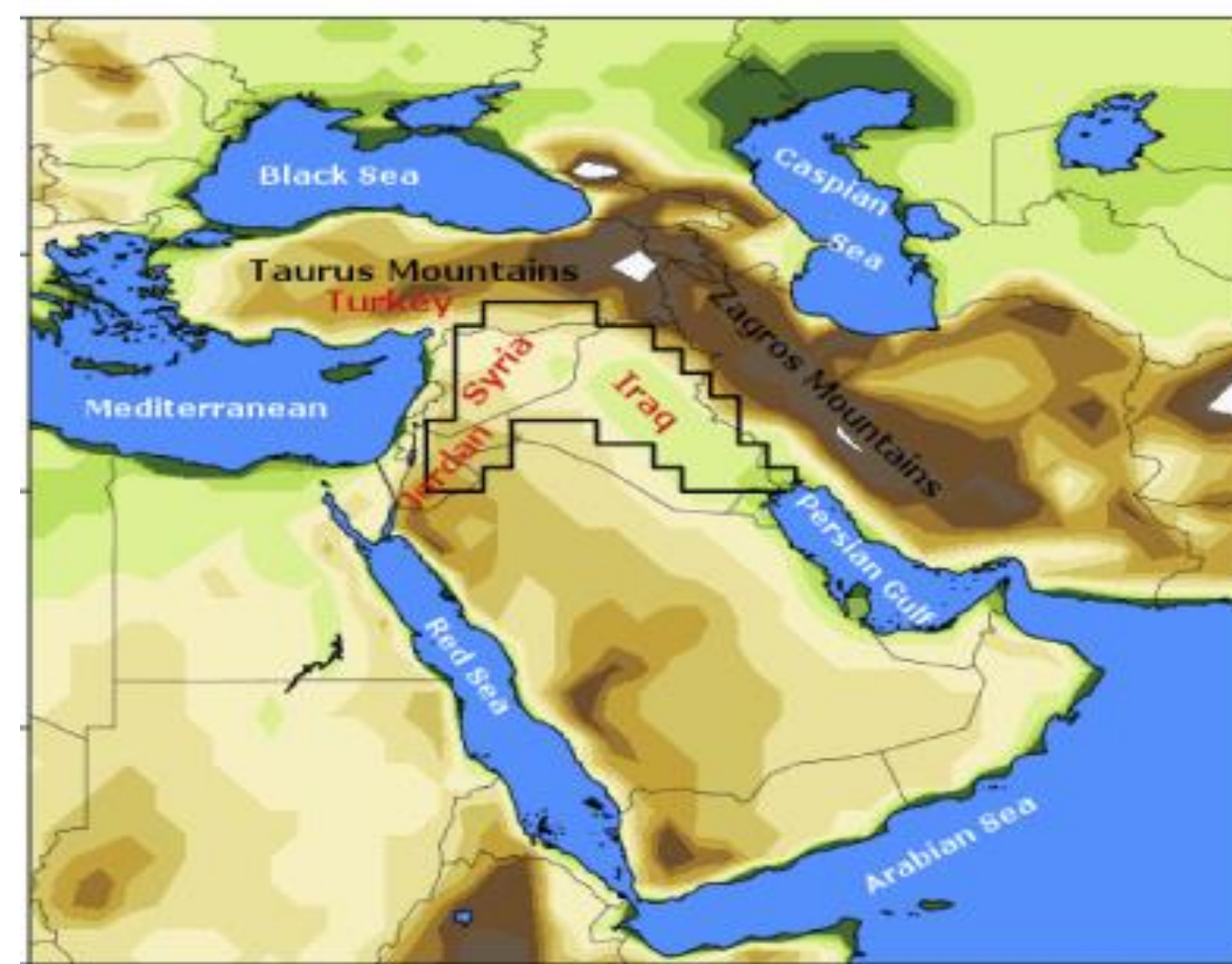
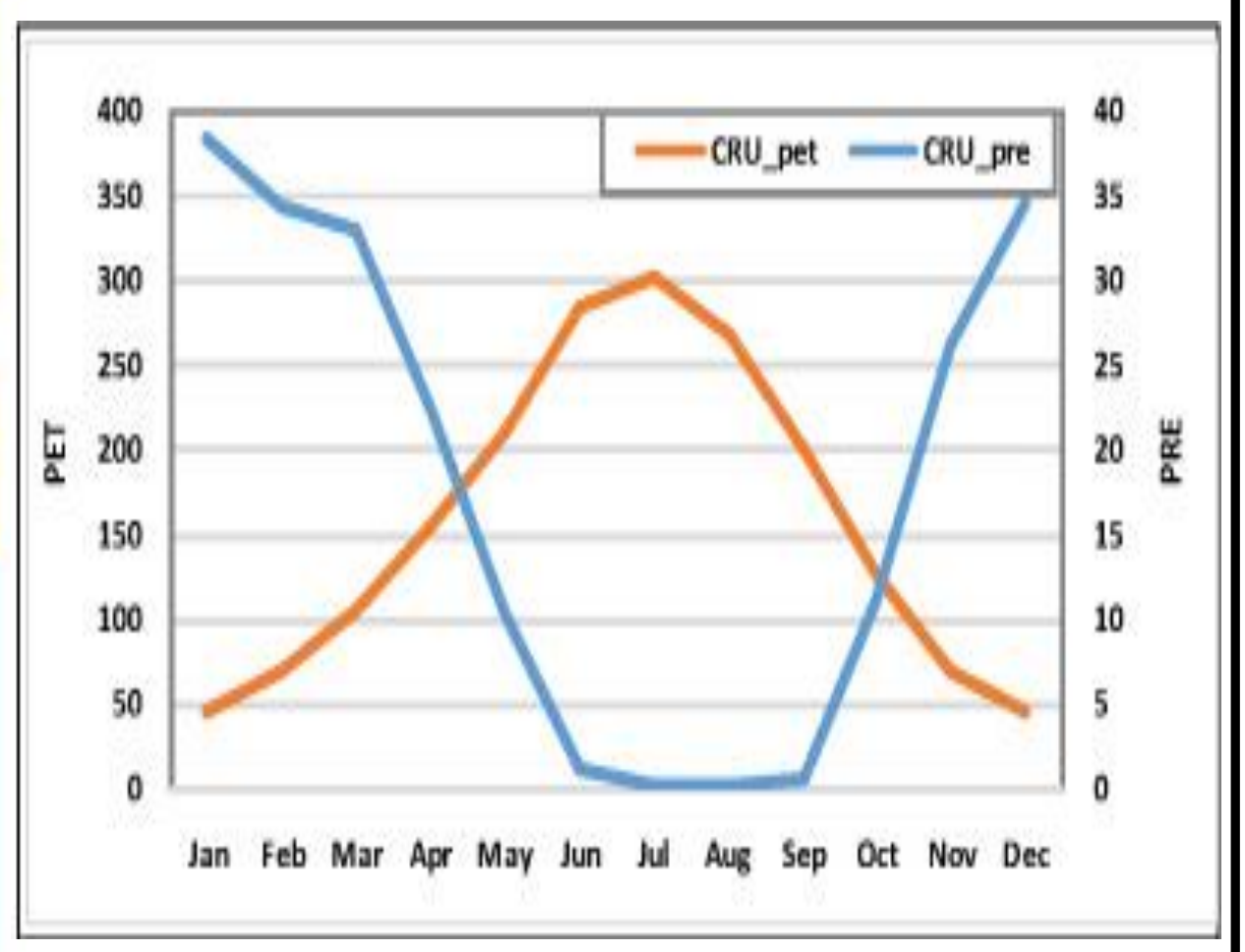


MOTIVATION AND OBJECTIVE

The Lagrangian approach was applied using the FLEXPART model and the ERA-Interim data (1°x1° lon-lat resolution) to identify the main climatological sources of moisture and their characteristics over the Fertile Crescent (FC) during its wet season (from October to May) from 1980 to 2014, and also to investigate the changes in these sources during the two severe droughts episodes of 1998-2000 and 2007-2009. Both of them were identified through the Standardised Precipitation-Evapotranspiration Index (SPEI) (Vicente-Serrano et al., 2010).



Monthly mean of PRE and PET on FC



I. METHODOLOGY

The atmosphere were divided into a large number of particles with constant mass (m). These particles are carried by the wind and they can gain moisture from regions called “**sources**” and loss moisture over regions called “**sinks**”.

Changes in the specific humidity q carried by each particle during its trajectory from the source to the sink is (e-p = m dq/dt). It represents the increases through evaporation from the environment (e) and decreases through precipitation (p).

The total (e-p) of the K particles placed in the atmospheric column over an area (A) denotes the freshwater flux associated:

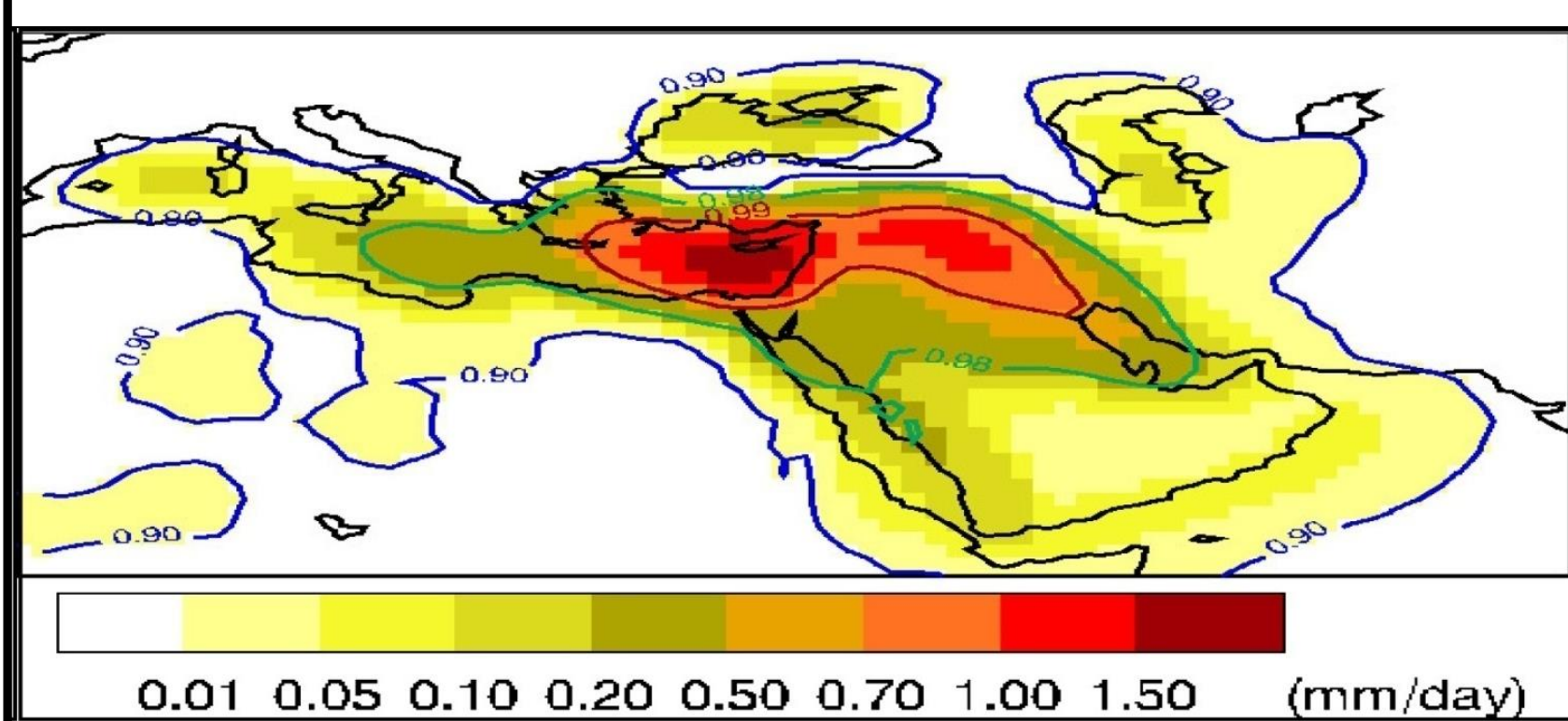
$$E - P \approx \frac{\sum_{k=1}^K (e - p)}{A}$$

Where (E) is the evaporation rate, and (P) is the precipitation rate per unit area (Stohl and James, 2004).

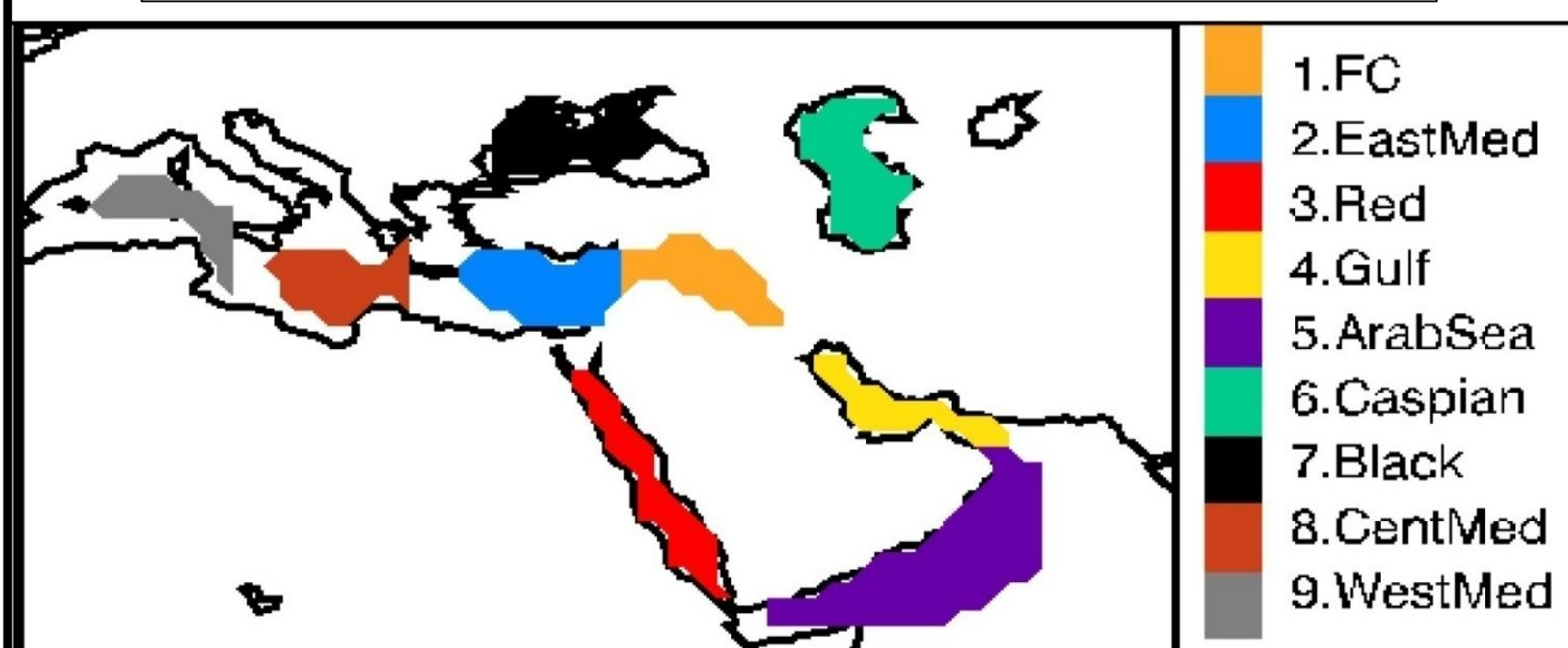
- Using the **Backward analysis from the FC**, the main “moisture sources” are regions in which (E-P) > 0. We delimited the area of sources based on the percentile method, with the thresholds of (90%, 96%, 98%, and 99%).
- Using the **Forward analysis from the sources**, we defined the “moisture sinks” as areas where (E-P) < 0. So we estimated the contribution of each source to the moisture budget over the FC.
- The Analyses will focus on the wet season of FC from October to May, during the years from 1980 to 2014.

II. Moisture Sources (E-P > 0) for FC

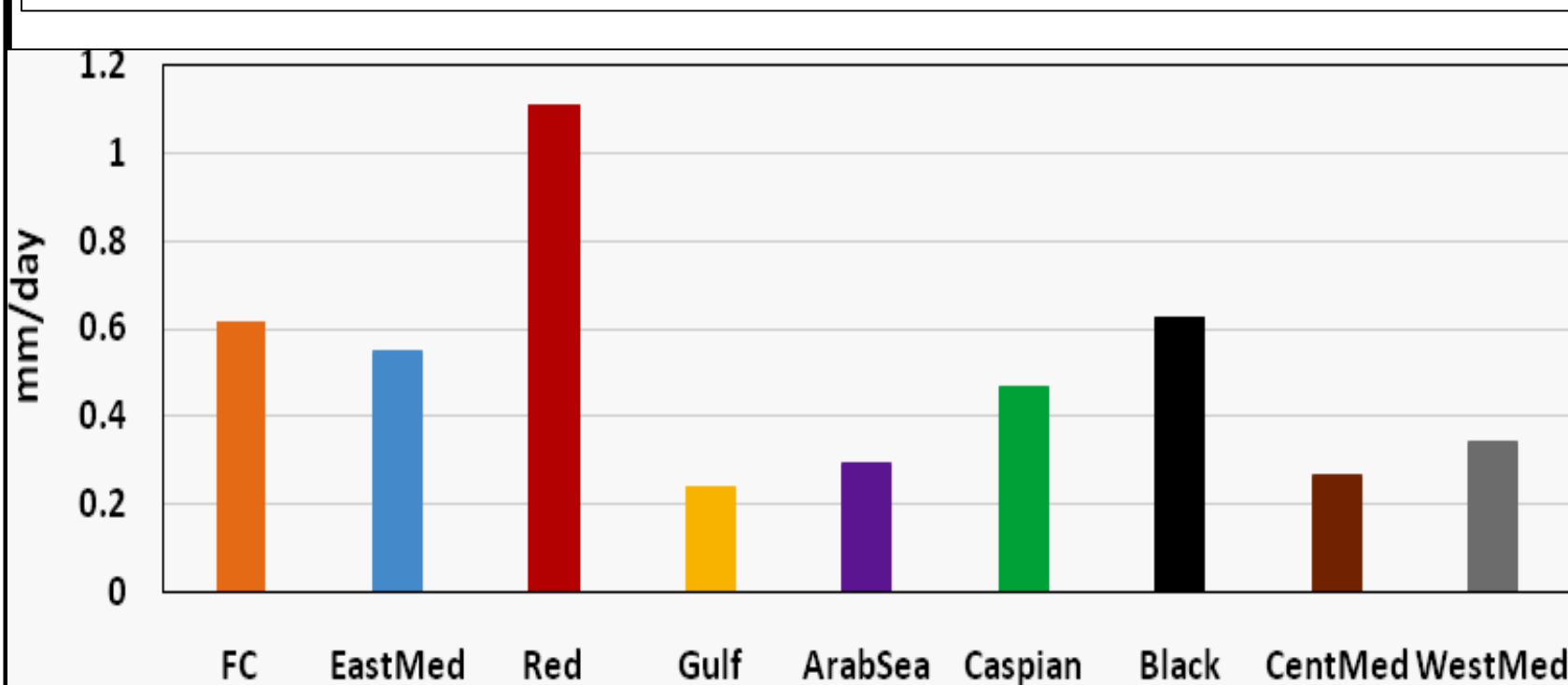
a) Climatology Of (E-P > 0) With Lines Of Percentiles Of 0.90, 0.98, And 0.99 Defining The Main Sources



b) The Areas Of The Main Moisture Sources

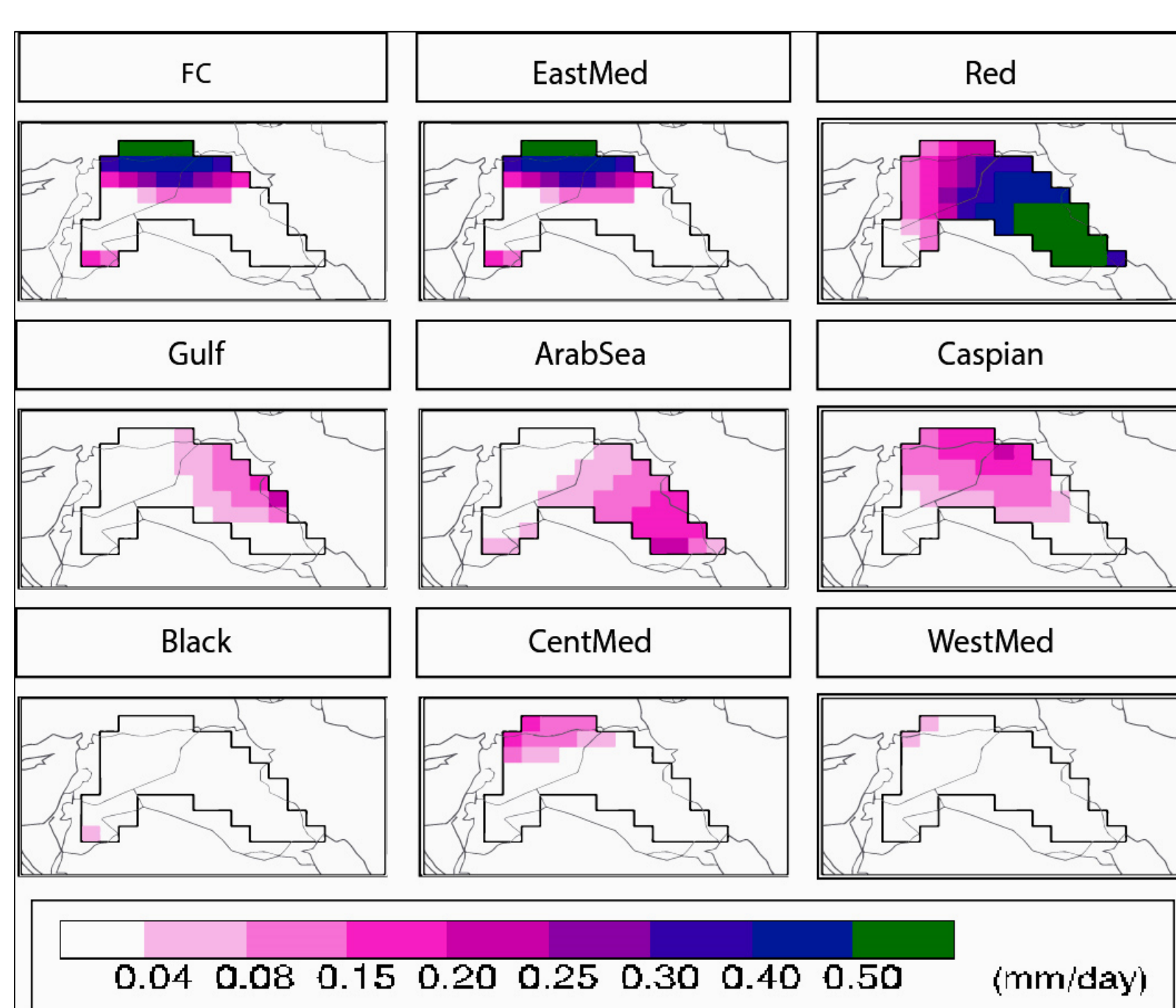


c) Area Average of The Moisture Uptake (E-P > 0) Over The Sources

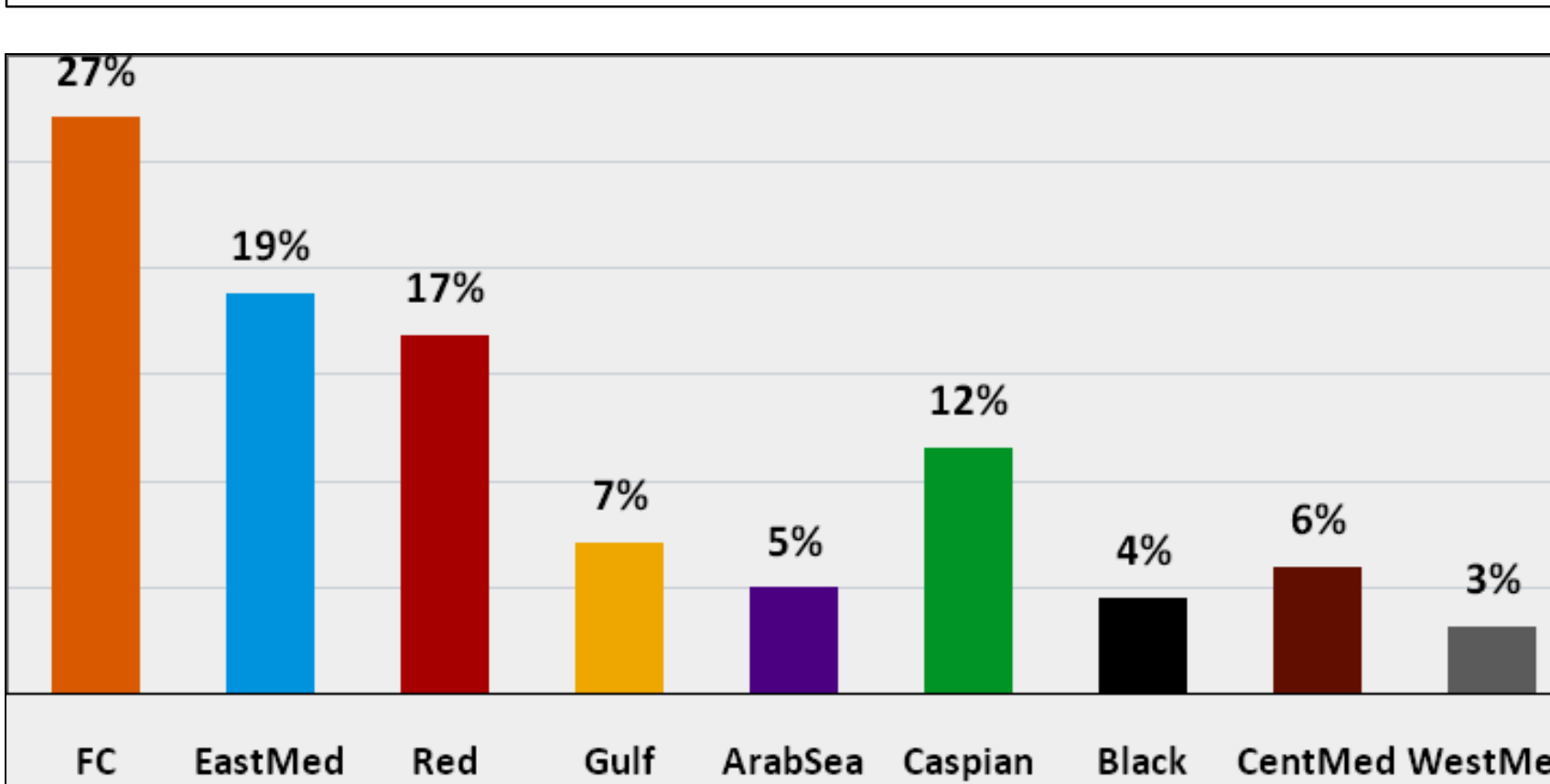


III. Moisture Loss |E-P < 0| over FC

a) Spatial Distribution Of |E-P < 0| Associated With The Particles Coming From Each Source To FC

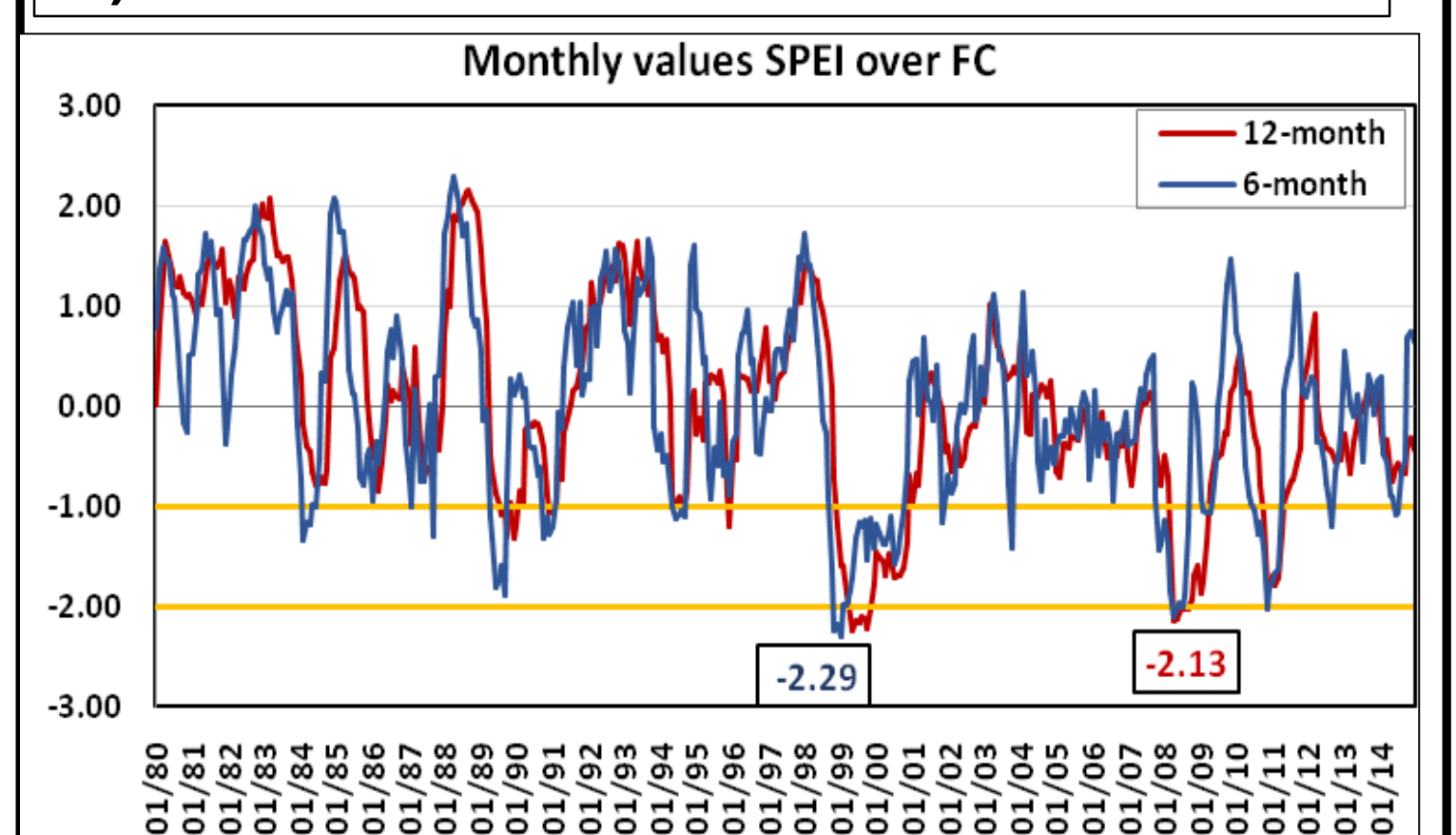


b) Percentage Of Contribution Of Each Source In |E-P < 0| Over FC

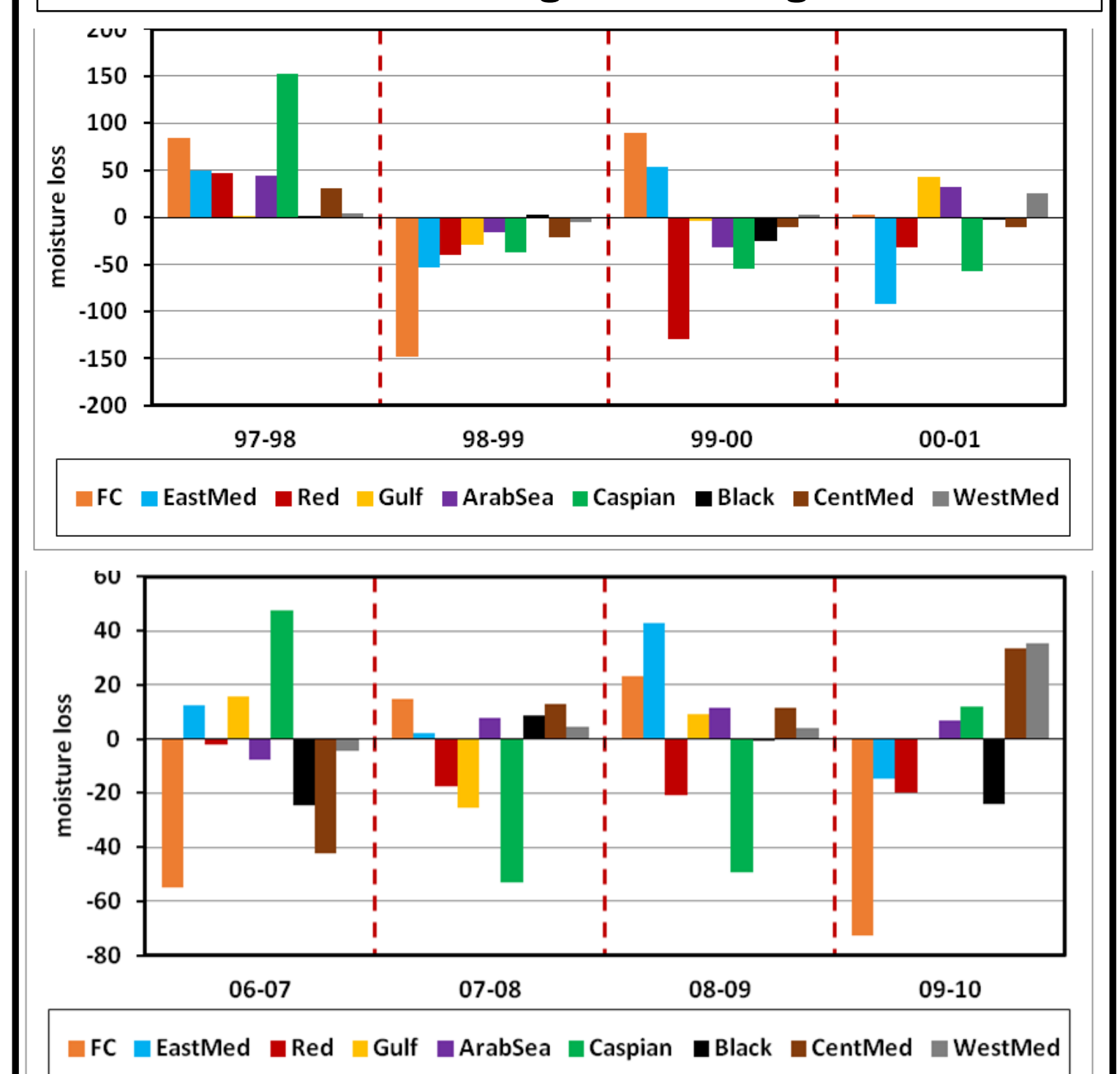


IV. Extreme Drought Events over FC

a) Extreme Events With SPEI -6 and -12 < -2



b) Anomalies Of |E-P < 0| Associated With Each Source During The Drought Events



Anomalies of moisture losses associated with the particles from every source during the wet seasons in the periods of 1997-2000 and 2006-2009, the drought events delimited by red dashed lines.

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- Vicente-Serrano S.M., Beguería S., López-Moreno J.I. (2010). A multi-scalar drought index sensitive to global warming: The standardized precipitation evapotranspiration index - SPEI. *J. Clim.* 23(7): 1696-1718.

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