



THE ATMOSPHERIC MOISTURE BUDGET OVER THE EASTERN MEDITERRANEAN BASED ON A HIGH-RESOLUTION GLOBAL MODEL---PAST AND FUTURE

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1. Objectives

- To investigate the features of moisture budget over the Middle East region and Mediterranean under the SRES A1B global warming scenario based mainly on the high spatial resolution (20km) global climate models (GCM)

2. Data

- MRI's GCM: The model is based on the global numerical weather prediction (NWP) model of JMA-GSM0103 (Japan Meteorological Agency), details about the model is available online at http://www.jma.go.jp/JMA_HP/jma/jma-eng/jma-center/nwp/outline-nwp/index.htm
- European global reanalysis (ERA-40)
- Climate Research Unit (CRU)
- Israel Meteorological Service (IMS)'s station observed data

3. Results (cont'd)

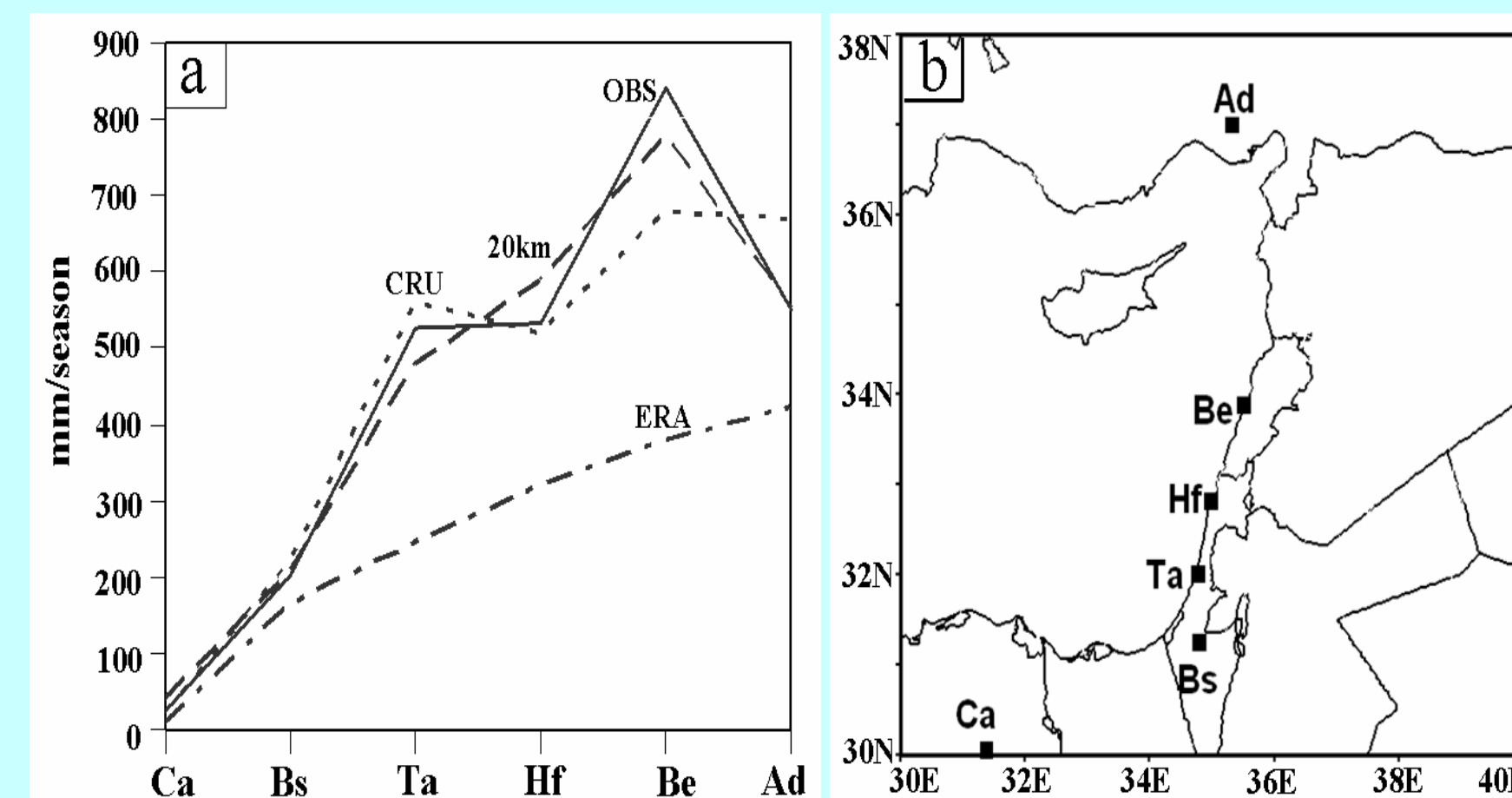


Fig. 2: (a) Comparison of average total observed seasonal precipitation with three model data for the selected 6 stations. The six stations are from south-to-north, Egypt---Cairo (Ca.), Israel---Beer-Sheva (Bs), Tel-Aviv (Ta), Haifa (Hf); Lebanon---Beirut (Be) and Turkey---Adana (Ad). Unit: mm/season. (b) Eastern Mediterranean map indicating the location of the six stations.

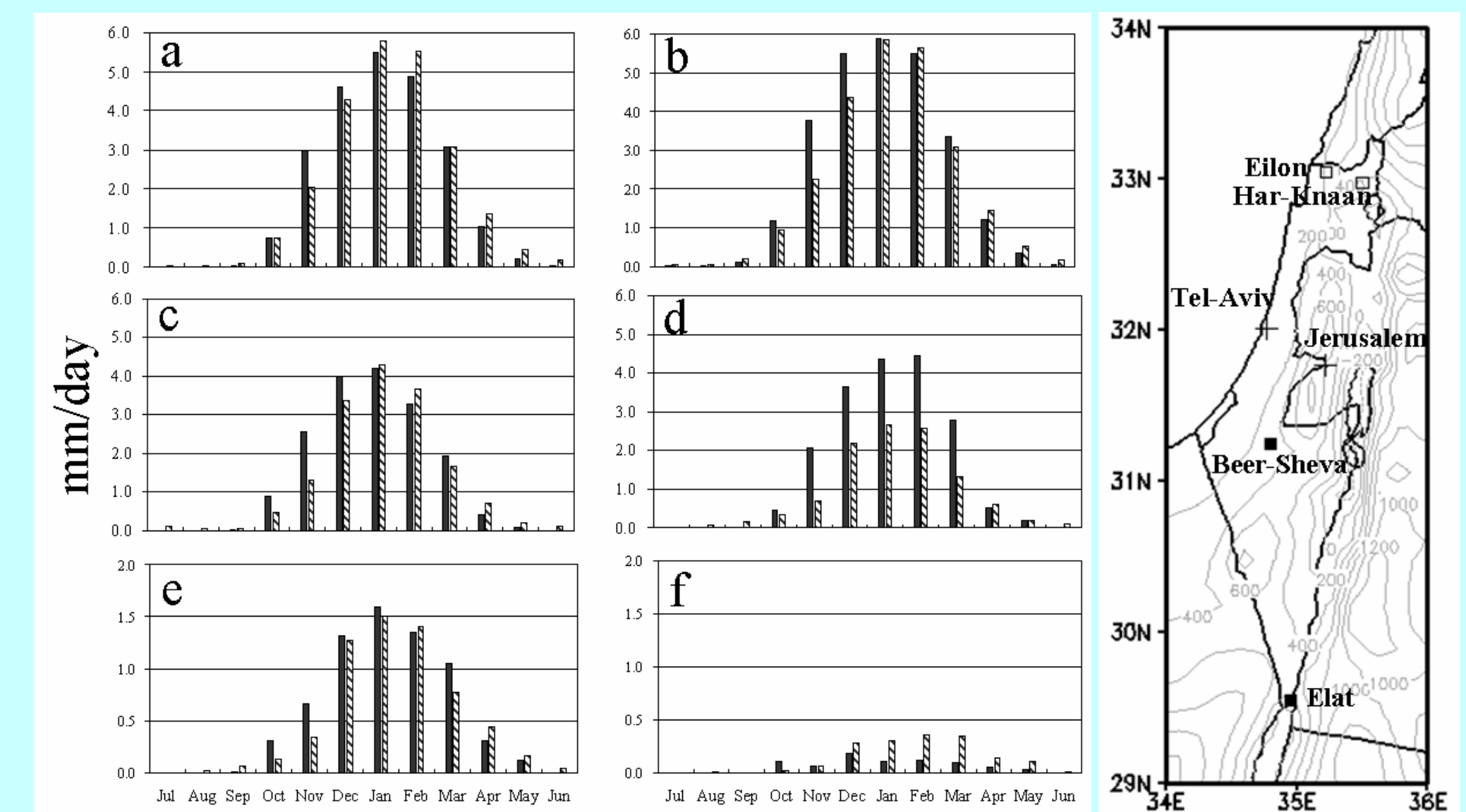


Fig. 3: Comparison of monthly mean precipitation from observed rain gauge (black column) and 20km GCM (grey column) for selected six stations in Israel based on their locations. Unit: mm/day. The selected stations are: Northern Israel---(a) Har-Knaan, (b) Eilon; Center Israel---(c) Tel-Aviv, (d) Jerusalem; Southern Israel---(e) Beer-Sheva, (f) Elat.

3. Results

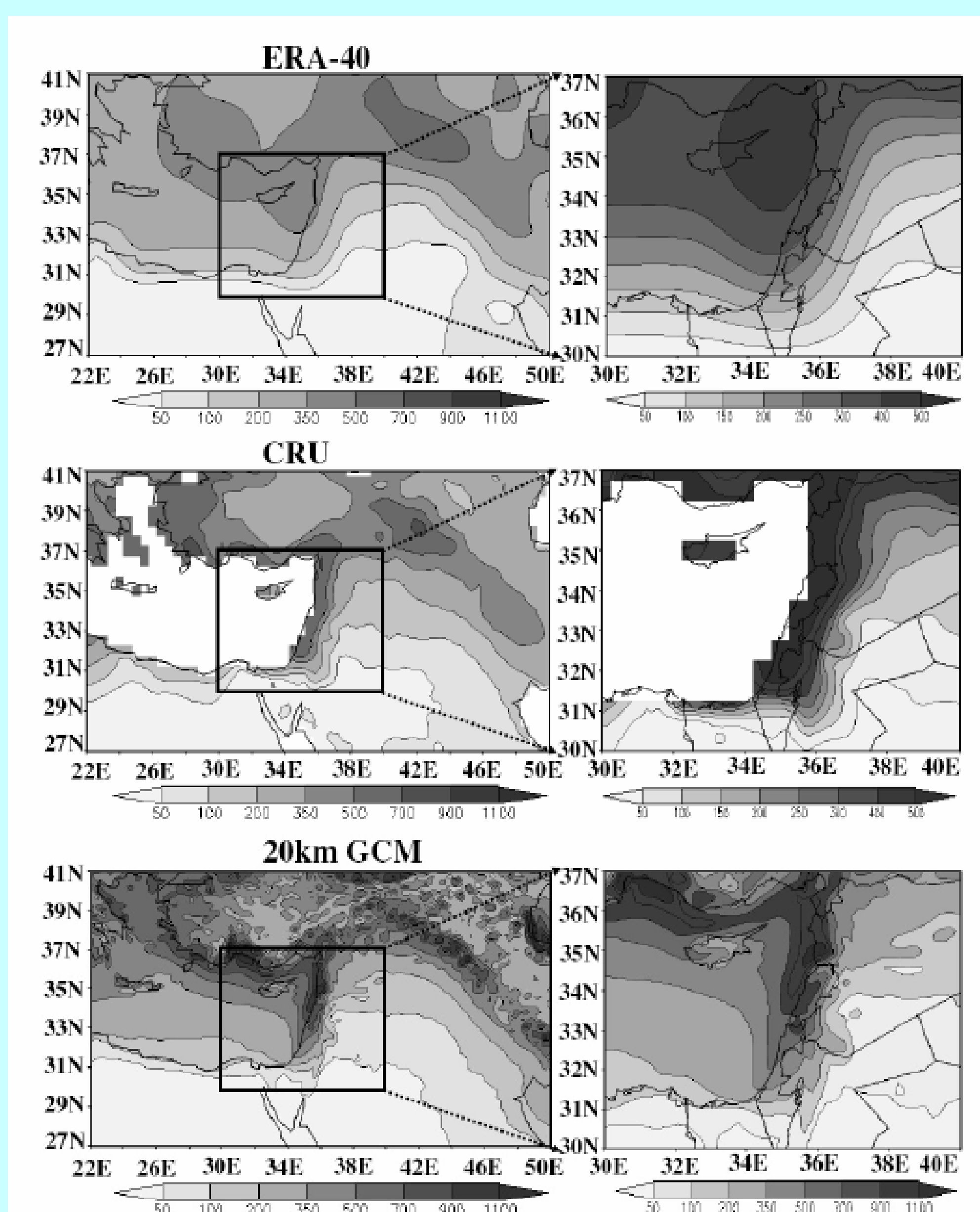


Fig. 1: Total seasonal (Oct-Apr) precipitation for the Eastern Mediterranean(EM)+Middle-East (left panel) and zoomed in over the EM (right panel). Averaging time period is 1979 - 2002. Unit: mm/season.

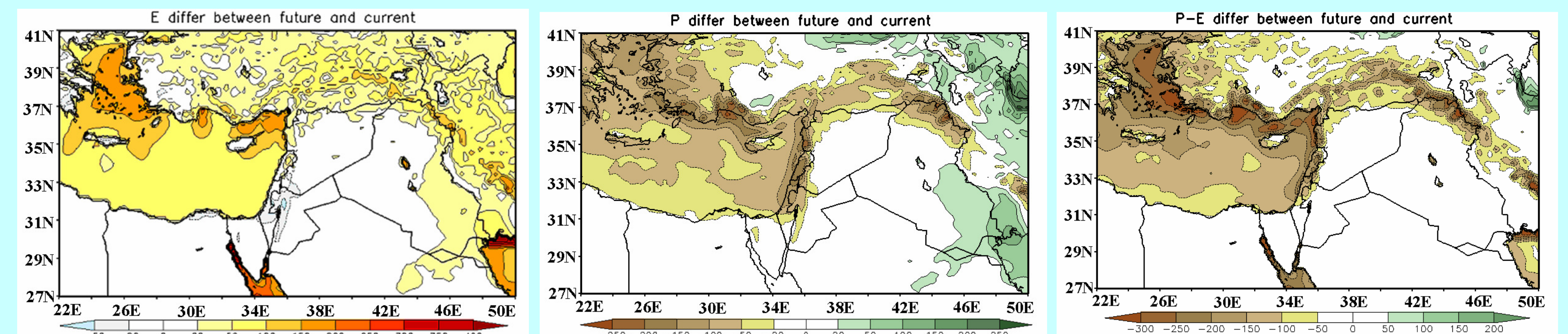


Fig. 4 Difference of seasonal total E, P and P-E between the future (2075-2099) and current (1979-2002) 20 km GCM runs. Dashed contour lines indicate the negative changes, i.e. reduction in the future. Unit: mm/season

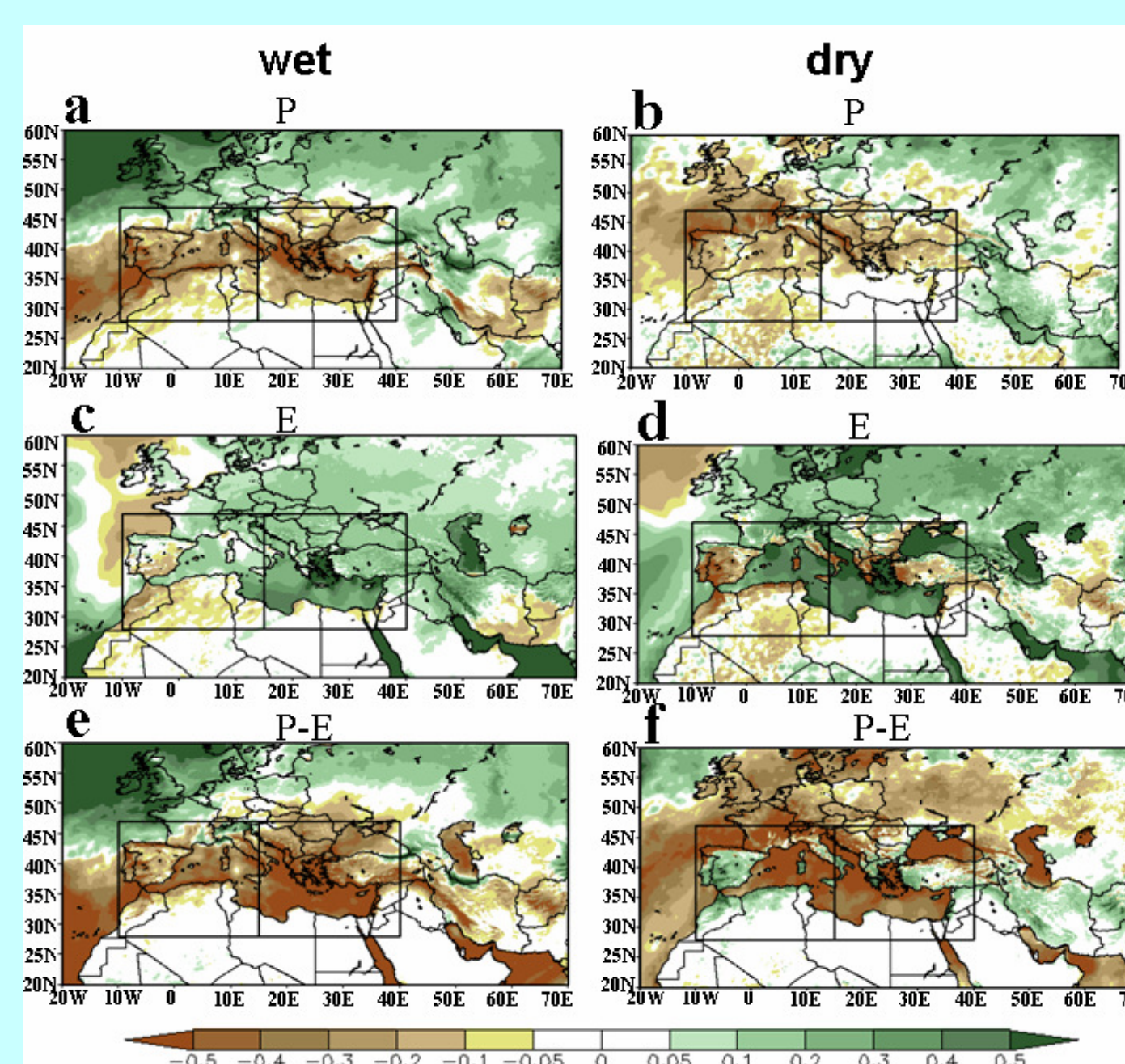


Fig. 5 Mediterranean water cycle changes by 2075-2099 compared to 1979-2007 for the 'wet' and 'dry' seasons based on MRI 20km GCM. Precipitation (a) and (b), evaporation (c) and (d), and precipitation minus evaporation (e) and (f). Unit: mm/day. The box broadly depicts the western and eastern Mediterranean region.

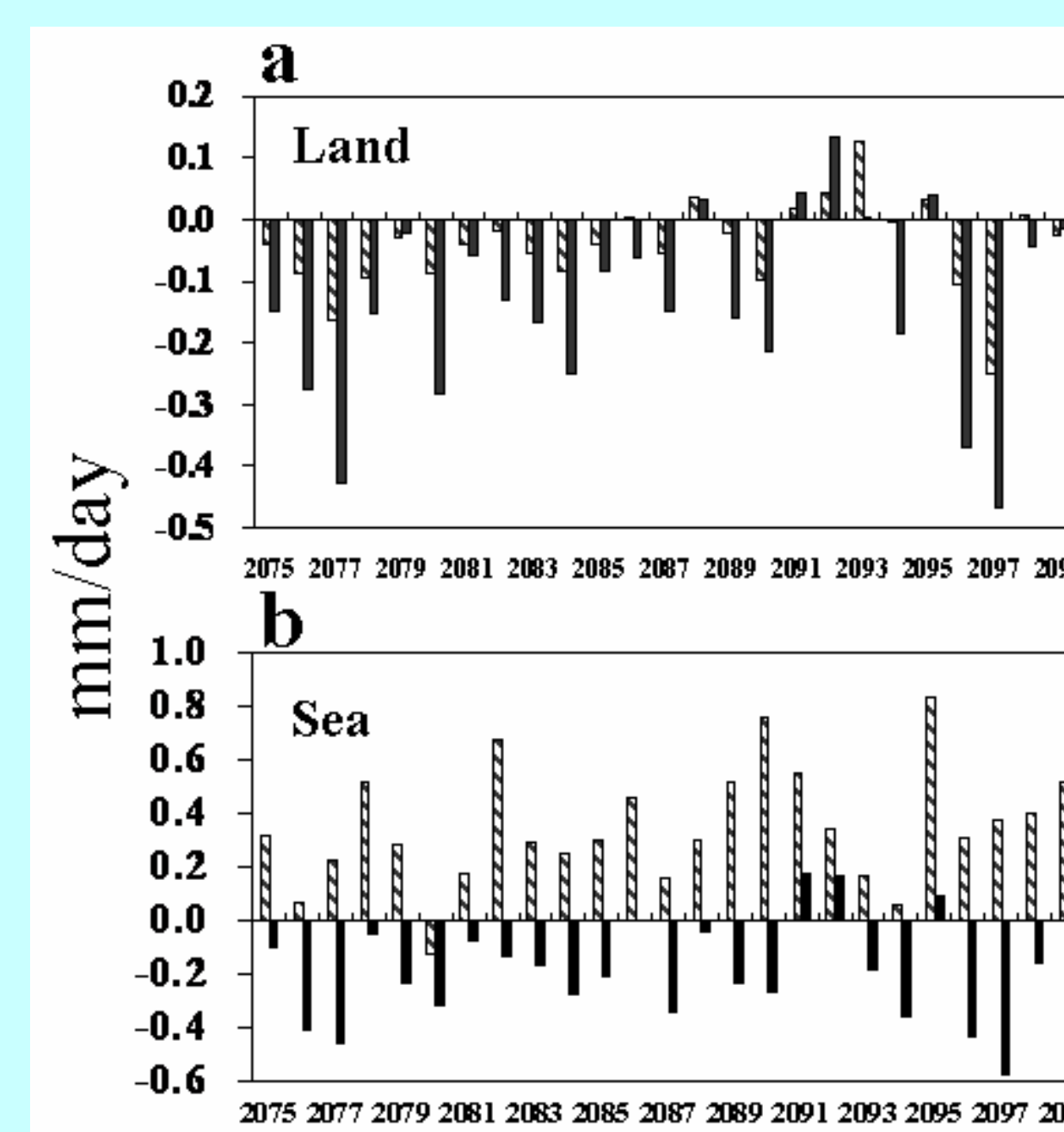


Fig. 6 Annual anomaly of precipitation (black bar) and evaporation (shaded bar) for the future (2075-2099), separated by sea and land area over the Mediterranean region. Calculated by individual year of the future minus the current mean (1979-2007). Unit: mm/day.

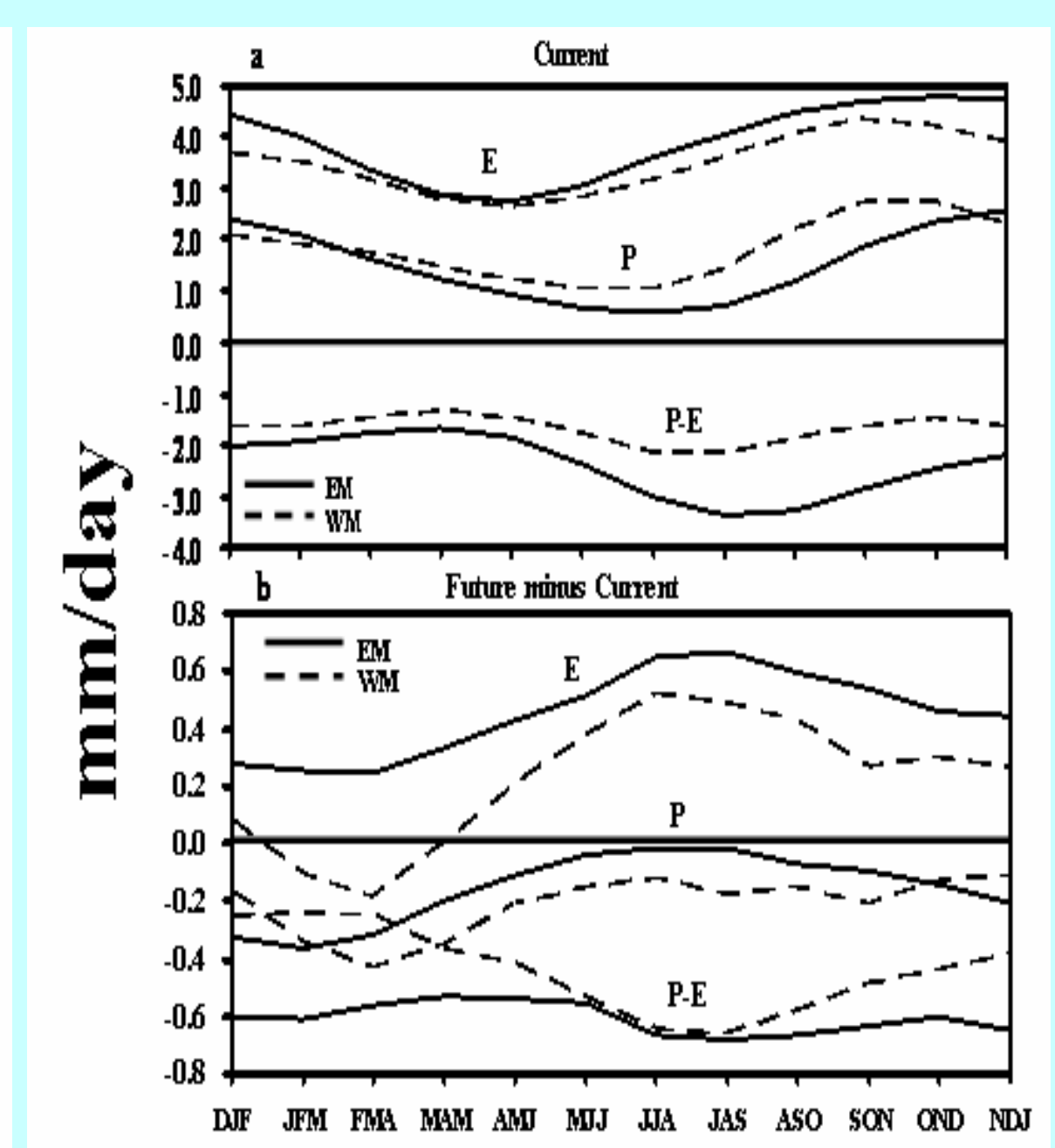


Fig. 7 Sea area water cycles for western Mediterranean (dashed) and eastern Mediterranean (solid) based on MRI 20km GCM. The annual cycles of precipitation (P), evaporation (E) and precipitation minus evaporation (P-E), are shown (mm/d). (a) Current (1979-2007) (b) Future (2075-2099) minus current.

4. Conclusions

- 20km GCM data showed credible performance on the simulation of precipitation regime for the control run over research area.
- The increased evaporation over the eastern Mediterranean was found higher than for the western Mediterranean, but the precipitation decrease is lower.
- Transition to drier 21th century is projected by the super-high GCM over the eastern Mediterranean as well as the entire Mediterranean, and the "fertile crescent" is projected to nearly disappear in the end of this century.

References

- Akio Kitoh, Akiyo Yatagai and Pinhas Alpert, 2008: First super-high-resolution modeling study that the ancient "Fertile Crescent" will disappear in this century. *Hydrological Research Letters*. 2, 1-4, DOI 10.3178 HRL.2.1.
- Mariotti, A., N. Zeng, J. H. Yoon, V. Artale, A. Navarra, P. Alpert and Z. X. Li, 2008: Mediterranean water cycle changes: transition to drier 21st century conditions in observations and CMIP3 simulations, *Environmental Research Letters*, 3, 044001 (8pp) doi:10.1088/1748-9326/3/4/044001.