A seasonally coherent calibration (SCC) model for post-processing numerical weather predictions

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Forecast calibration

- Bias
- Skill
- Reliability
- Climatology
Bayesian Joint Probability modelling

- Log-sinh transformations
- Bivariate normal distribution
- Zero values treated as censored data
- Maximum likelihood method

\[
\begin{align*}
\mu_o(m) & \quad \sigma_o(m) \\
\mu_f(m) & \quad \sigma_f(m) & \quad \rho(m)
\end{align*}
\]

\[\text{Observed}\]
\[\text{Forecast}\]
\[ \mu_o(m) \]

\[ \sigma_o(m) \]
$\mu_f (m)$

$\sigma_f (m)$

$\rho(m)$
A study case
• **Forecast data**
  - ACCESS-G APS1 (deterministic)
  - 2011-2013 (4 years)

• **Observed data**
  - 2007-2016 (10 years)

• **Calibration**
  - Daily precipitation
  - Lead times: 1-10 days ahead
Average monthly precipitation

![Graph showing average monthly precipitation with different lines representing observations and forecasts.](image)
Relationships

Graphs showing relationships between various metrics such as mean of observations, standard deviation of observations, and correlation coefficients.
\[ \mu_f(m) = \alpha \mu_o(m) + \beta \]

\[ \sigma_f(m) = \gamma \sigma_o(m) \]

\[ \rho(m) = \rho \]
Climatology - Day 1

**SCC**

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

**RPP**

- Jan
- Feb
- Mar
- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec

[Graphs showing ranked forecast distribution for SCC and RPP across different months with standard normal variate axes.]

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[The University of Melbourne logo]
Percentage of wet days

The graphs show the percentage of wet days over a period of 12 months for different models:

- **Raw**: Results without any adjustment.
- **RPP**: Results post-processing adjustments.
- **SCC**: Results after specific corrections.

Each graph includes a line for the observed (Obs) data and various models:

- **Day 1**: Model predictions for the next day.
- **Day 5**: Model predictions for the 5th day.
- **Day 10**: Model predictions for the 10th day.

The x-axis represents the months, and the y-axis shows the percentage of wet days.
Reliability and skill - SCC

Reliability

Skill
Summary

- Forecast climatology should be checked
- The SCC model
- Can work with short NWP archive data
- Correct seasonal climatology
- Reliable ensemble spread
- Much improved skill over raw forecasts