JOINTLY VERIFYING AND EVALUATING SEASONAL FORECASTS FROM CLIMATE SERVICES: EXPERIENCE FROM THE H2020 CLARA PROJECT

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Context – the CLARA project (2017-2020)

- 14 **climate services building upon C3S** forecasts/projections and sectorial information

| Disaster Risk Reduction | Water Resources Management | Agriculture | Renewable Energy Production | Air Quality |

- Co-generation between data providers, service developers and end users through 2 **Multi-User Forums**

  …and how do the two relate depending on the sector?

- Sustain services marketability and value
  - **When forecast-based, assess forecast quality**

Hydro-climate services

- Providing seasonal forecasts based on C3S forecast inputs

Sector	Service name	Aim	Developer	User involved	
Water resources management	ROAT - *Reservoir Operation Assessment Tool*	Support operations of multi-objective reservoirs	University of Córdoba	Technicians of the Béznar-Rules reservoir	
Agriculture	WRI - *Water Resources for Irrigation*	Support decision-making for both water procurement and water allocation	Arpae	Land Reclamation and Irrigation Consortium of Romagna and Burana	Villani et al. (2021)
Hydropower production	SCHT - *Smart Climate Hydropower Tool*	Simplify decision-making processes by predicting hydropower production	GECOSistema	Enel Green Power	Essenfelder et al. (2020)
	SHYMAT - *Small Hydropower Management-Assessment Tool*	Support operation of run-of-river plants	University of Córdoba	Endesa technicians	Contreras et al. (2020a; 2020b)
Solar energy production	SEAP - *Solar Energy Assessment and Planning Tool*	Provide information about the optimal tracking system for dynamic collectors	University of Córdoba	Magtel technicians	

Verification

	ROAT	SHYMAT	WRI	SCHT	SEAP
	River flow m^3/s	River flow m^3/s	Irrigation water needs m^3/ha	Reservoir inflow $Mm^3/month$	PV production $kWh/month$

Probabilistic framework
- Reliability
- Sharpness

Categorical framework
- Accuracy
- Category-based accuracy

Deterministic framework
- Accuracy
- Correlation

Reference	observations	observations	simulations of water needs based on ERA5-land	observations	simulations of PV production based on ERA5

Benchmark forecast	historical flows over 10 years	historical flows over 10 years	ERA5-land-driven climatology	linear model	ERA5-driven climatology

Verification

ROAT — River flow m^3/s

SHYMAT — River flow m^3/s

WRI — Irrigation water needs m^3/ha

SCHT — Reservoir inflow $Mm^3/month$
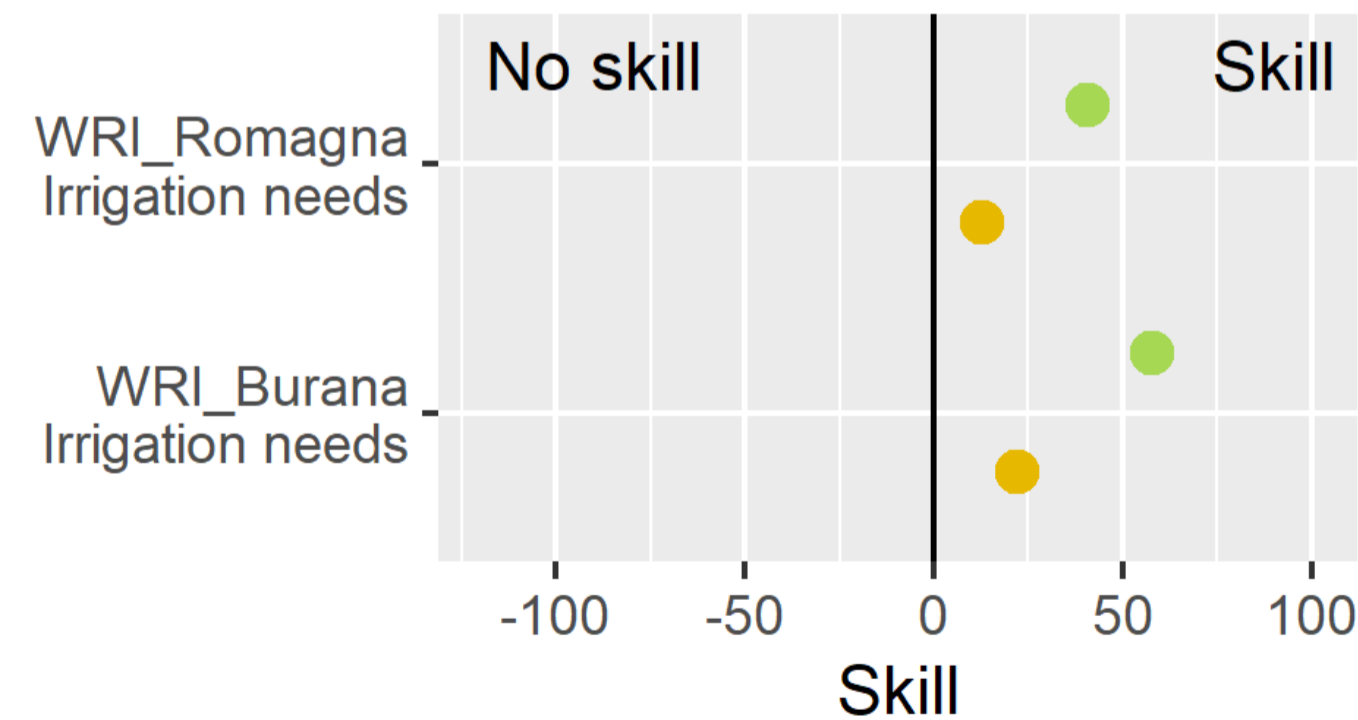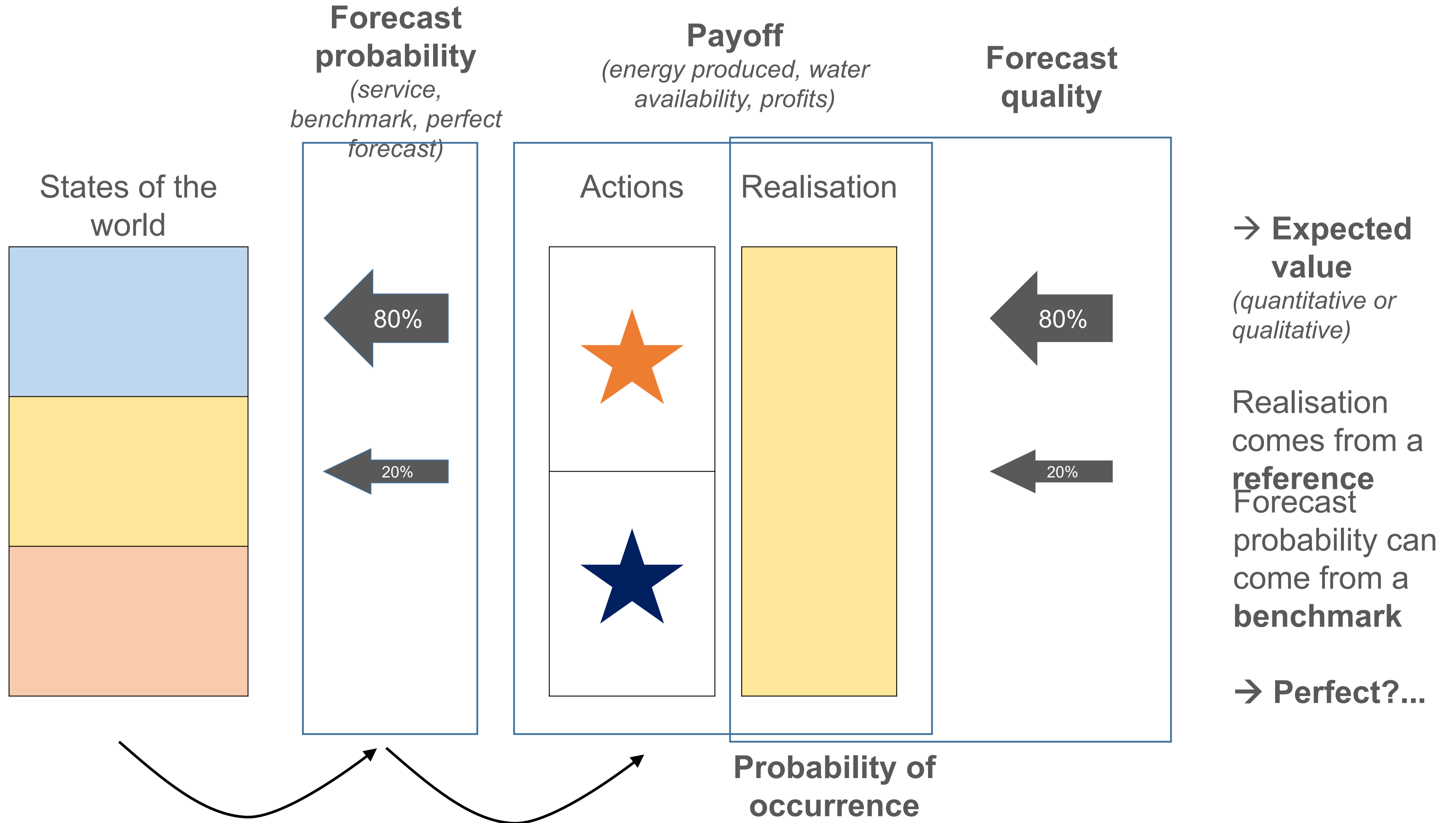
SEAP — PV production $kWh/month$
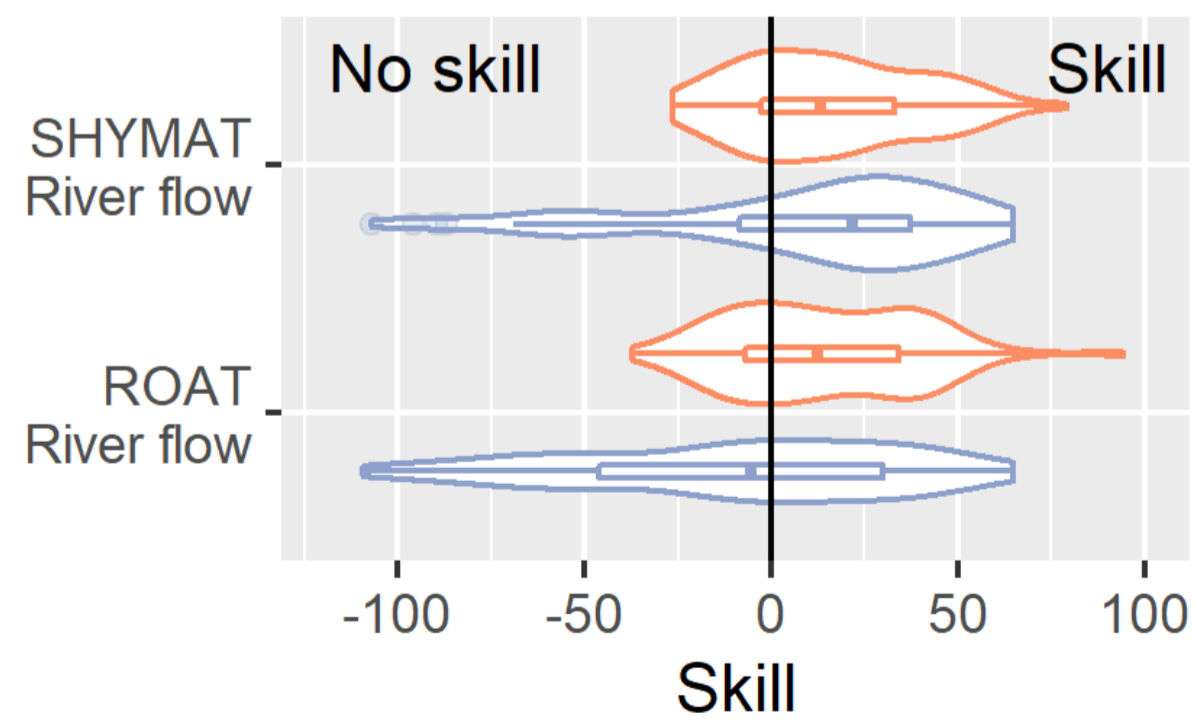
Valuation

	ROAT	SHYMAT	WRI	SCHT	SEAP

|	**Stored water** m^3/s	River flow m^3/s	Irrigation water **savings** m^3/ha	**Stored water** $Mm^3/month$	**Clearness index** $kWh/month$
	Value assessment		Value assessment	Value assessment	
Reference	observations	observations	**too little data on water pumped for irrigation**	observations	ERA5 simulations
Benchmark forecast	historical data of stored water	**expert judgment**	✖	historical water volume data	**current collectors tracking method**

$\neq$ linear model

Lesson #1 – A joint verification-evaluation

- Requires the verification of value-related variables (additional impact models)

- Requires data on system uses (reservoir operations, water abstractions, PV system characteristics...)

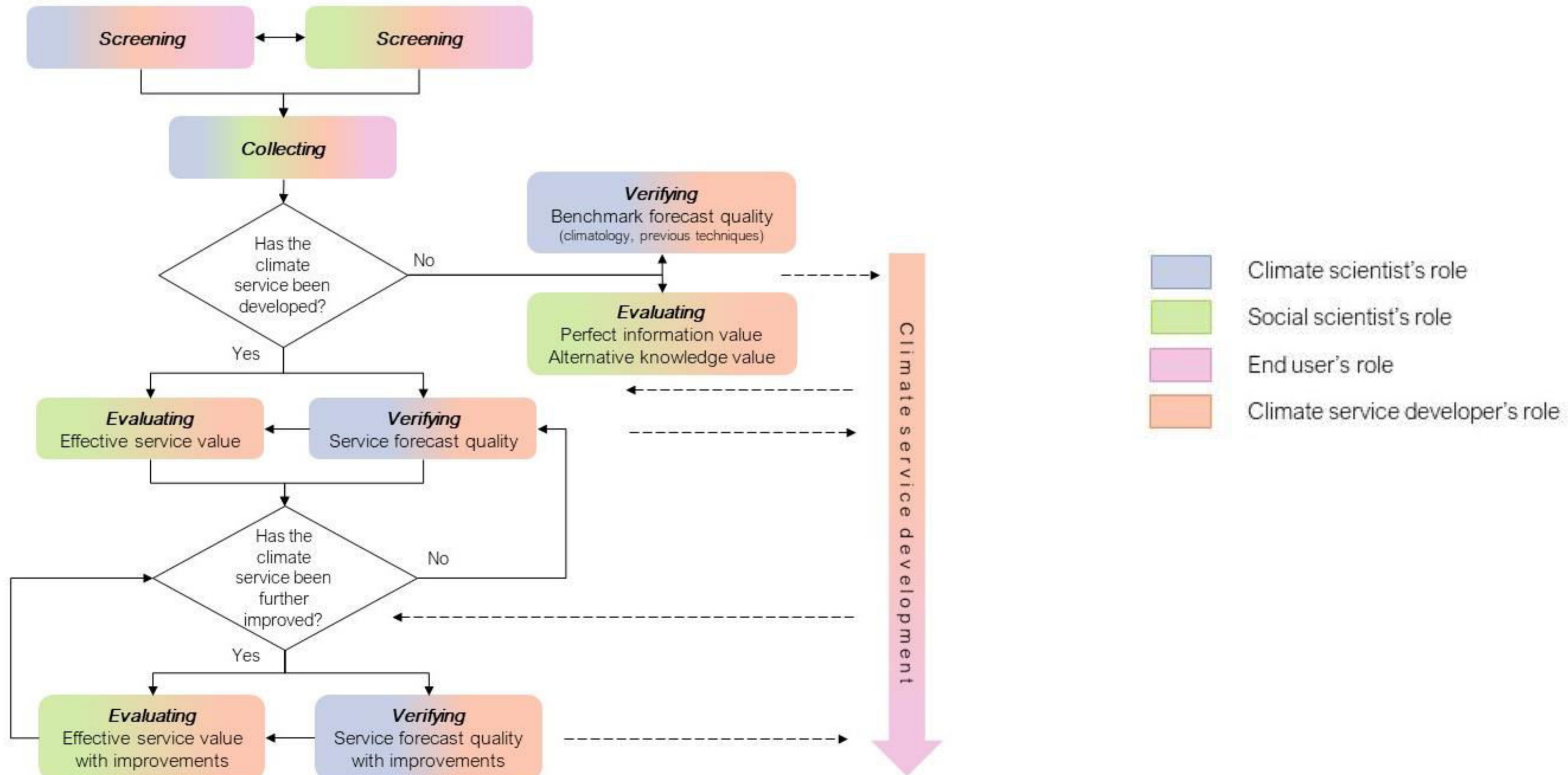- Is easier for service improvement than service prototyping
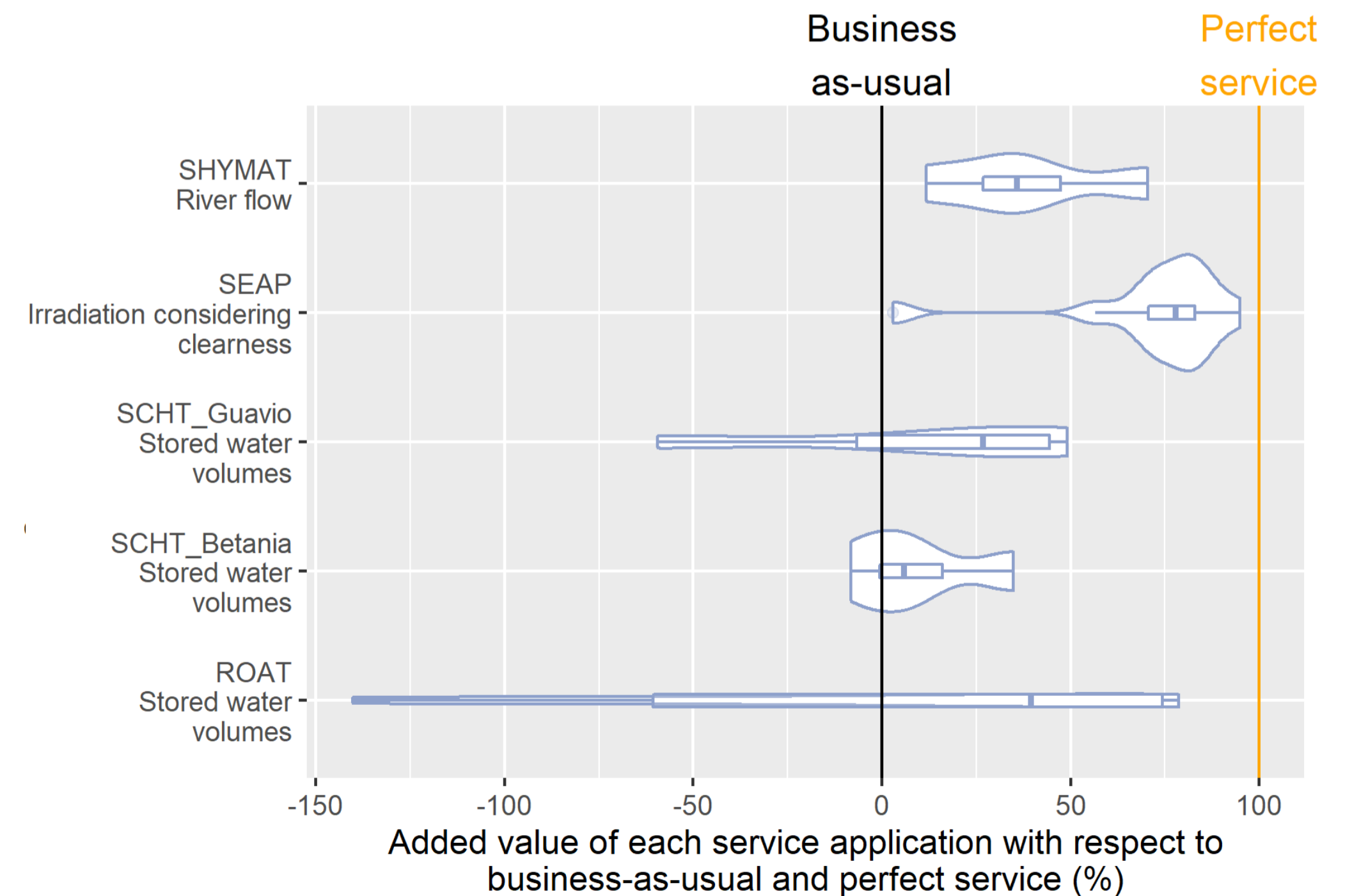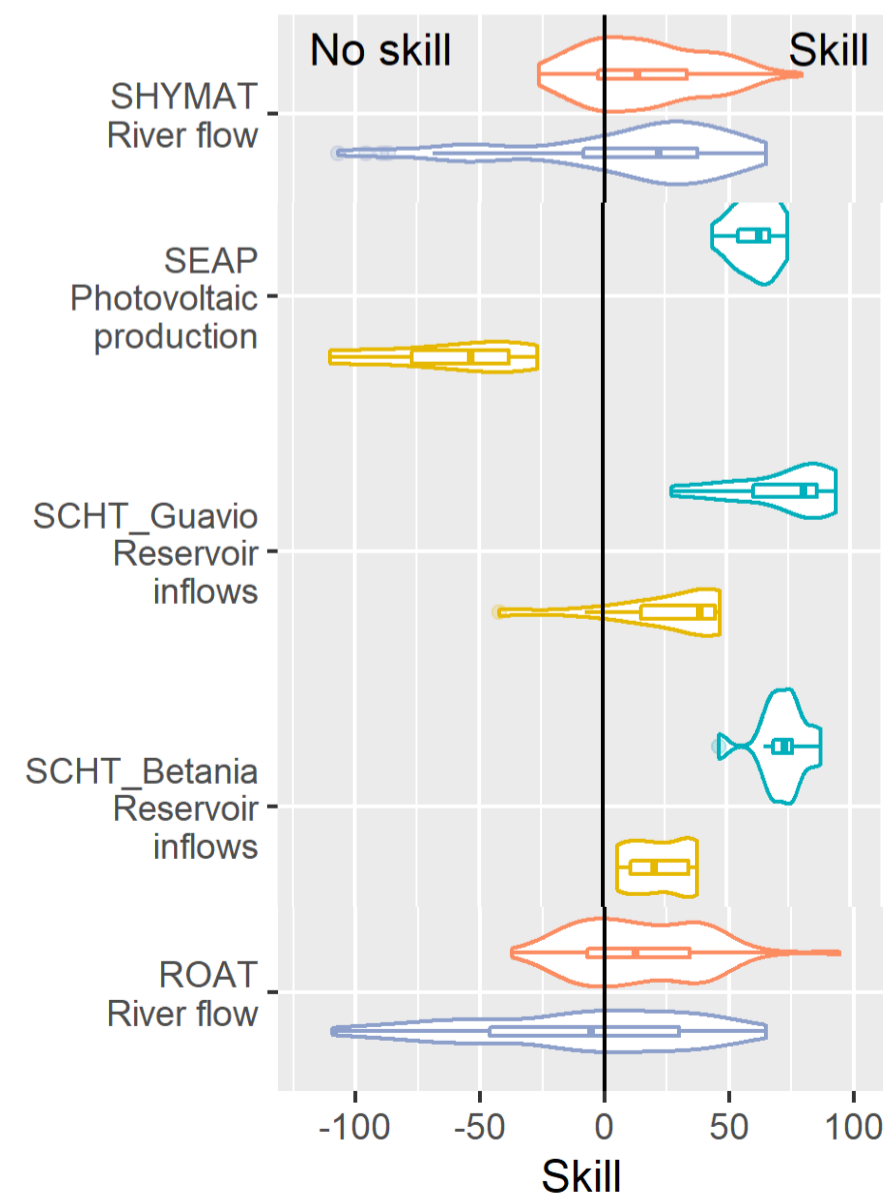
Lesson #2 – A joint verification-evaluation

Had we had 3 more years...

Perspectives

Value-oriented metrics ?

- Non-symmetrical effect of overestimation/underestimation

- Weighted contingency matrix

- Works have explored such metrics/joint assessment Richardson (2000), Roulin (2007, HESS) Laugesen et al. (2023, HESS), ...

Forecasts in the value chain

- Forecast quality is only a partial element of the service full value chain

- Here we assumed that the user always follows the forecast information and has a perfect understanding of it

Thank you!

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New game

Flash floods
Compound events
Vulnerability
Communication
Decision-making

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