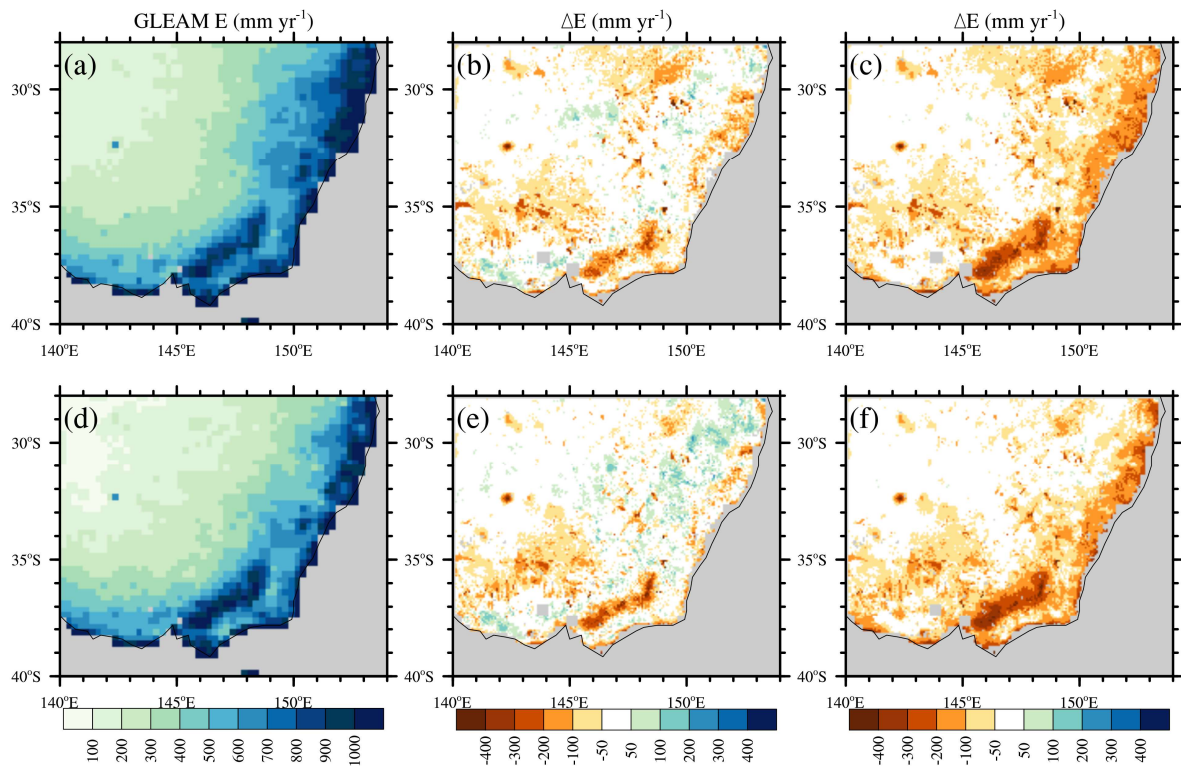
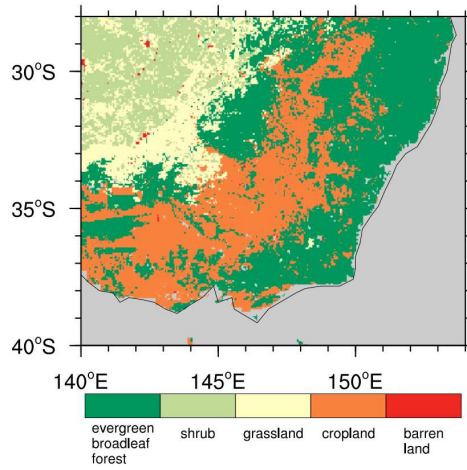
2 **Fig S1** annual precipitation anomaly (P) from 2000 to 2019 over S.E. Australia. The anomalies were calculated relative to

3 the 1970-2019 climatology.

5

6 **Fig S2** Annual evaporation (E). (a)-(c) are for Millennium drought, and (d)-(f) are for the recent drought. (a) and (d) are E in

7 GLEAM; (b) and (e) are ΔE between GW and GLEAM; (c) and (f) are ΔE between FD and GLEAM.

8

9   **Fig. S3.** Distribution of CABLE plant functional types over S.E. Australia.

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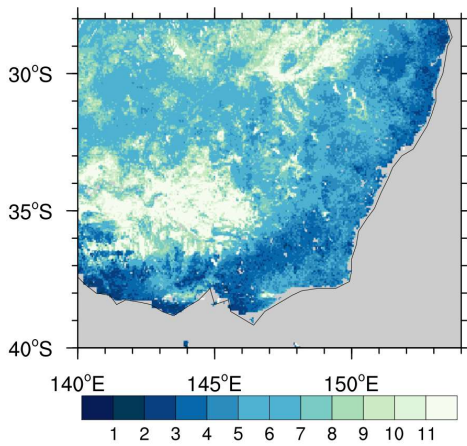
11

12   **Fig S4** The mean water table depth (m) during 2017-2019 from the GW experiment.

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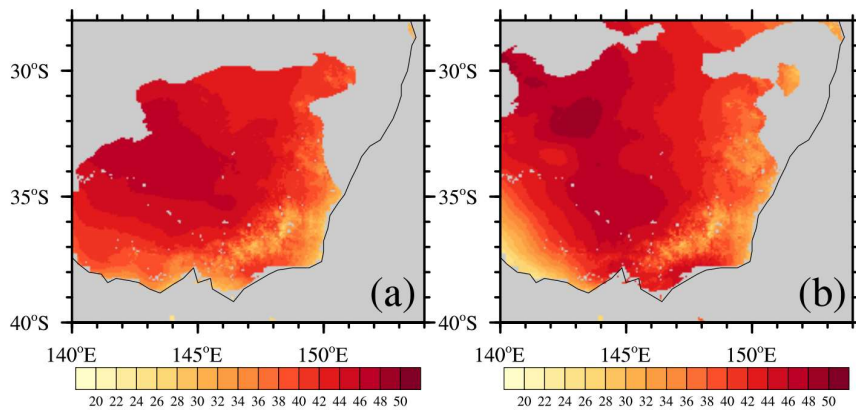
14

15   **Fig S5.** Maximum air temperature (°C) over the heatwave regions on (a) 15th and (b) 25th Jan 2019.

16

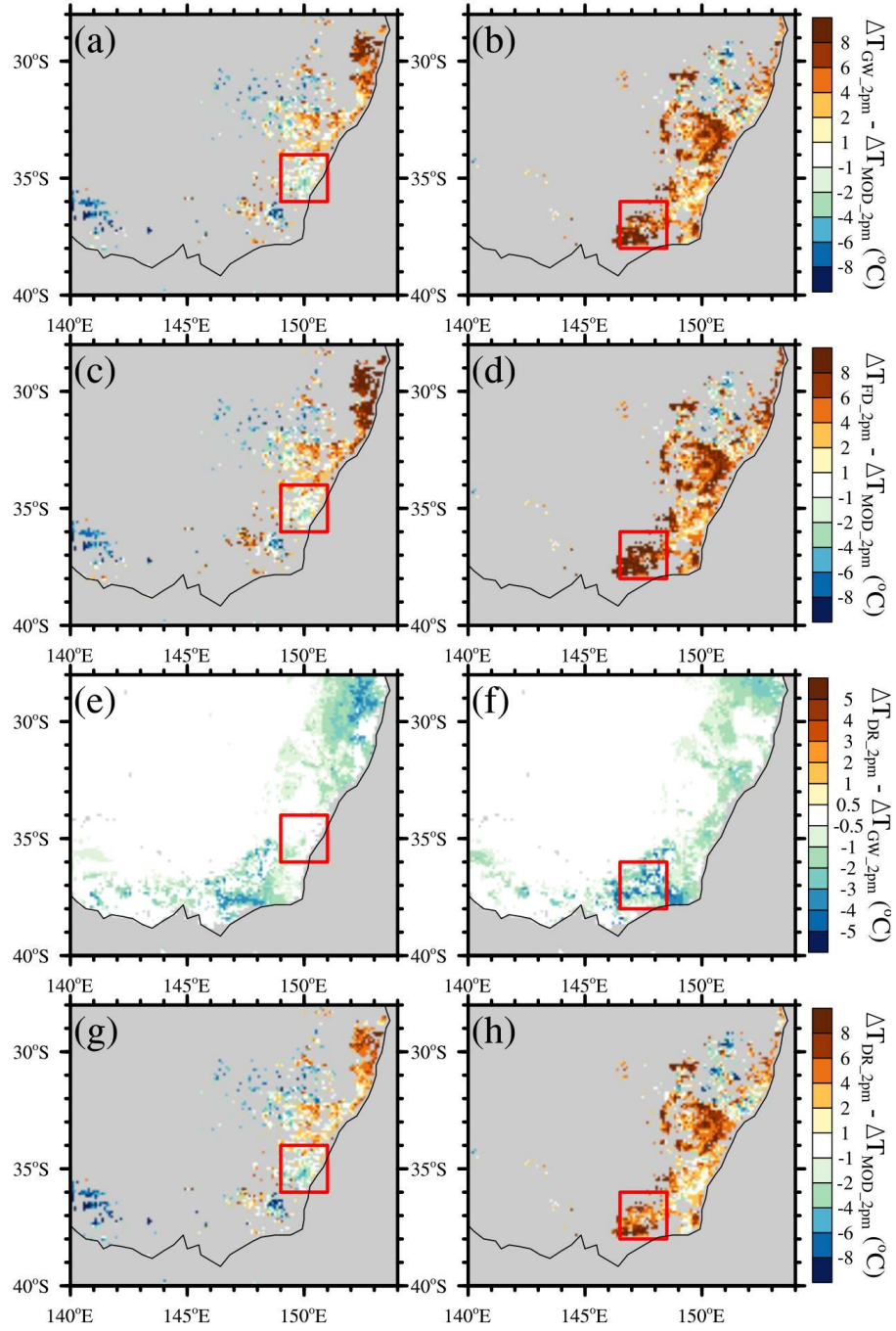
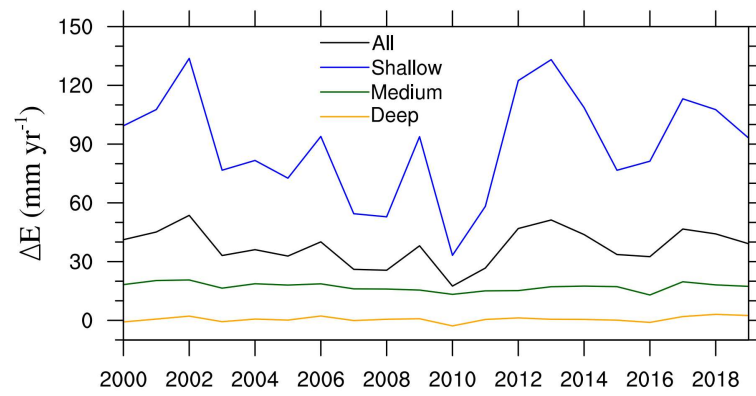



Fig S6. The difference of ΔT at 2pm between (a)-(b) GW and MODIS LST (ΔT_{GW_2pm}-ΔT_{MOD_2pm}), (c)-(d) FD and MODIS

LST (ΔT_{FD_2pm}-ΔT_{MOD_2pm}), (e)-(f) DR and GW (ΔT_{DR_2pm}-ΔT_{GW_2pm}), and (g)-(h) DR and MODIS LST (ΔT_{DR_2pm}-ΔT_{MOD_2pm}). The left column is for 15th and the right is for 25th Jan 2019.

22

23 **Fig S7.** The time series of the difference in E between GW and FD (ΔE) over S.E. Australia. The lines show the mean ΔE

24 over S.E. Australia (black), shallow WTD regions (< 5m; blue); medium WTD regions (5~10m; green) and deep WTD

25 region (>10m; orange).

26