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Flip-Flop Index: Quantifying Revision Stability for Fixed Event Forecasts

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Traditional verification statistics focus on measures that inform us of forecast skill. Another aspect of the forecast is its stability or, to take the opposite view, how much it "flip-flops". Weather forecasters report that they are reluctant to change a published forecast if they judge there is a risk of it being changed back again as they consider that such instability detracts from the message delivered and likely response. This aspect of forecasts is quantified using the Flip-Flop Index [1].

The Flip-Flop Index allows us to measure the degree to which sequences of forecasts at shorter lead-times are more stable than the same length sequence at longer lead-times. It also allows us to compare stability of forecasts produced by two different forecast systems. The Flip-Flop Index provides information that can be considered alongside information about forecast skill when deciding on the best system to use for a general public forecast service.

For a revision sequence of forecasts $f_1, f_2, ..., f_n$, for a fixed event, the Flip-Flop Index is defined as

$$\text{Flip-Flop Index} = \frac{1}{n-2}\left\{\sum_{i=1}^{n-1}|f_i - f_{i+1}| - \left(\max_i f_i - \min_i f_i\right)\right\}. \tag{1}$$

If the forecasts are directions, in degrees, we use the

$$\text{Circular Flip-Flop Index} = \frac{1}{n-2}\left\{\sum_{i=1}^{n-1}|f_i - f_{i+1}| - \min(180^\circ, \text{encompassing\_sector})\right\} \tag{2}$$

where $|f_i - f_j|$ is to be interpreted as modular arithmetic, modulo 360°, and encompassing_sector is the size of the smallest sector containing all directions f_i.

The Flip-Flop Index is in the units of the forecast with a Flip-Flop Index of 0 corresponding to no flip-flopping.

We will describe the Flip-Flop Index and Circular Flip-Flop Index in terms of the impact of flip-flops on users with a simple decision making process. We will present some results for Official (manually prepared) and Automated (bias corrected consensus) forecasts with a lead time of up to one week, updated daily. Parameters considered so far are Probability of Precipitation, Minimum and Maximum Temperature, Wind Speed and Wind Direction.

[1] Griffiths, D., Foley, M., Ioannou, I. , Leeuwenburg, T. *Flip-Flop Index: Quantifying revision stability for fixed-event forecasts.* Meteorological Applications (accepted for publication 23 March 2018)