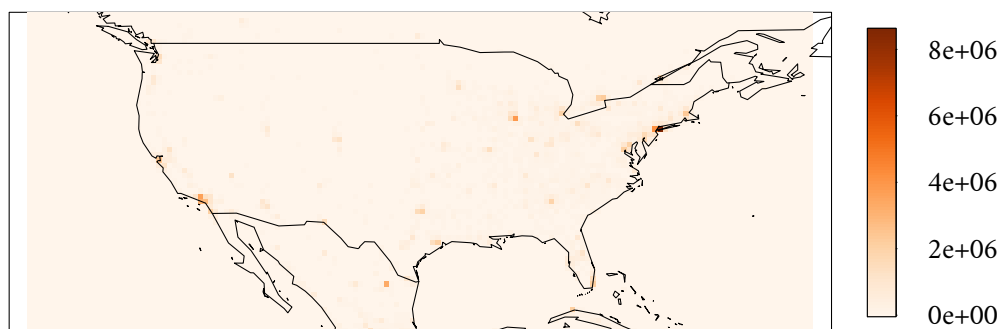


Figure 61: population [number of people], ISIMIP2b, USA, 2000.

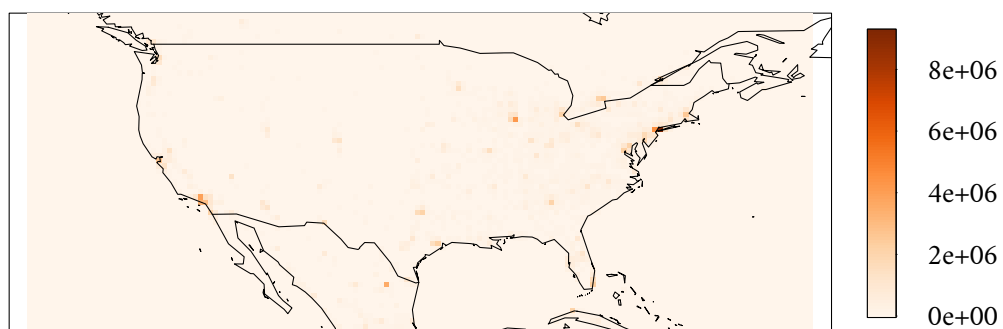


Figure 62: population [number of people], ISIMIP2b, USA, 2005.

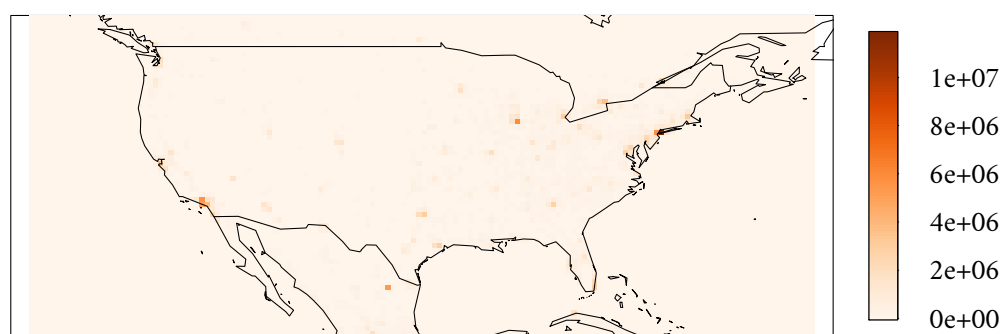


Figure 63: population [number of people], ISIMIP2b, USA, 2030.

5 Comparisons of data sets

5.1 Comparison of LitPop and ISIMIP GCP data

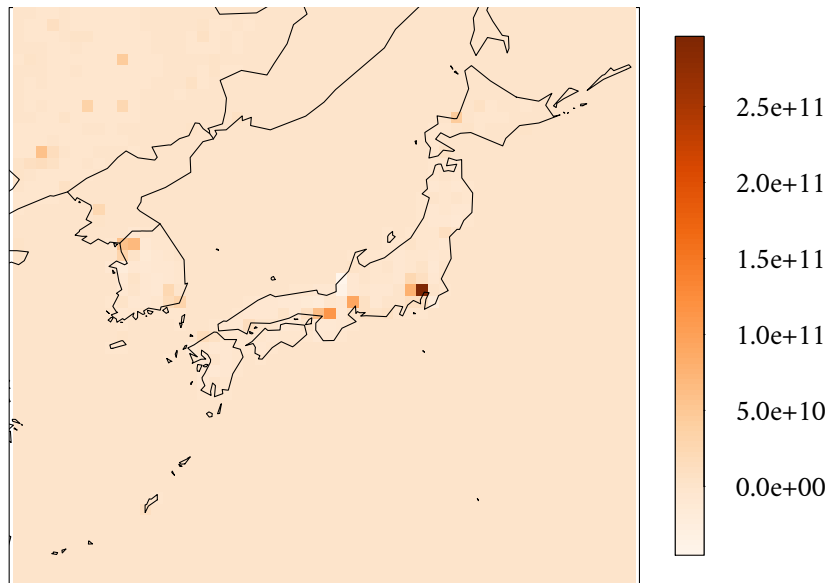


Figure 64: absolute difference between LitPop and ISIMIP2b (LitPop–ISIMIP2b), 日本 (Japan), 2005.

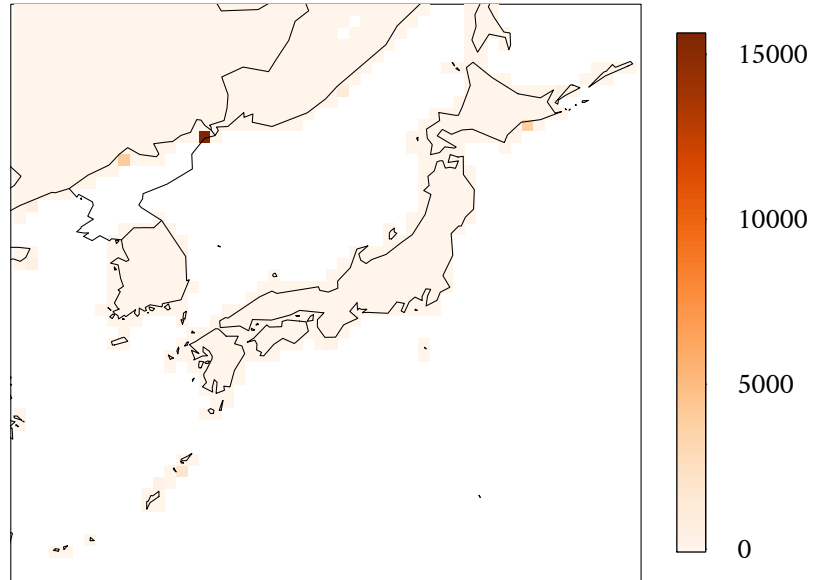


Figure 65: relative difference between LitPop and ISIMIP2b (abs. difference / ISIMIP2b), 日本 (Japan), 2005.

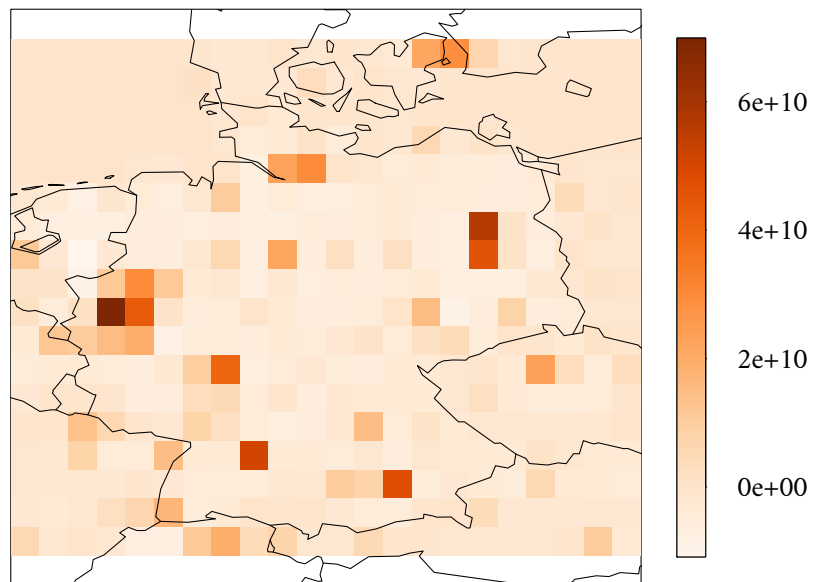


Figure 66: absolute difference between LitPop and ISIMIP2b (LitPop–ISIMIP2b), Deutschland (Germany), 2005.

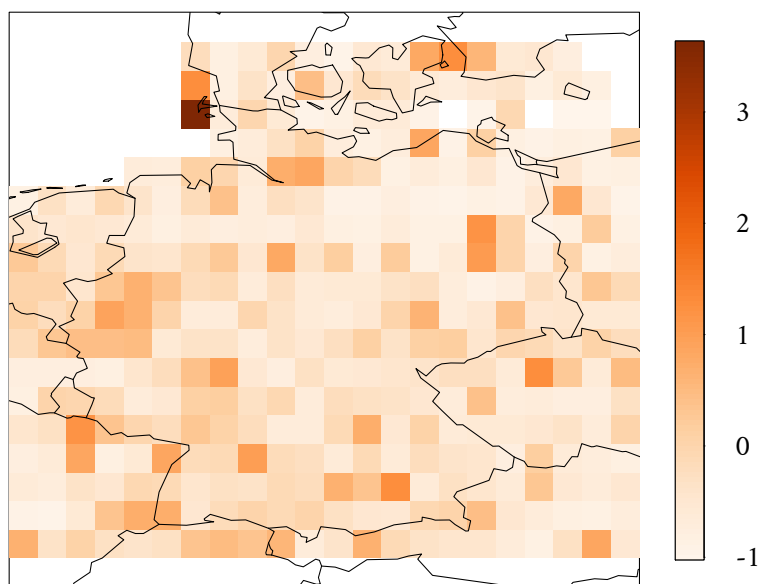


Figure 67: relative difference between LitPop and ISIMIP2b (abs. difference / ISIMIP2b), Deutschland (Germany), 2005.

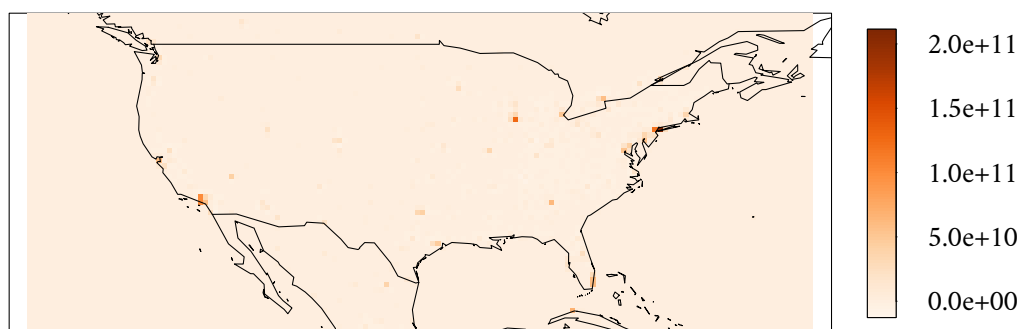


Figure 68: absolute difference between LitPop and ISIMIP2b (LitPop-ISMIP2b), USA, 2005.

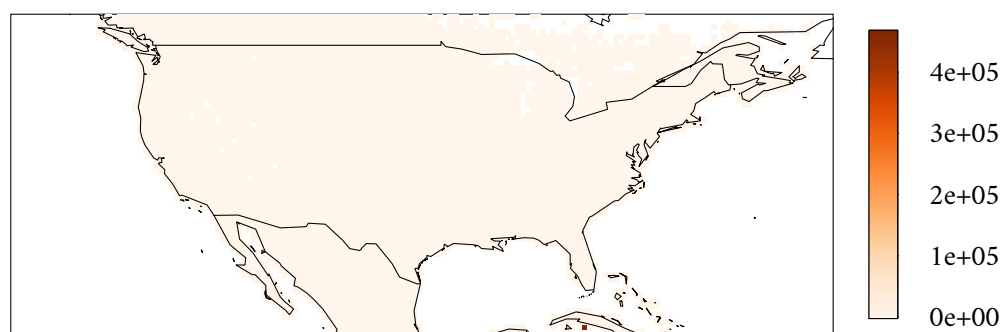


Figure 69: relative difference between LitPop and ISIMIP2b (abs. difference / ISIMIP2b), USA, 2005.

5.2 Comparison of GPWv4 and ISIMIP population data

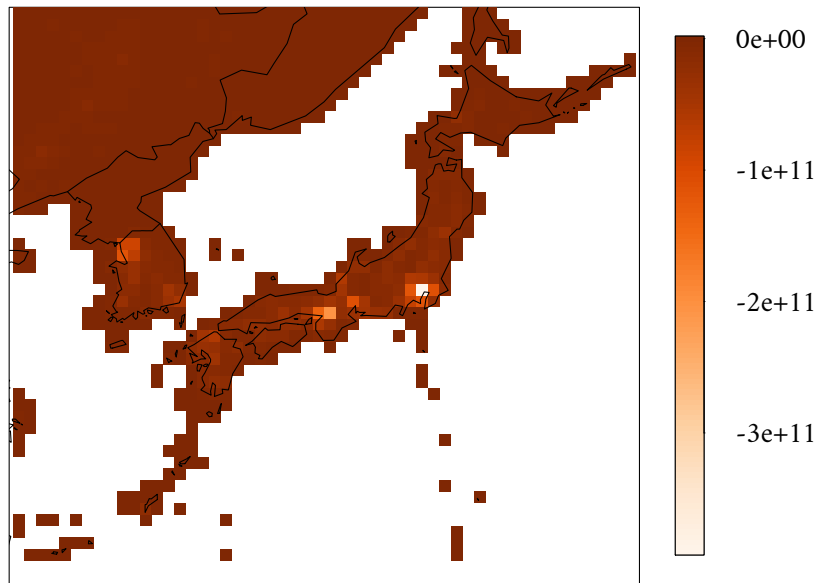


Figure 70: absolute difference between GPWv4 and ISIMIP2b (GPWv4–ISIMIP2b), 日本 (Japan), 2000.

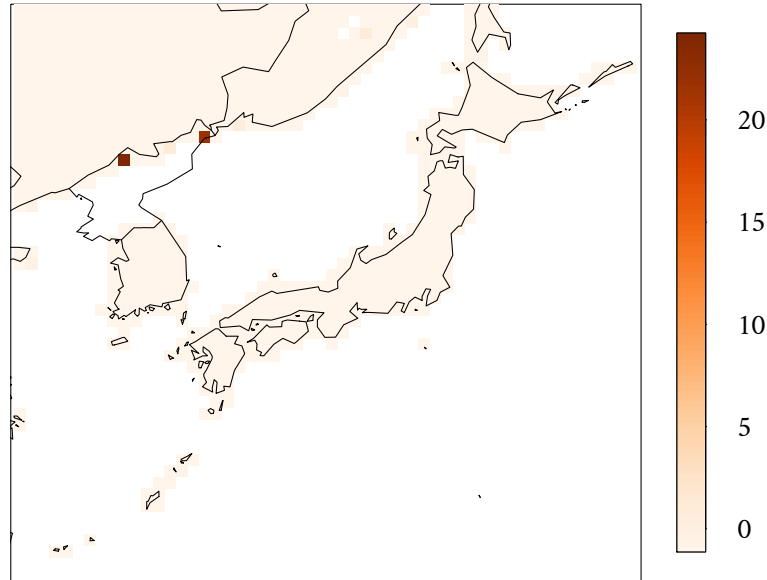


Figure 71: relative difference between GPWv4 and ISIMIP2b (abs. difference / ISIMIP2b), 日本 (Japan), 2000.

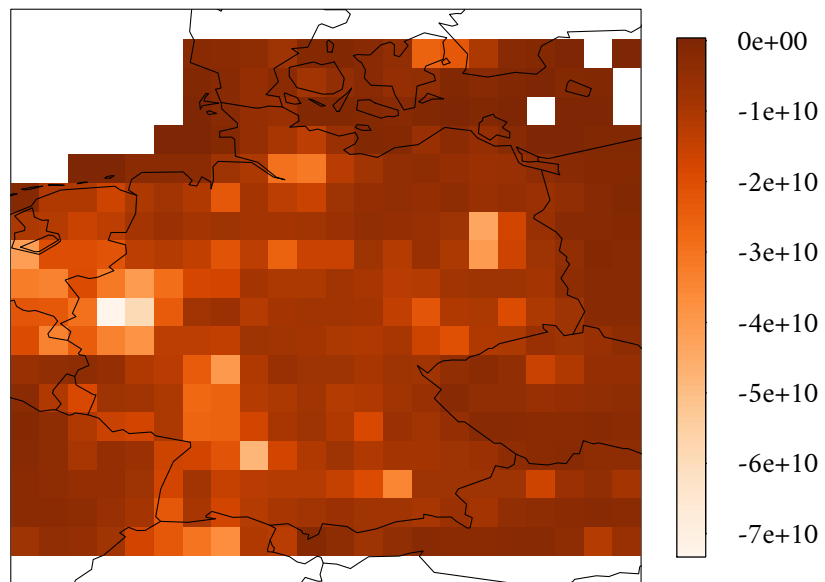


Figure 72: absolute difference between GPWv4 and ISIMIP2b (GPWv4–ISIMIP2b), Deutschland (Germany), 2000.

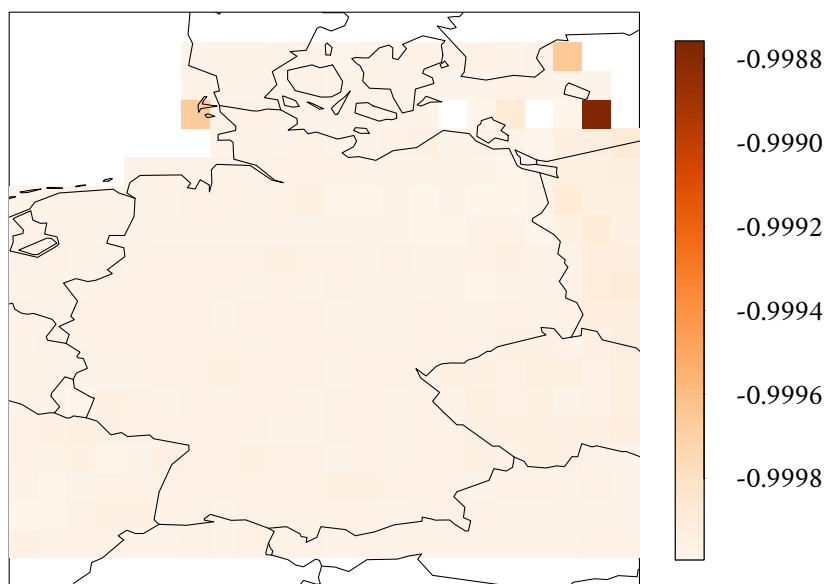


Figure 73: relative difference between GPWv4 and ISIMIP2b (abs. difference / ISIMIP2b), Deutschland (Germany), 2000.

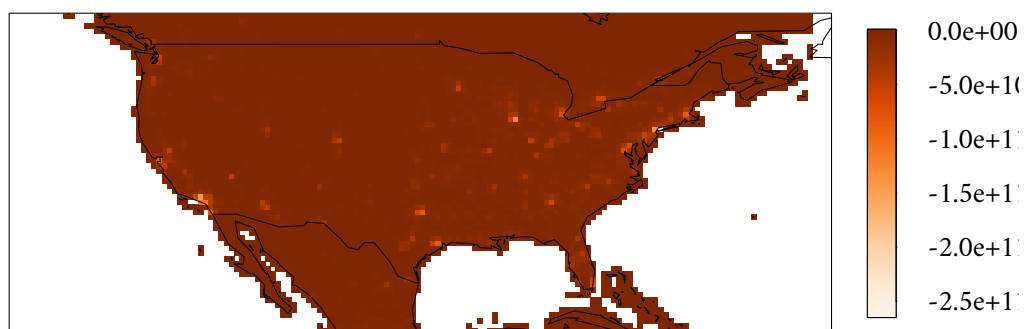


Figure 74: absolute difference between GPWv4 and ISIMIP2b (GPWv4-ISMIP2b), USA, 2000.

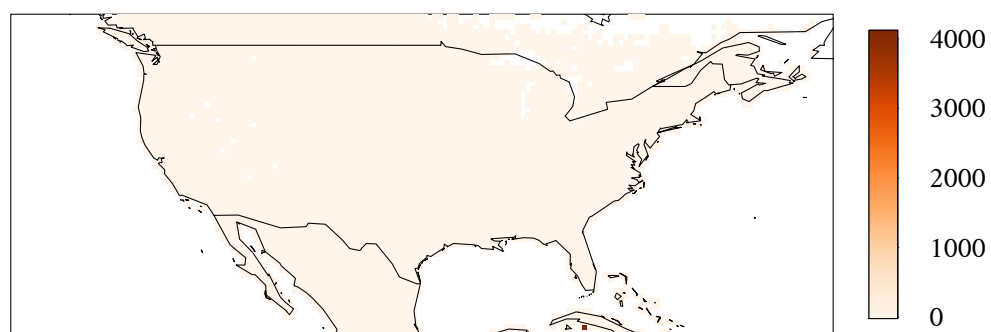


Figure 75: relative difference between GPWv4 and ISIMIP2b (abs. difference / ISIMIP2b), USA, 2000.

6 Regional data

6.1 Data for Berlin vs. Mecklenburg-Vorpommern (2005)

	GCP (ISIMIP)	GCP (LitPoP)	GCP/capita (ISIMIP)	GCP/capita (ISI/Lit)
52.25,13.25 (Berlin)	43718149941.4	8.95483e+10	25342.5732185	51909.5
53.25,12.25 (MV)	5447885838.41	5.0659e+08	69169.4909751	6431.96

6.2 National data for 2000

	GDP (ISIMIP)	GDP (LitPoP)	GDP (Worldbank)	GDP/capita (ISIMIP)	GDP/capita (Lit/ISI)	GDP/capita (WB/ISI)
China	5256461048488.02	-	1211346869600.41	34115968.3834172	-	955.233
Germany	2480745656823.64	-	1943145384190.16	7073516.70637651	-	23075
Japan	3746351391733.46	-	4968359075956.59	12679869.5656578	-	39542.6
USA	11490378318799.7	-	10252345464000	447291217.798318	-	35996.9

6.3 National data for 2005

	GDP (ISIMIP)	GDP (LitPoP)	GDP (Worldbank)	GDP/capita (ISIMIP)	GDP/capita (Lit/ISI)	GDP/capita (WB/ISI)
China	7341442945418.27	6.866204e+12	2285965892364.2	47596877.8915011	7594976	1752.66
Germany	2639484260147.82	2.708036e+12	2845802760850.64	7568884.71470909	4527770	33750.8
Japan	3821339346272.43	4.050375e+12	4831467035389.8	12931640.5005393	1.794545e+07	38328
USA	12291871777025.3	1.315662e+13	13036640230000	472608250.236314	1.82892e+09	43603.7

6.4 National data for 2030

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	GDP (ISIMIP)	GDP (LitPoP)	GDP (Worldbank)	GDP/capita (ISIMIP)	GDP/capita (Lit/ISI)	GDP/capita (WB/ISI)
China	34064721339937.6	-	-	163440482.506581	-	-
Germany	3589399199024	-	-	11473980.1527278	-	-
Japan	4756072568480.96	-	-	9899979.95395341	-	-
USA	20990419777627.1	-	-	875480815.926333	-	-