

Assessing seasonal meteorological and hydrological forecasts across South Korea

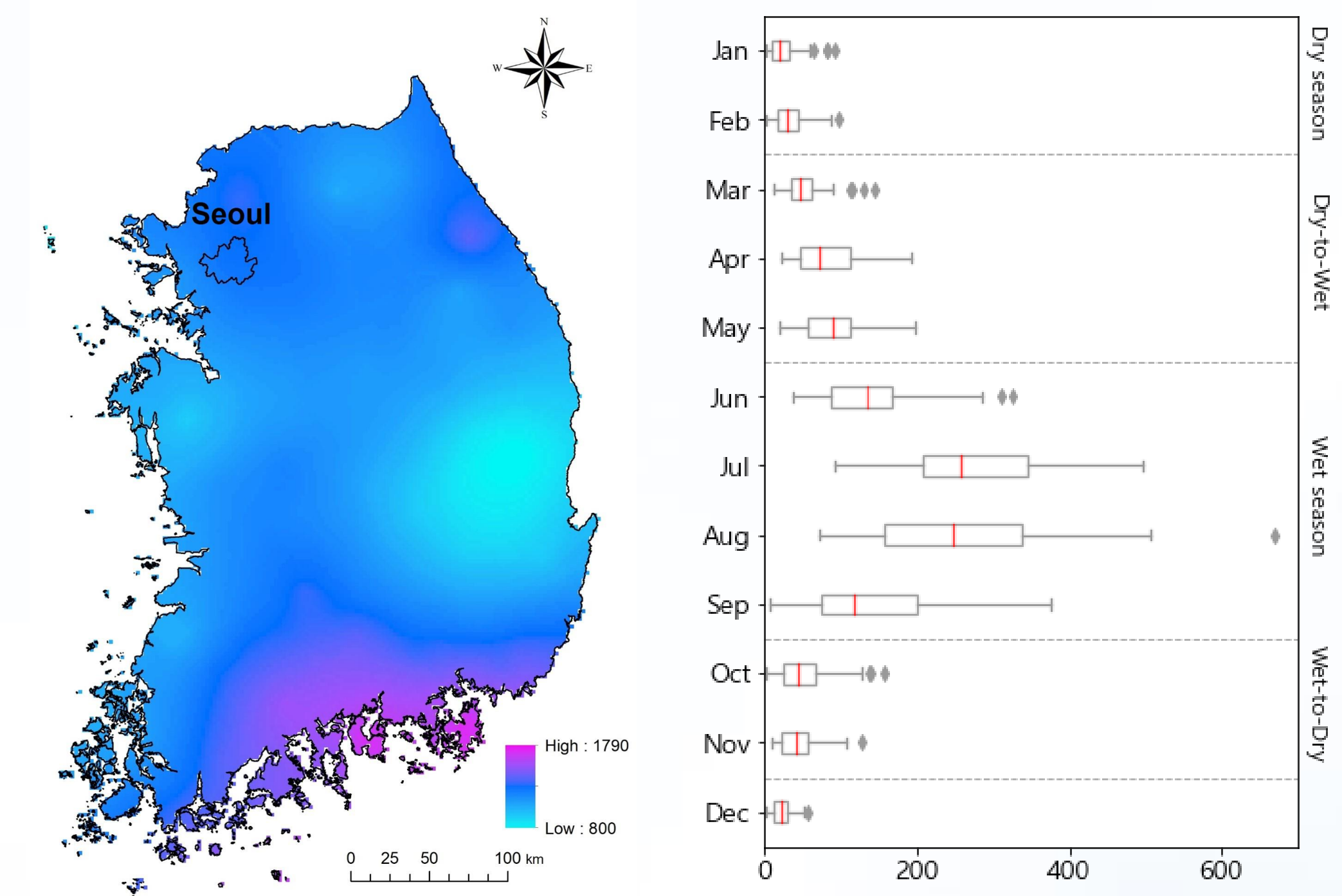


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1. Challenges of water management in South Korea

Annual mean precipitation of South Korea is around 1,300mm, with a high inter-annual and seasonal variability. Therefore, South Korea is highly susceptible to both floods and droughts.

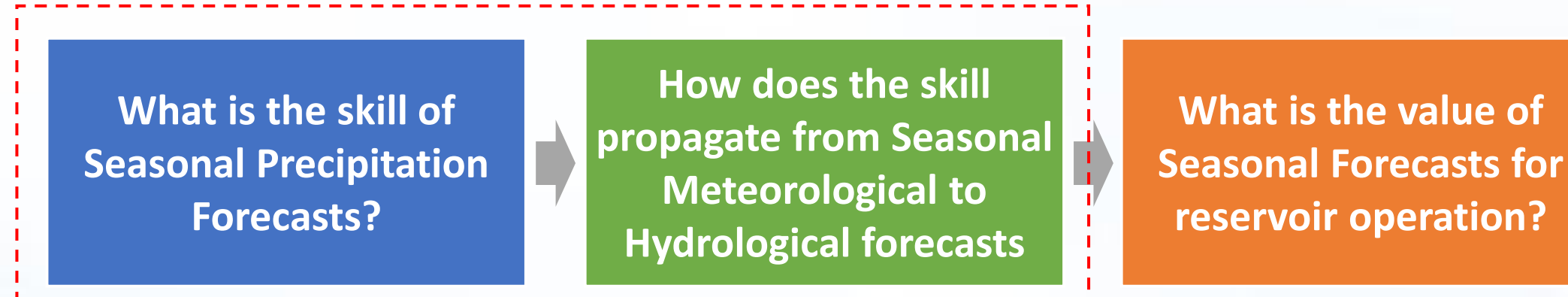
Unfortunately, intensified impact of climate change aggravates water crisis over the country. Recently, we have experienced extreme droughts from 2013 to 2015 and floods in 2011, 2020.



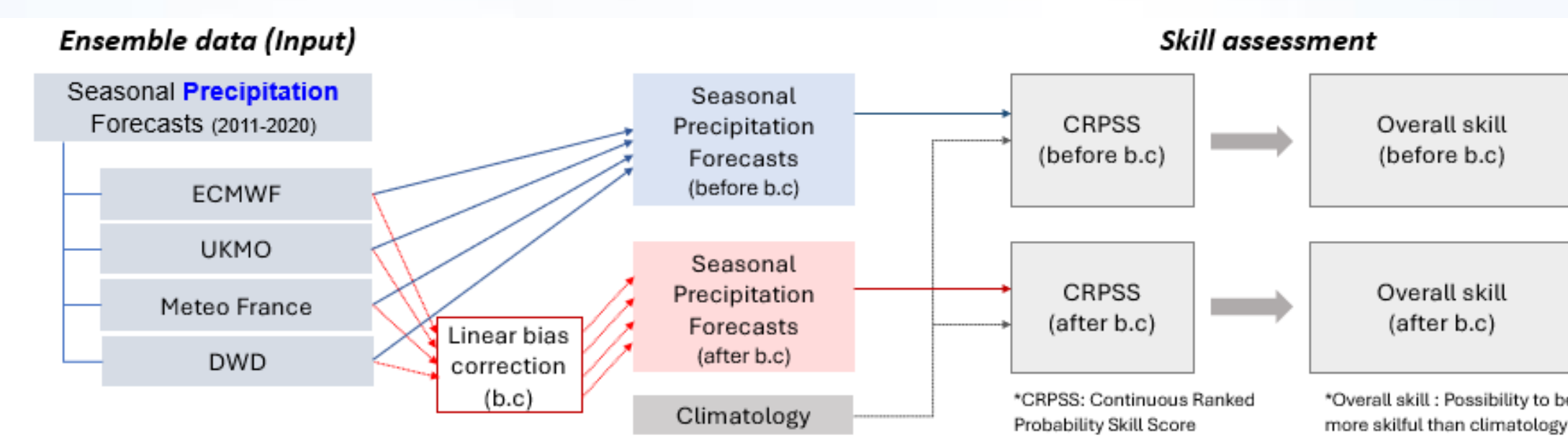
< Annual mean precipitation (left) and monthly precipitation (right) >

2. How seasonal forecasts can help

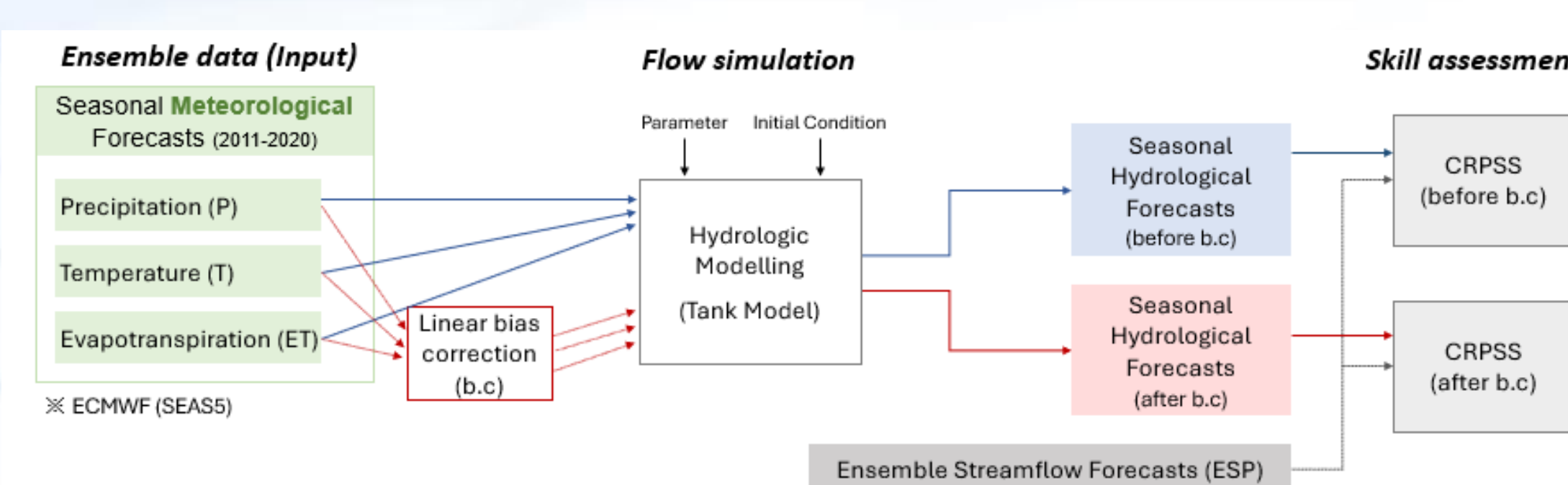
The major goal of our study is to validate the Seasonal Forecasts whether it can suggest better water management (reservoir operation) performance in South Korea.



Skill assessment of Seasonal Precipitation Forecasts

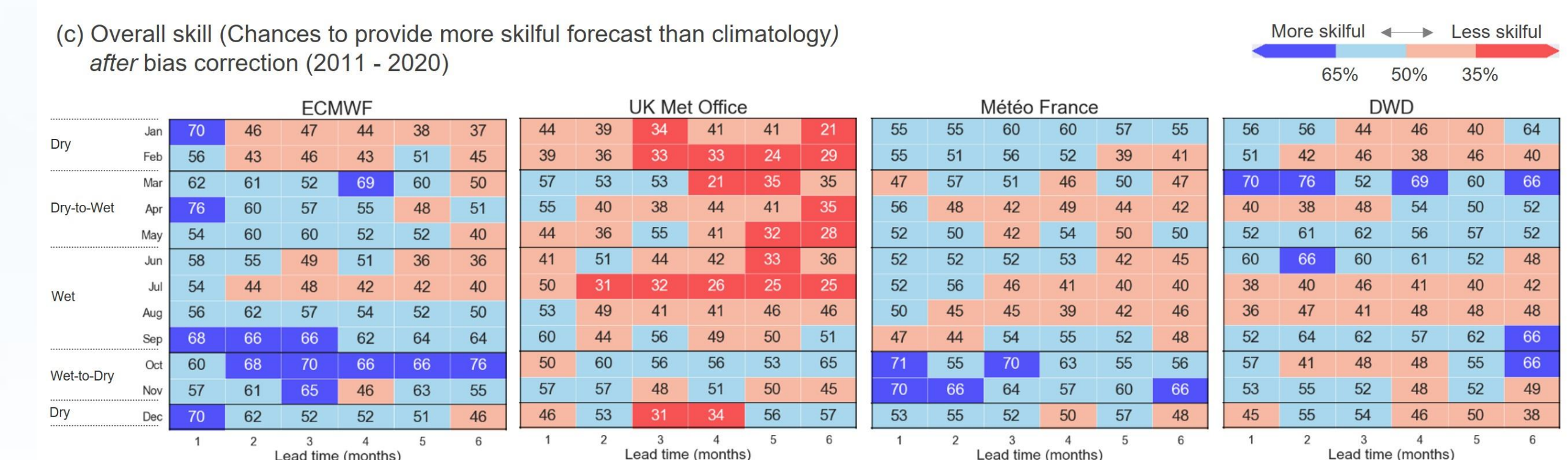
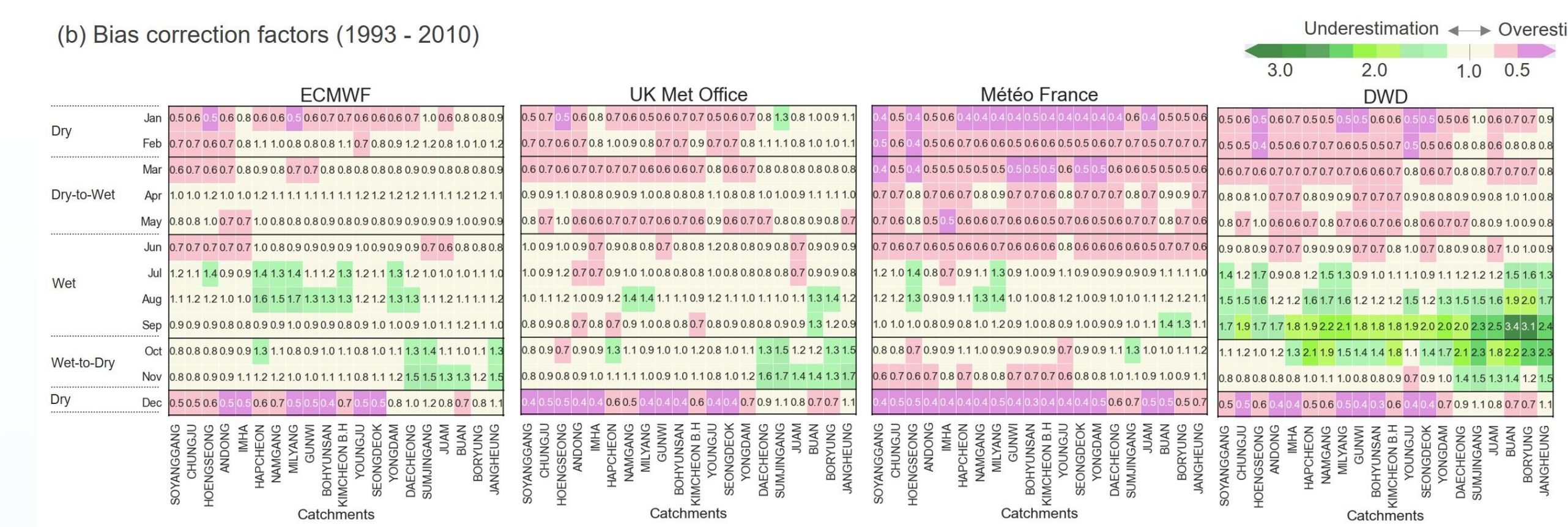
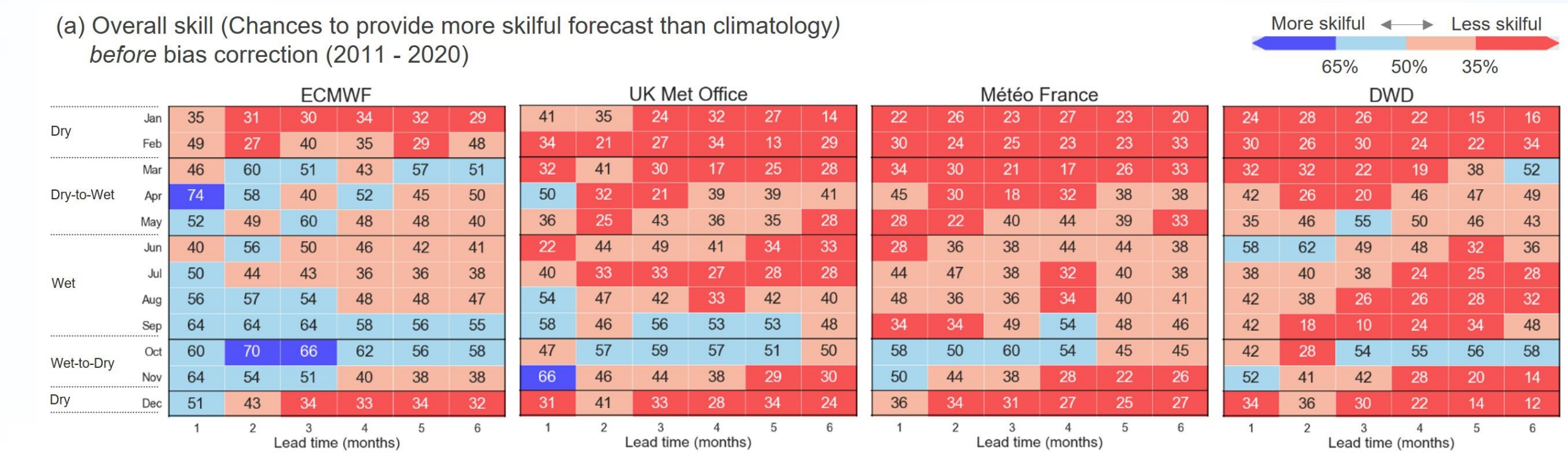


From Seasonal Meteorological to Hydrological Forecasts



3.1 Are Seasonal Precipitation Forecasts (SPFs) skillful?

ECMWF provides more skillful forecasts than other forecasting centres and it outperforms the climatology up to 2 months of lead times.



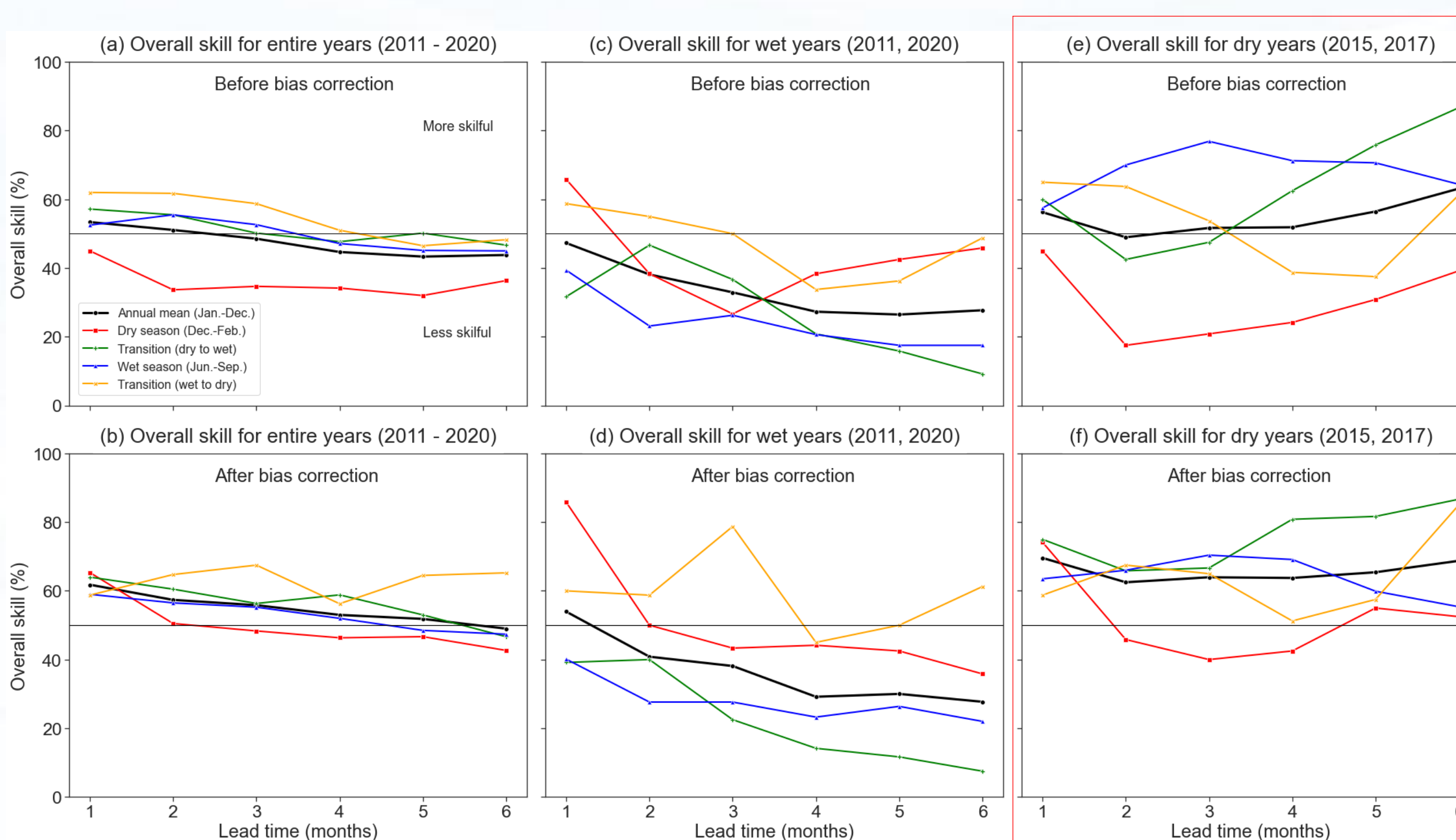
< Overall skill (averaged chances of SPFs being more skillful than climatology) for 20 catchments and over 10 years (2011-2020) (a) before and (c) after bias correction, (b) represents Linear bias correction factors. >

SPFs show the highest skill during the Wet season of dry years, and better than climatology at all lead times.

The Dry season shows lower skill compared to climatology, however, the impact of bias correction is more significant during this season.

In general, the skill during the wet years is less skillful than during dry years.

For all lead times (month), the Wet season in dry years shows the highest level of skill.

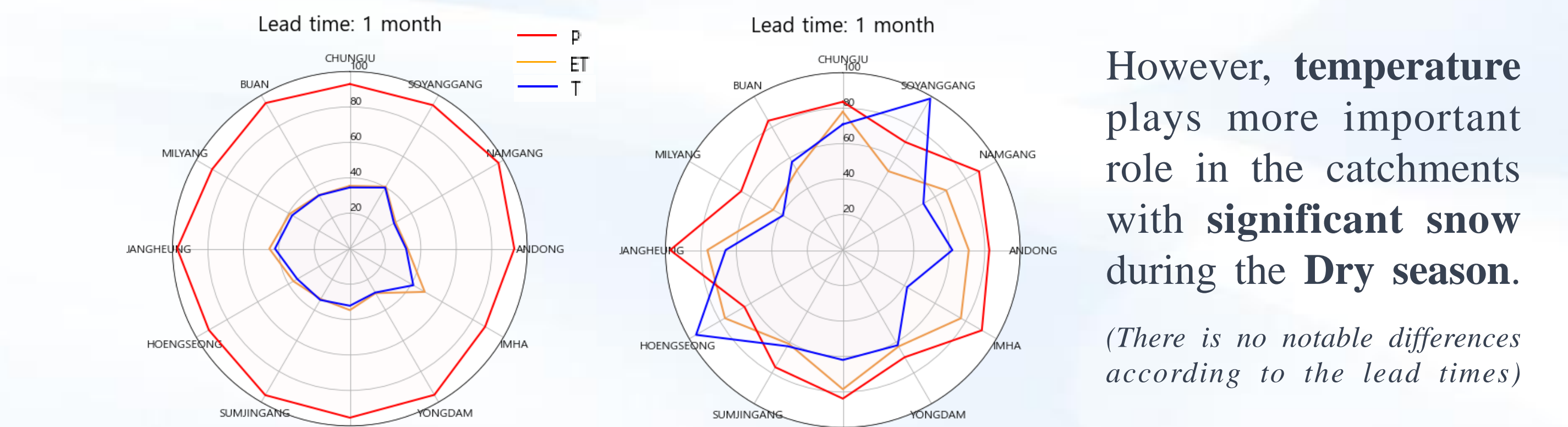


< Overall skill of SPFs from ECMWF, averaged over 20 catchments for (a, b) entire years, wet (c, d) and dry (e, f) years. Top (bottom) row is before (after) bias correction. >

3.2 How does skill of Seasonal Meteorological Forecasts propagate to Hydrological Forecasts?

Precipitation is the dominant driver of the Seasonal Hydrological Forecasts (SHFs) skill in South Korea.

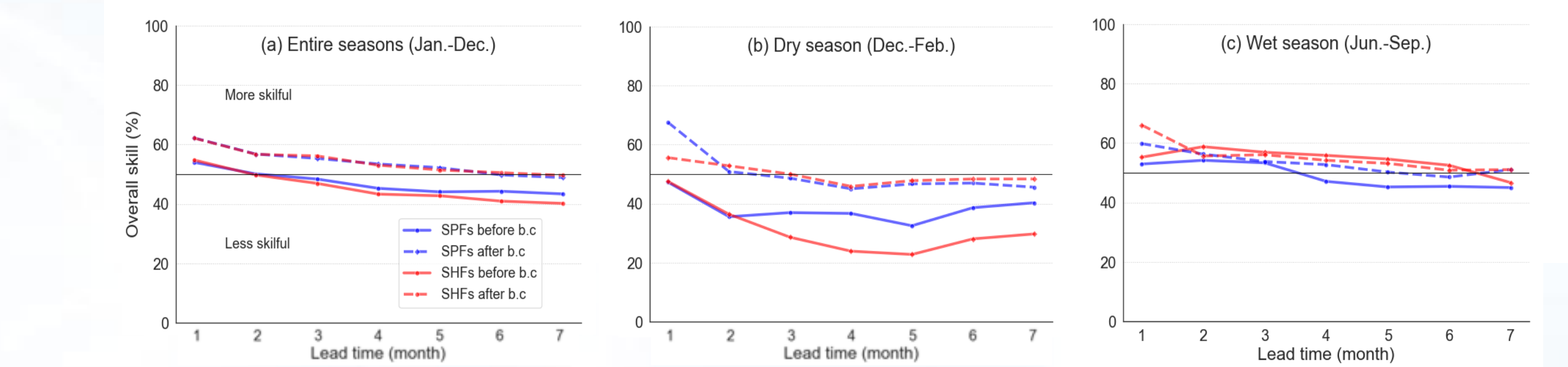
SPFs are less skillful than climatology, except the forecasts from ECMWF with 1~2 months lead time. Therefore, ECMWF forecasts are the most skillful in South Korea.



< Contribution rate (%) of each weather forcing (Prec.: red, ET: orange, Temp.: blue) to the skill of SHFs during all season (left) and Dry season (right) >

The skill of Seasonal Precipitation Forecasts (SPFs) is directly mirrored into the Hydrological Forecasts skill

Both skills are generally coherent even in different seasons. In summary, improved precipitation forecasts lead to skillful hydrological forecasts.



< Overall skill of SPFs (blue) and SHFs (red) before (solid lines) and after (dashed lines) bias correction. >

4. Key Findings

- Seasonal Precipitation Forecasts provided by ECMWF are the most skillful in South Korea and linear bias correction was useful to improve the skill.
- Seasonal Precipitation Forecasts have the highest skill during the Wet season in dry years, thus, it might be mainly useful for anticipating dry years.
- Precipitation is the key variable in Seasonal Hydrological Forecasts in South Korea, and the skill of precipitation forecasts is directly propagated into the skill of hydrological forecasts.

5. What's next?

We plan to assess the value of seasonal forecasts for informing water management decisions. *Want to get in touch?* yongshin.lee@bristol.ac.uk

Try our Python based SEAFORM package to assess the skill of Seasonal Forecasts for your catchment of interest!
[SEAFORM, <https://github.com/uobwatergroup/seaform.git>]

