**Highlights**

1. Runoff efficiency is higher in the Central Indian basins such as Narmada, Godavari, Mahanadi, and Brahmani where mean monsoon rainfall are higher.
2. Large basins such as Brahmaputra, Subarnarekha, and Ganga exhibit low runoff efficiency due to higher rainfall contribution to baseflow.
3. Temporally variability of Runoff efficiency is primarily controlled by event magnitude precipitation and antecedent soil moisture with relatively higher influence from the latter.
4. The ENSO significantly influences runoff efficiency in monsoon season since its influence on rainfall is amplified on runoff.
5. There is an increasing trend in runoff efficiency over different basins without any trend in rainfall showing the accelerated response of water cycle owing to climate change.