

INTRODUCTION & OBJECTIVE

1 Introduction

Observations from superpressure balloons of the Strateole 2 campaign provide accurate estimates of Gravity Wave Momentum Fluxes (GWMF), see Corcos et al. (2021).

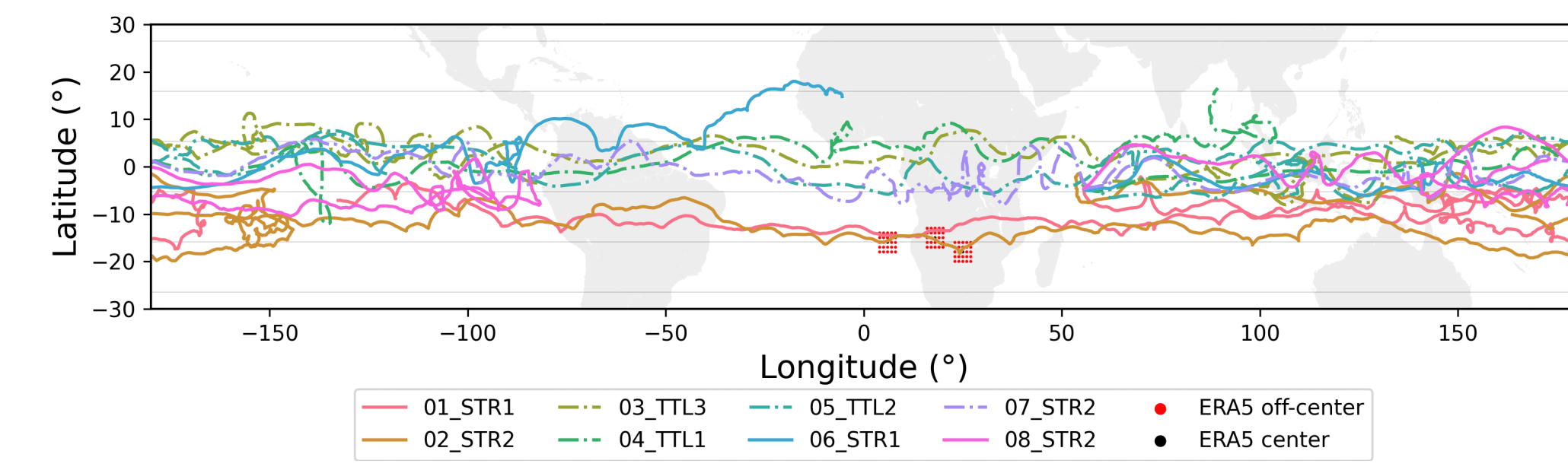


Figure 1: Balloons' trajectories of the first campaign.

Prior related studies:

- Lott et al. (2023) compared several gravity wave drag parameterizations against the observations.
- Has et al. (2024) applied tree-based ensemble ML and inputs from ERA5 to reconstruct the balloon-observed GWMFs.

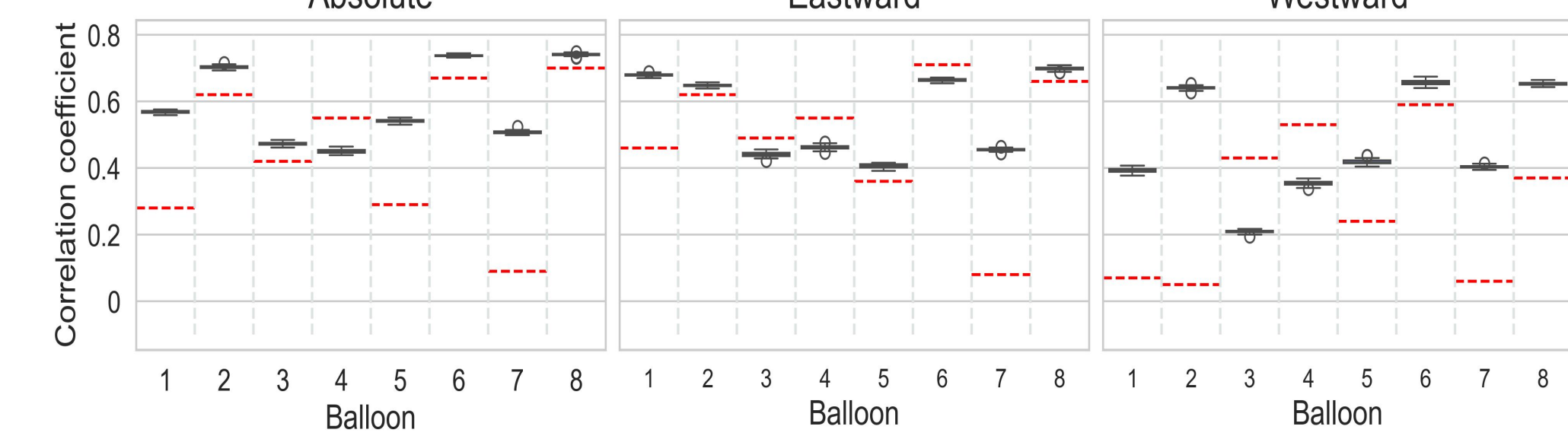
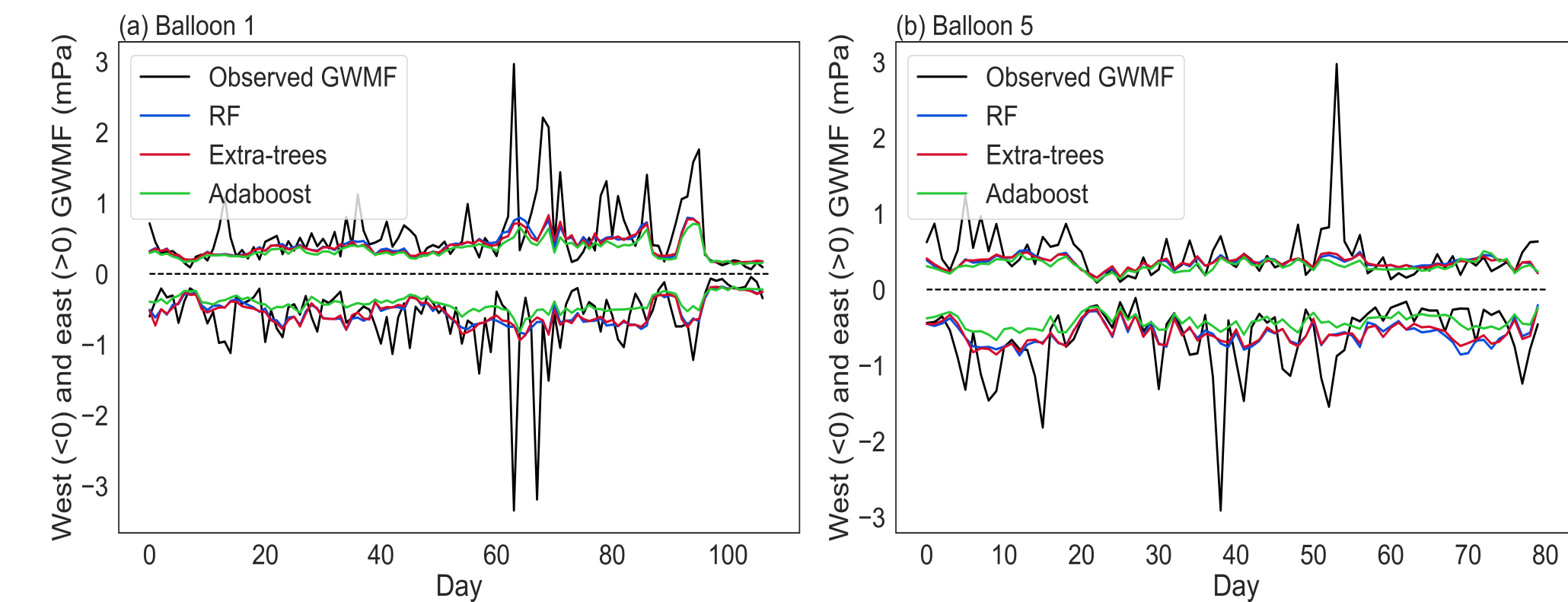


Figure 2: Results from Has et al. (2024) and Lott et al. (2023).

2 Objective

- How can we improve the estimation made by tree-based models of Has et al. (2024)?
- Is there any complementarity between ML by Has et al. (2024) & parameterizations by Lott et al. (2023)?

METHODOLOGY

3 Aggregation methods

MLs are trained using the 2nd campaign (2021), and parameterizations are treated as trained ML models.

3.1 Aggregation 1

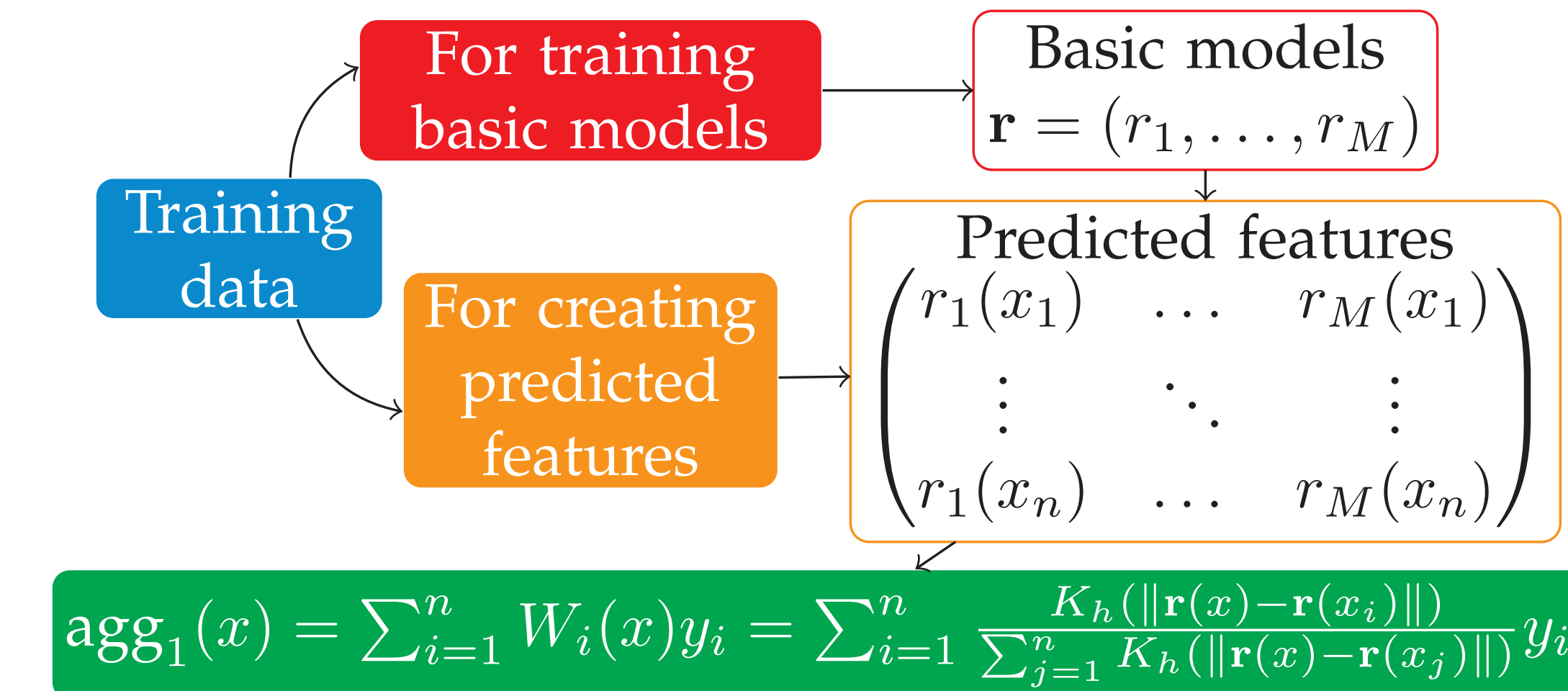


Figure 3: Gradient COBRA method (HAS, 2023).

3.2 Aggregation 2

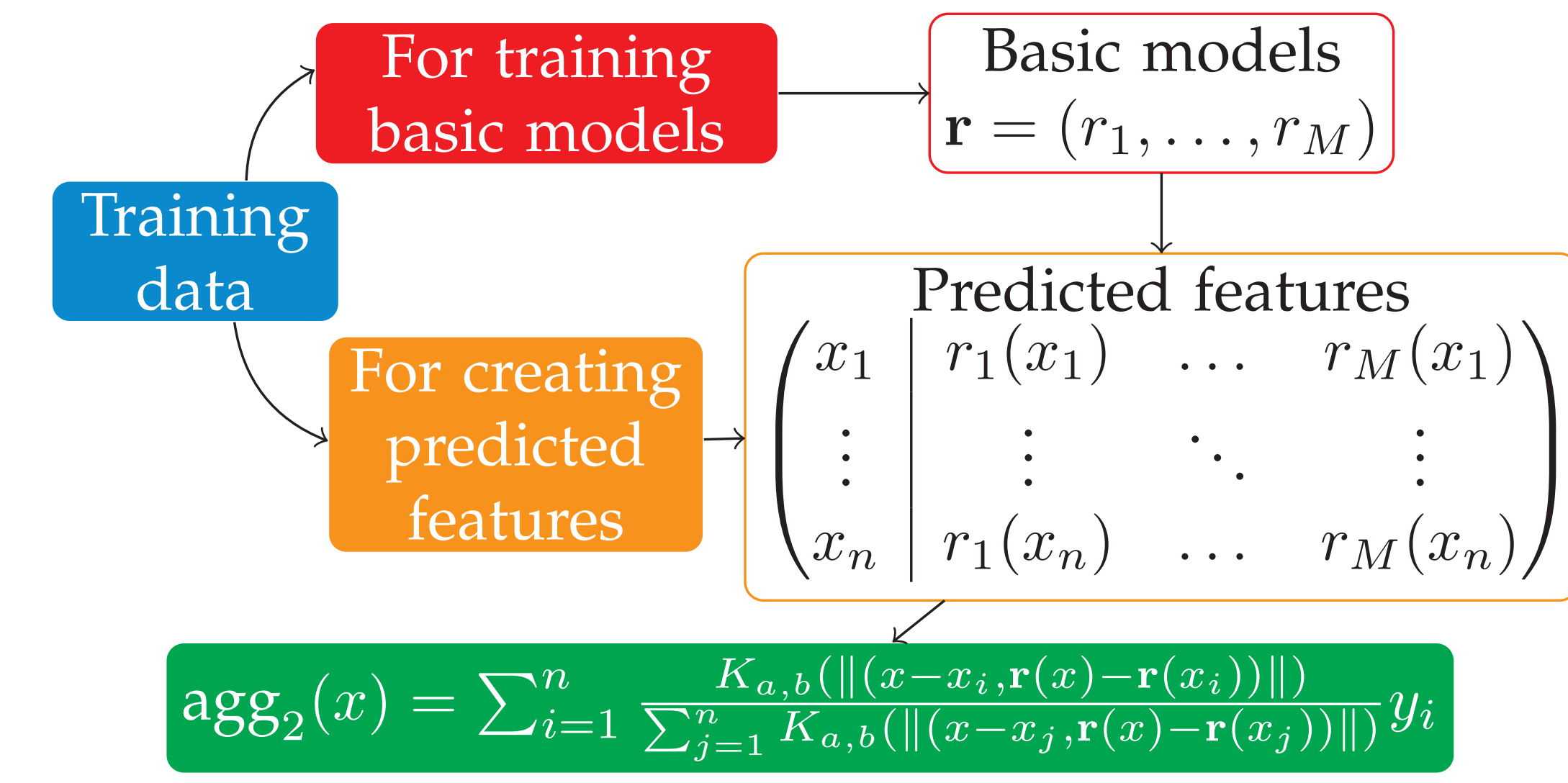


Figure 4: Input-output trade-off aggregation (Fischer and Mougeot, 2019).

3.3 Aggregation 3

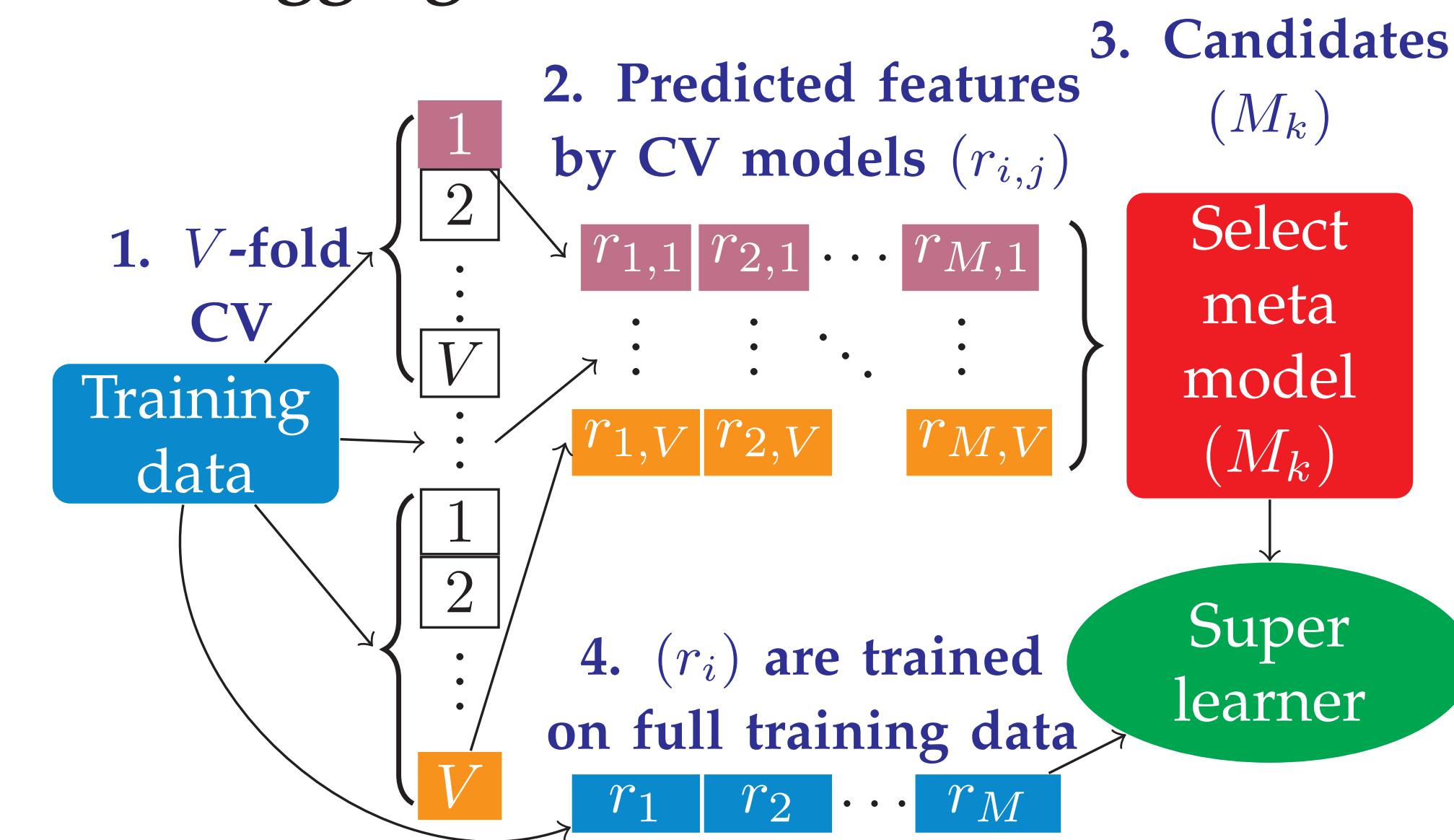


Figure 5: Super learner (van der Laan et al., 2007).

RESULTS, DISCUSSION & FURTHER EXPLORATION

4 Results

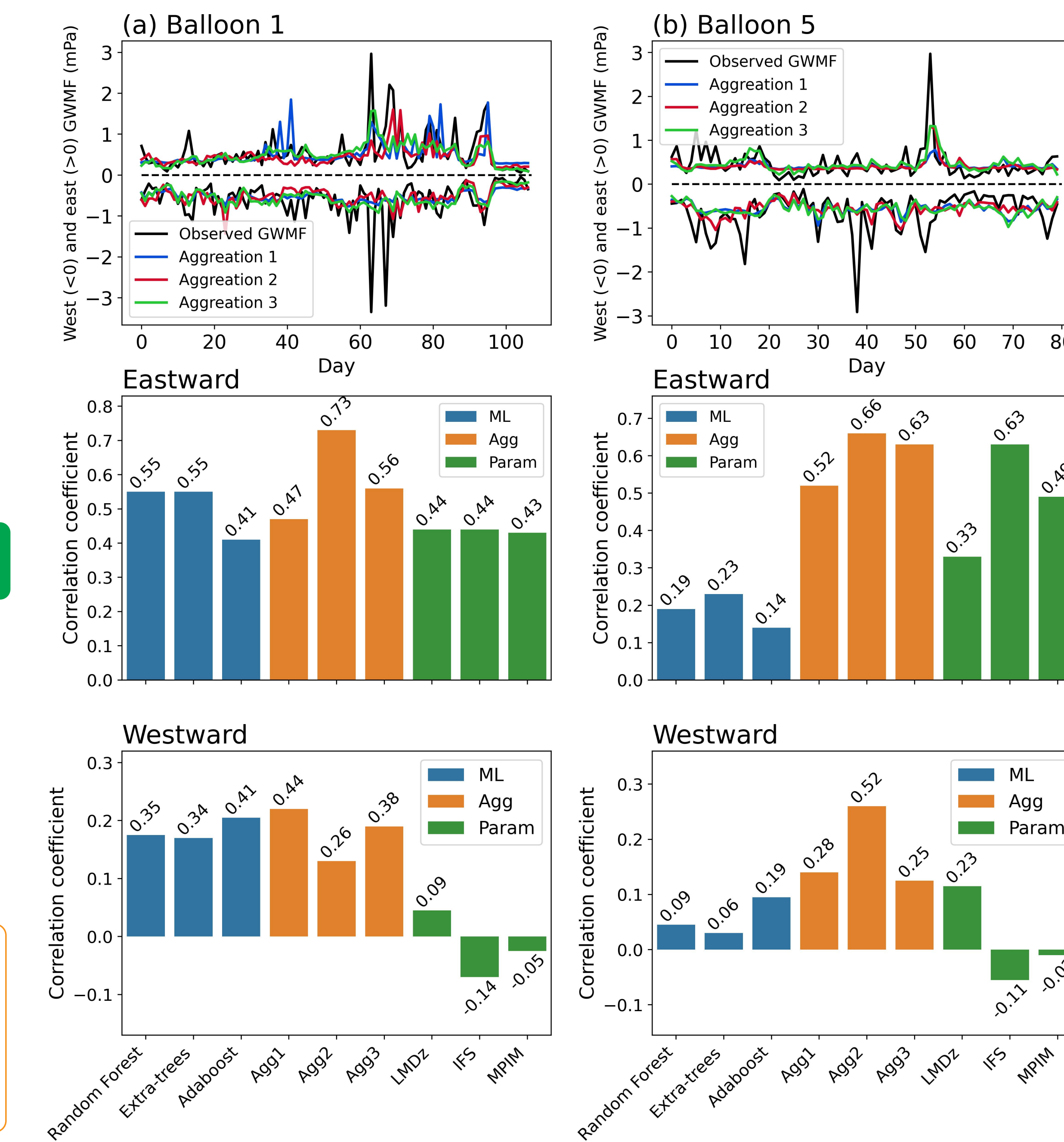


Figure 6: Results of ML, Parameterizations, and aggregations.

5 Discussion

- Aggregation 2 often does a better job compared to the other two.
- Improved in catching the peaks but suffered in terms of correlations.
- There seems to be no significant complementarity between ML & parameterizations.

6 Further exploration

Balloons sampled particular realizations of GWMFs over an extensive grid of ERA5's large-scale flow. How about aiming for the distribution instead?

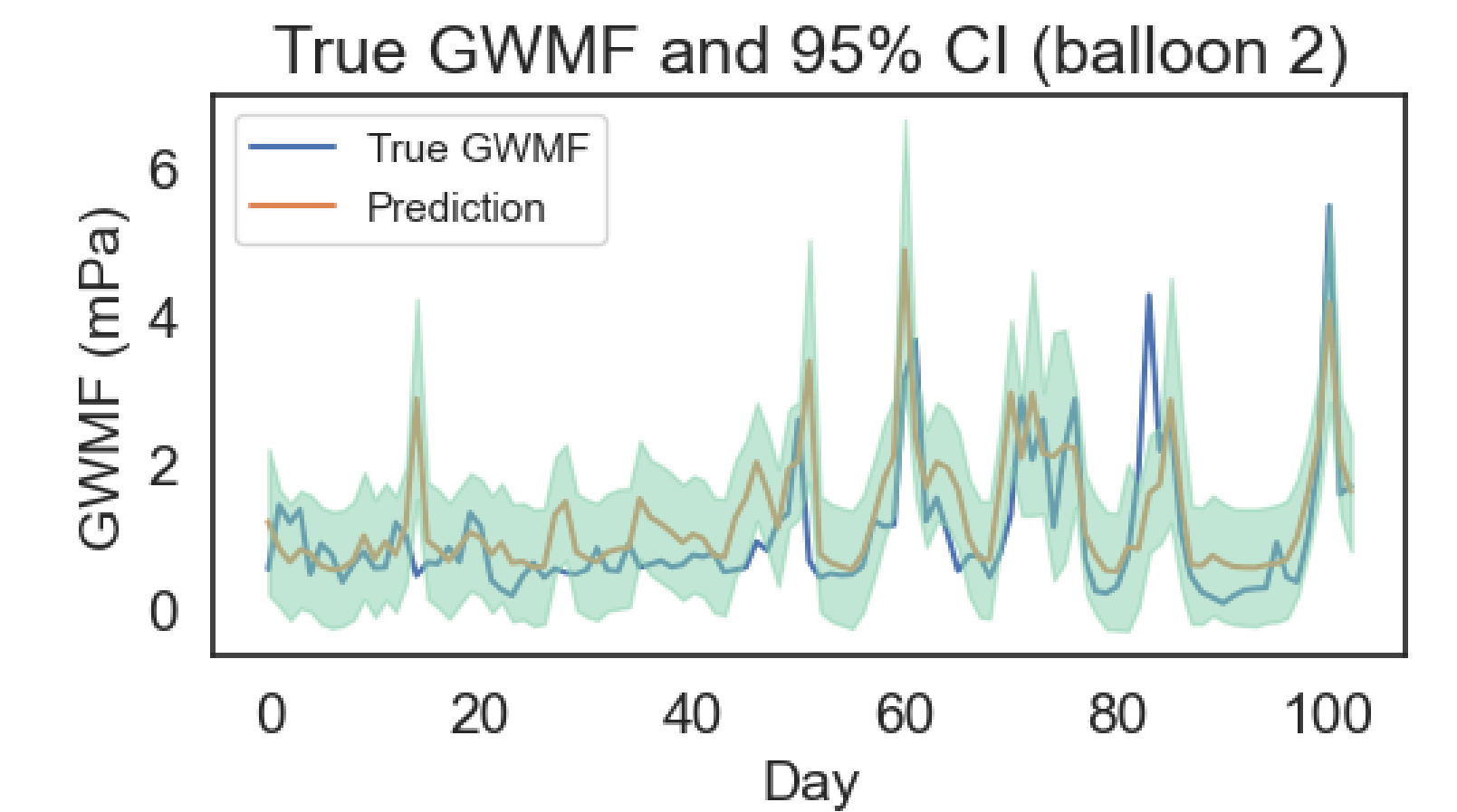


Figure 7: A prediction on balloon 2 of the 1st campaign (2019) using Bayesian Neural Network trained on data of the 2nd campaign (2021).

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