### 4.3 Discussion of Results- GHGs and Climate Variability

#### 4.3.1 Melbourne

The GHG emissions of Melbourne was 11.4 $MtCO_2e$ in 1975, that escalated to 14.3 $MtCO_2e$ in 1990 and 17.9 $MtCO_2e$ in 2015. Most of the GHG emissions in 2015 (Figure 4.1, top) were contributed by the industry sector (52%) and transport sector (26%), followed by the residential sector (15%) and energy sector (7%). As per the ICLAP model estimates (Figure 4.1, bottom), there would be an increase in city's emissions at 1.1% per annum, leading to 20.2 $MtCO_2e$ in 2030 and 23 $MtCO_2e$ in 2050.

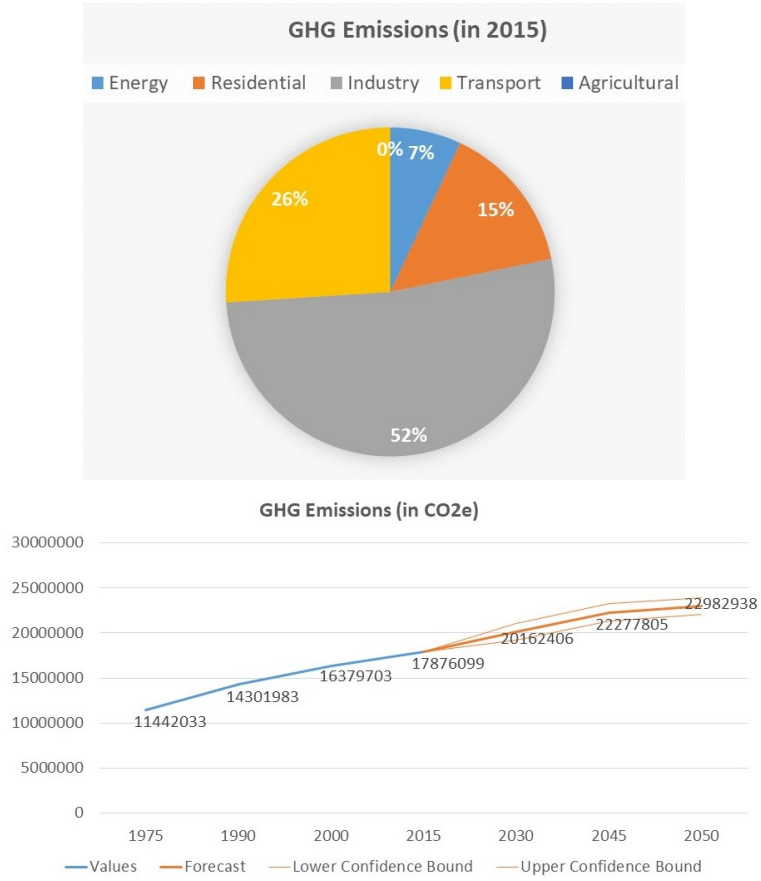


**Figure 4.1: GHG contributions from different sectors in Melbourne (top); ICLAP model estimates for Melbourne's GHG emissions till 2050 (bottom)**

The results for climate variability in Melbourne indicate that depending on the emission scenarios, there would be a temperature increase of 0.5–3.1 degC up till 2080s (Figure 4.2, top). The scenario corresponding to the pathway with moderate GHGs (SSP245_MIROC6) exhibits an increase of 0.75 degC in 2030s (above the 1980 baseline temperature), 1.0 degC in 2050s, peaking to 1.3 degC in 2080s. The spatial results for moderate scenario over 2010-80s are mapped in Figure 4.2 (middle). Meanwhile, the scenario corresponding to the pathway with the highest GHGs (SSP585_MIROC6) exhibits an increase of 0.7 degC in 2030s (above the 1980 baseline temperature), stabilizing to 1.3 degC in 2050s, thereafter rising rapidly to 3.1 degC above normal in 2080s. The spatial results for high emission scenario over 2010-80s are mapped in Figure 4.2 (bottom). Meanwhile, the precipitation change for Melbourne shows a very high variability in the long run, ranging from -60 to 50 mm from the normal (Figure 4.3, top) depending on the emission scenarios. The scenario corresponding to the pathway with moderate GHGs (SSP245_MIROC6) shows Melbourne's precipitation declining by 15 mm during 2030s (against the 1980 baseline rainfall), rising to 10 mm in

2050s, hovering around 30 mm in 2060-70s and peaking up to 40 mm in 2080s. The spatial results for moderate scenario over 2010-80s are mapped in Figure 4.3 (middle). Meanwhile, the scenario corresponding to the pathway with the highest GHGs (SSP585_MIROC6) shows significant fluctuations in Melbourne city's rainfall, escalating to 50 mm (above the 1980 baseline rainfall) in 2030s, nosediving to -50 mm in 2050s, rising to 30 mm in 2050s, falling to -20 mm in 2080s, thereafter stabilising to 10 mm in 2090s. The spatial results for high emission scenario over 2010-80s are mapped in Figure 4.3 (bottom).

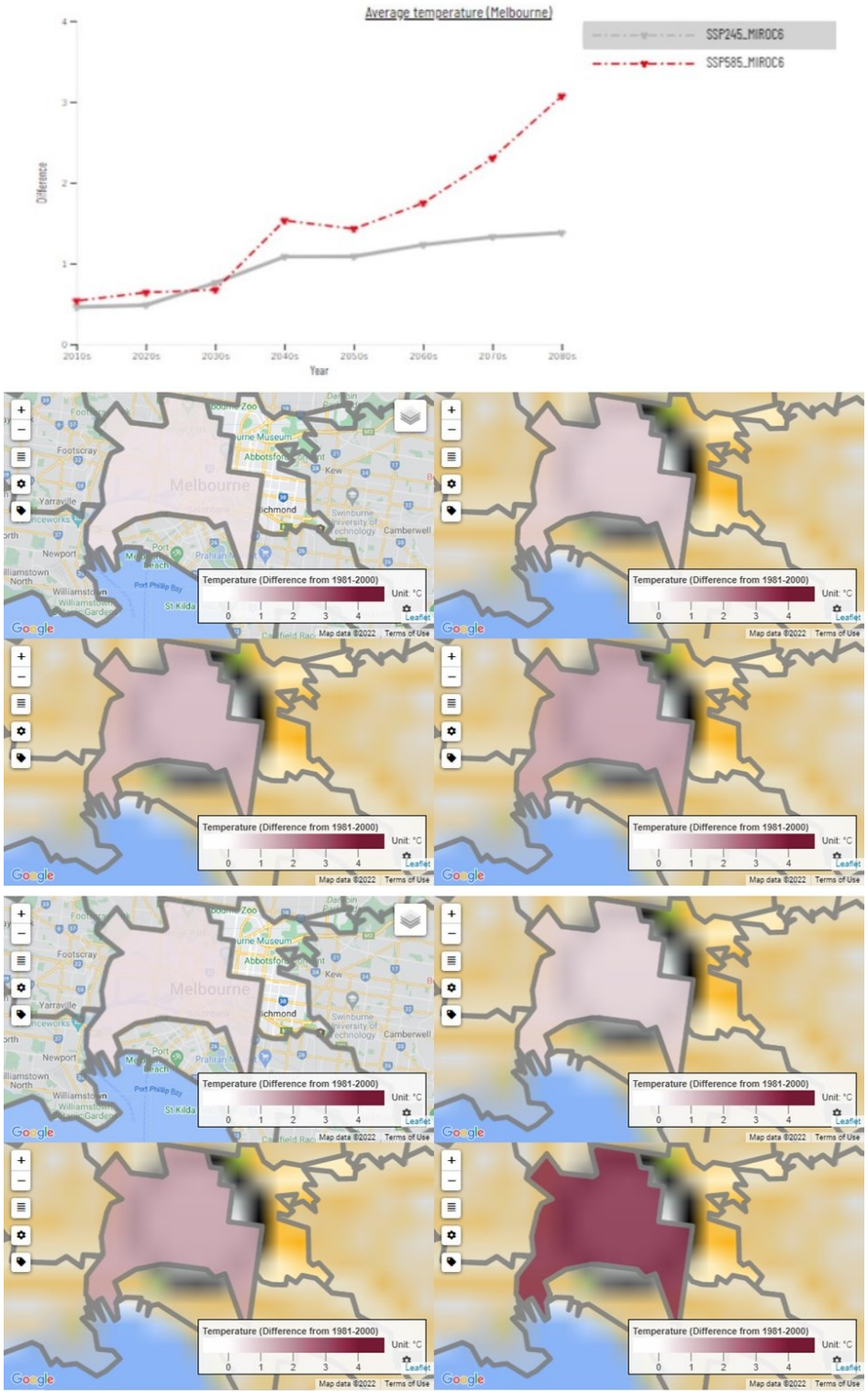


**Figure 4.2: Temperature increase in Melbourne under medium (grey) and high (red) emission scenario till 2080s (top); Spatial results for medium scenario for 2010s, 2030s, 2050s, 2080s (middle); Spatial results for high scenario for 2020s, 2030s, 2050s, 2080s (bottom)**

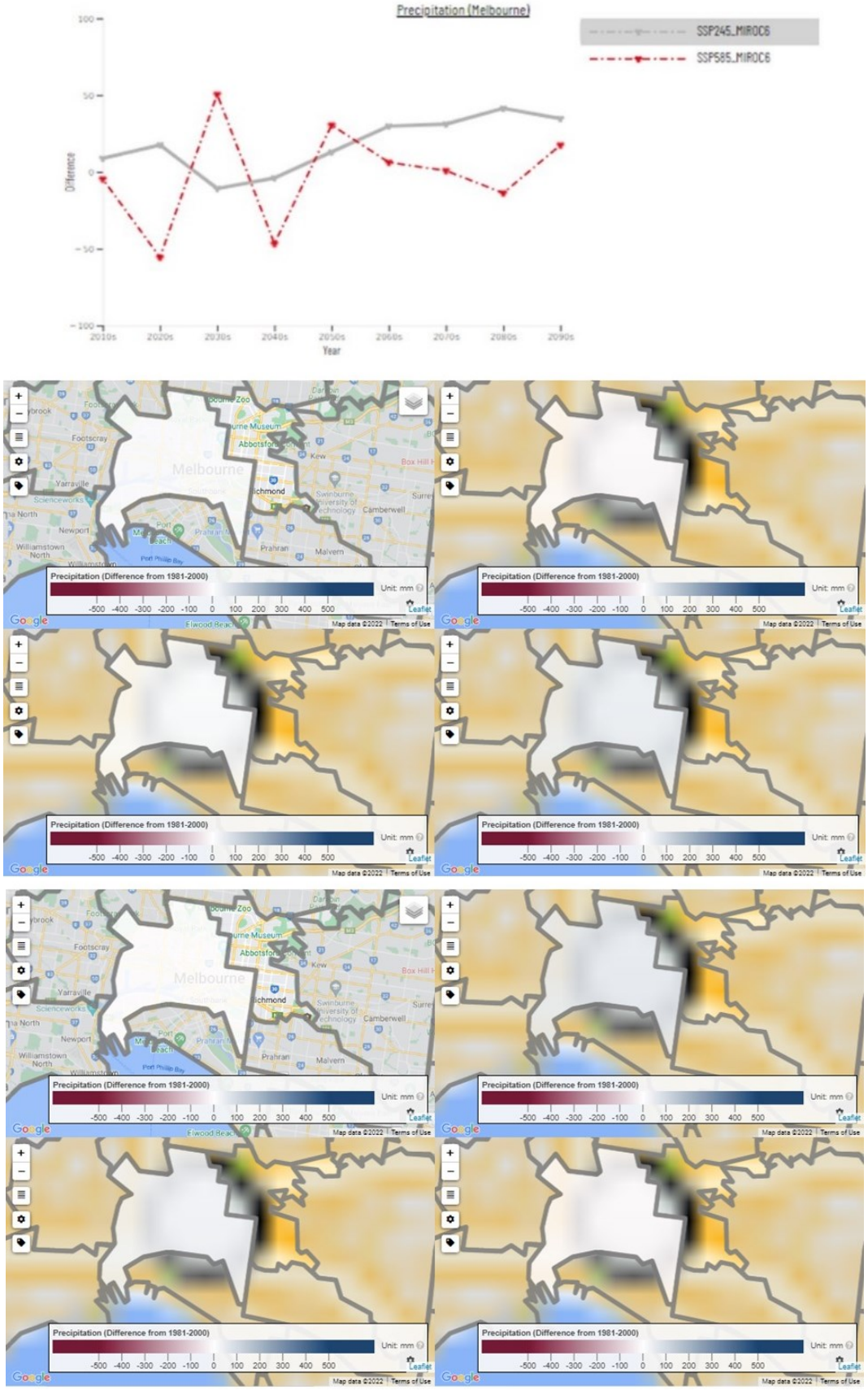


**Figure 4.3: Precipitation variation in Melbourne under medium (grey) and high (red) emission scenario till 2080s (top); Spatial results for medium scenario for 2010s, 2030s, 2050s, 2080s (middle); Spatial results for high scenario for 2020s, 2030s, 2050s, 2080s (bottom)**