Analysis of seasonal climate and streamflow forecasts performance for Mainland Southeast Asia

Ubolya Wanthanaporn, Iwan Supit, Bert van Hove, Ronald W.A. Hutjes
Water System and Global Change, Wageningen University & Research

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Background

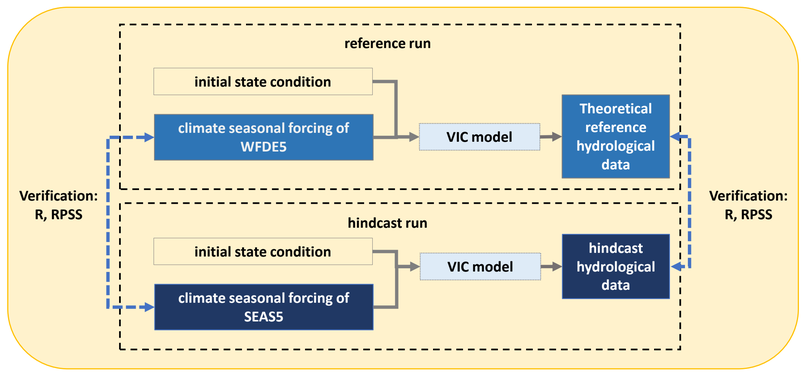
- In mainland Southeast Asia (MSEA) climate variability depends on complex monsoon interactions between ocean and atmosphere.
- Climate change and increased climate variability lead to meteorological and hydrological challenges that will affect human livelihoods.
- Seasonal forecasts become necessary to provide early warning information and support adaptive management.

Objective

We aim to assess the performance of a seasonal forecast system (ECMWF SEAS5 + VIC) on climate and streamflow predictability over MSEA.

Methods

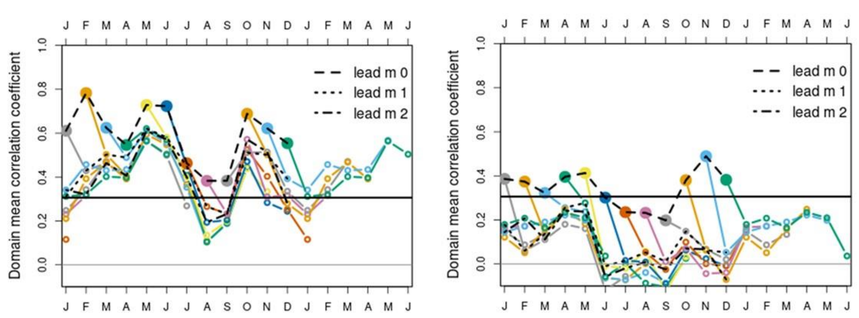
We used hindcasts to test the SEAS5 performance over MSEA during 1985-2014. SEAS5 temperature and precipitation hindcasts were validated against WFDE5 and APHRODITE, respectively. Then, the VIC hydrological model was used to generate monthly streamflow hindcasts using SEAS5 forcing and tested against the WFDE5 driven streamflow reanalysis and observed streamflow.



Set-up of this study.

Results

Prediction skill in climate



(a) Temperature (b) Precipitation

Spatially aggregated correlation coefficient R (p<0.05) for (a) temperature and (b) precipitation of SEAS5 hindcast against reference datasets (WFDE5).

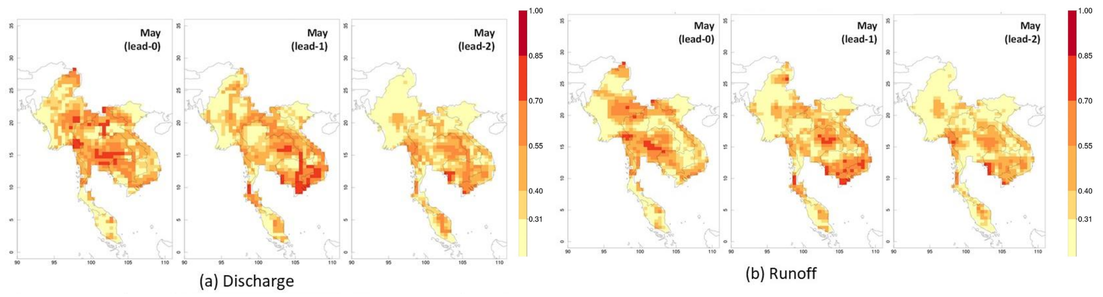
- Prediction potential for temperature beyond two months in advance.
- Skill of precipitation is limited to the first month.
- High forecast skills were shown during the pre-monsoon (April–May) and post-monsoon (October–November).

Prediction skill in hydrology

- The skill of both discharge and runoff hindcasts is lower compared to the temperature and precipitation skill.
- The central MSEA exhibits high skill during the wet season (April–June) but shows low skill in the dry season.
- Malaysia, Vietnam and Cambodia show significant skill in the dry season.

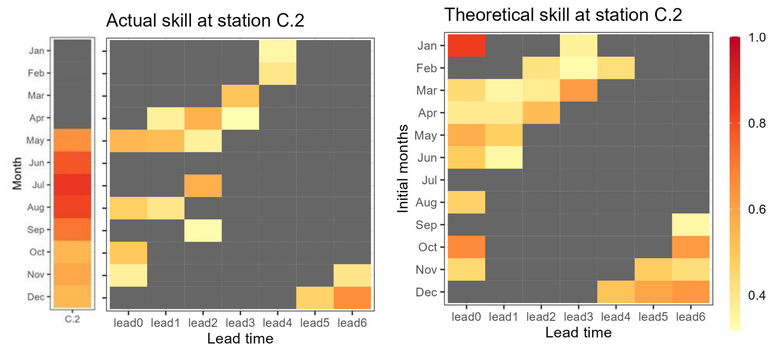
Results

Prediction skill in hydrology



(a) Discharge (b) Runoff

Skill of (a) discharge and (b) runoff by mean correlation coefficient R (p<0.05) of SEAS5-VIC hindcast against pseudo-observation from WFDE5-VIC for 1985–2014, lead 0–2.

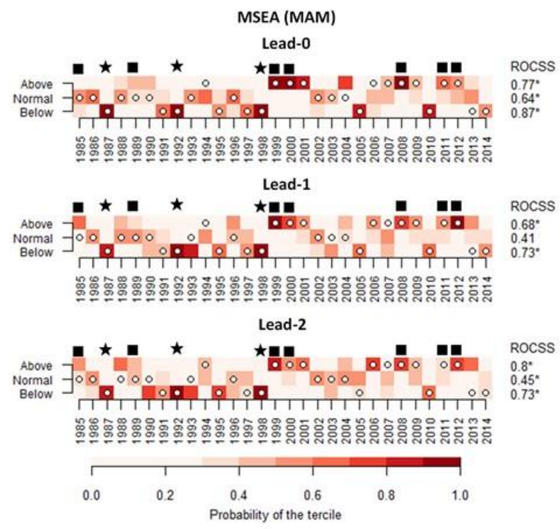


Comparison between river discharge from VIC model driven by WFDE5 and data from gauging stations (reanalysis skill; far left column), between discharge from VIC driven by SEAS5 hindcast and observations (actual forecast skill; middle matrix), and river discharge from VIS-SEAS5 against VIC-WFDE5 (theoretical skill; right matrix).

- Theoretical skill of discharge is generally a little higher than actual skill, but it is comparable. Therefore, the reanalysis is reliable method for this area.

Prediction of anomalous years

- The hindcast shows a remarkable possibility of capturing the extreme coincidences during the pre-monsoon season (MAM) and also SON period.
- In contrast, the hindcast hardly detects abnormal rainfall during the JJA monsoon period after the first lead month.



Year–to–year precipitation hindcast probabilities in tercile plots for March–May (MAM) by SEAS5.

Conclusions

- The analysis highlights a good skill for detecting anomalous incidences in both El Niño and La Niña occurrences by SEAS5.
- SEAS5 and derived hydrological forecasts by the VIC model show useful skill that and potential for agricultural and hydrological anticipatory management in MSEA.

Acknowledgements

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Wageningen University & Research
P.O. Box 123, 6700 AB Wageningen
Contact: ubolya.wanthanaporn@wur.nl