User-oriented forecast system development: The ‘Proper’ way

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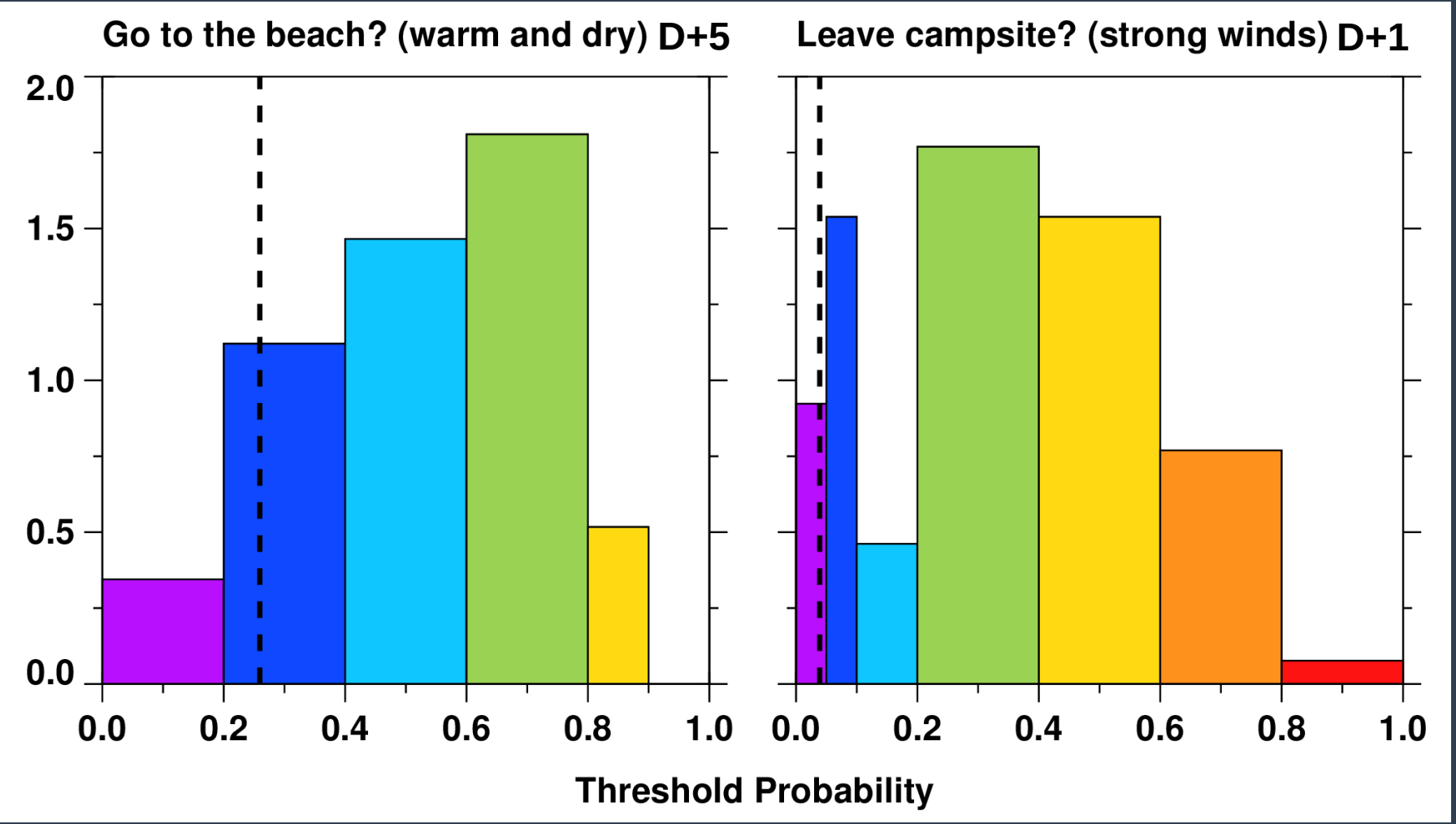
Live science event: Participants' distributions of threshold probabilities

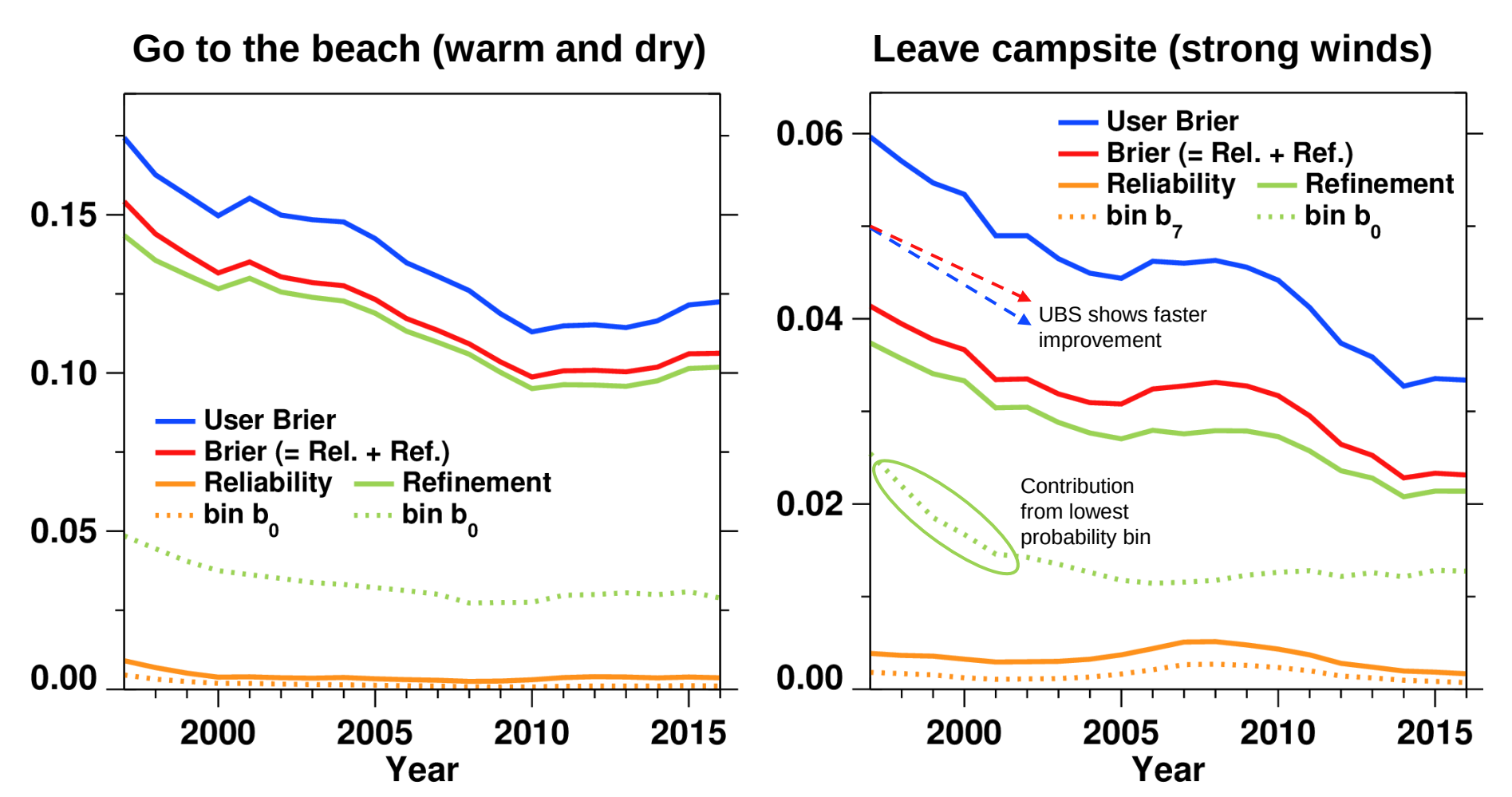


If a user's action optimises their expected financial (or emotional) state, then their probability threshold indicates their 'cost-loss ratio' and their overall expense E is a proper score of the forecast

Proper scores are the 'gold standard' in forecast system development

Participants require higher probabilities to go to the beach than to avoid dangerous winds

‘User Brier Score’ (UBS) applied to ECMWF ensemble forecasts



$$UBS = \frac{\widetilde{\overline{E}}_{prob} - \widetilde{\overline{E}}_{best}}{\widetilde{\overline{E}}_{worst} - \widetilde{\overline{E}}_{best}}$$

- $\overline{\blacksquare}$ = Mean over forecasts
- $\widetilde{\blacksquare}$ = Integral over users’ cost/loss ratios

Proper (asymptotically)

Range [0,1]

Brier Score for uniform distribution of cost/loss ratios

UBS > BS as users were not interested in high probability thresholds

Key issue: Extreme weather in the tails of the ensemble distribution (⇒ larger ensemble, better post-processing of pdf, ...)

Summary

Candid (even if limited) communication between users and forecasters could guide developments which improve forecast utility

If you are interested in developing user-oriented score(s) please email mark.rodwell@ecmwf.int

Example information

Sector	Energy
Event	$v > 20\ ms^{-1}$
Leadtime	$D + 5$
Prob. thresh.	$p_t = 0.5$
Action	not specified
Importance	7/10
Sector	Agriculture
Event	$T < 0℃$
Leadtime	$D + 3$
Prob. thresh.	$p_t = 0.2$
Action	apply frost fan
Importance	8/10
Sector	Health
Event	H.I.$(T, RH) > 32℃$
Leadtime	$D + 2$
Prob. thresh.	$p_t = 0.3$
Action	prepare hospital
Importance	5/10
Sector	Transport
…	…

Thank You