

Supporting Information for

Deep Learning provides substantial improvements to county-level fire weather forecasting over the western United States

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Contents of this file

Figures S1 to S8
Tables S1 and S2

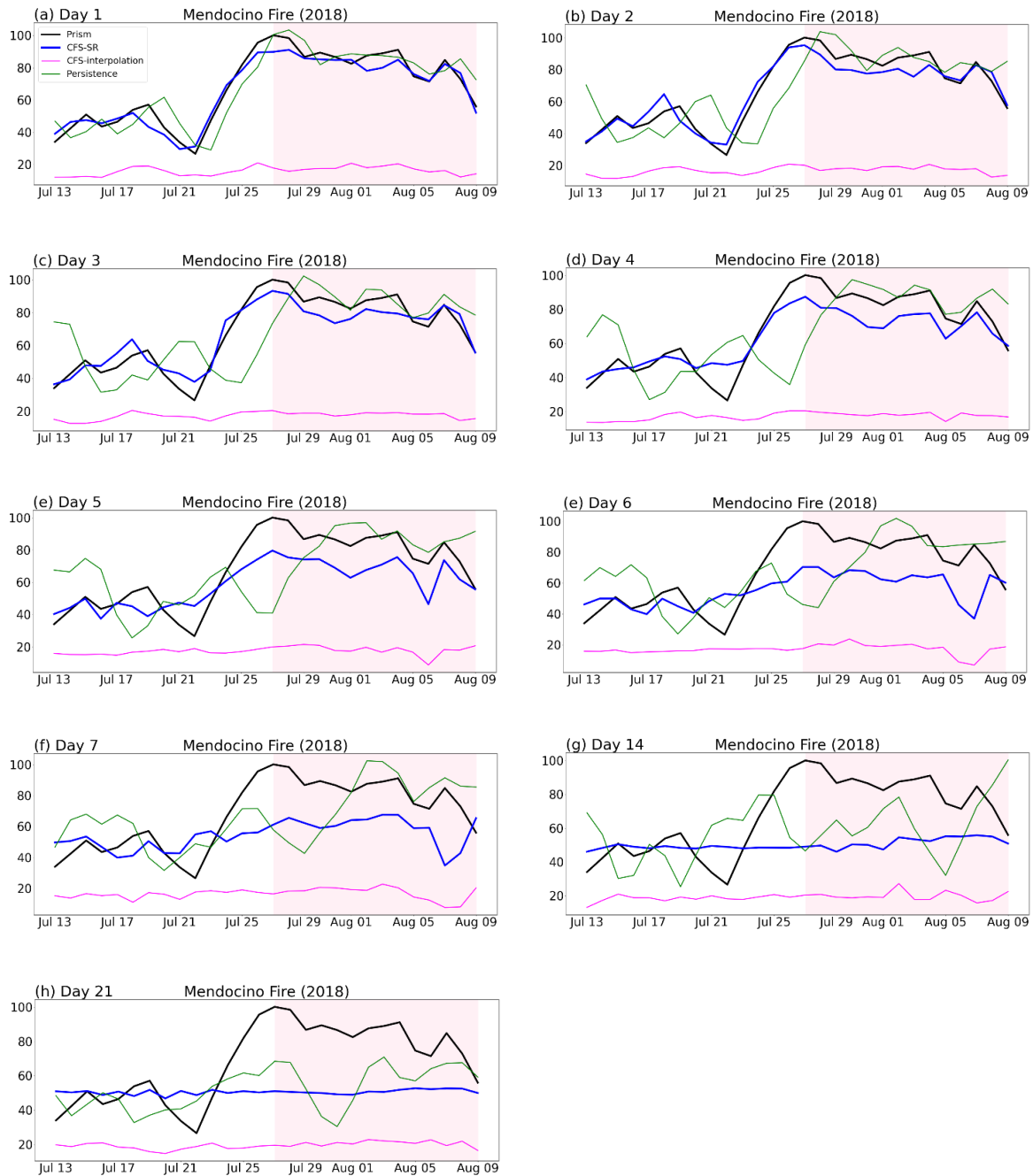


Figure S1. Comparison of the time-series of forecasted FWI in Mendocino county. Time-series of FWI averaged over Mendocino county for PRISM (black), CFS-SR (blue), interpolated FWI from CFSv2 (magenta) and persistence forecast (green) and. **a-h.** The lead time 1 to 21 days are individually compared for the outbreak of Mendocino Complex Fire (16/08/2018~, light red shade).

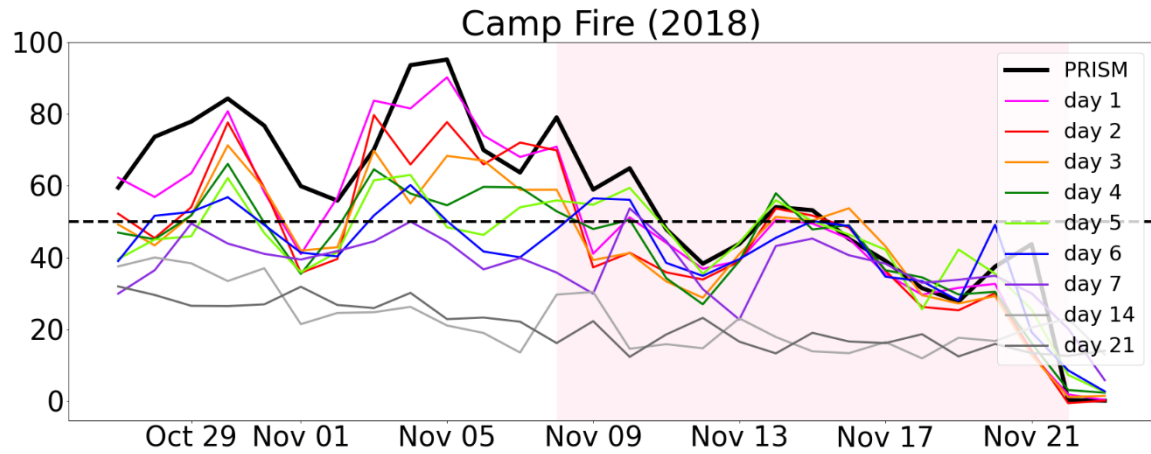


Figure S2. Time-series of forecasted FWI. The time-series of PRISM FWI and forecasted FWI from 1 to 21 lead time averaged over Butte county for the outbreak of Camp Fire (08/11/2018~, light red shade). The values above the black dash line (FWI=50) indicates an extreme danger state of wildfire.

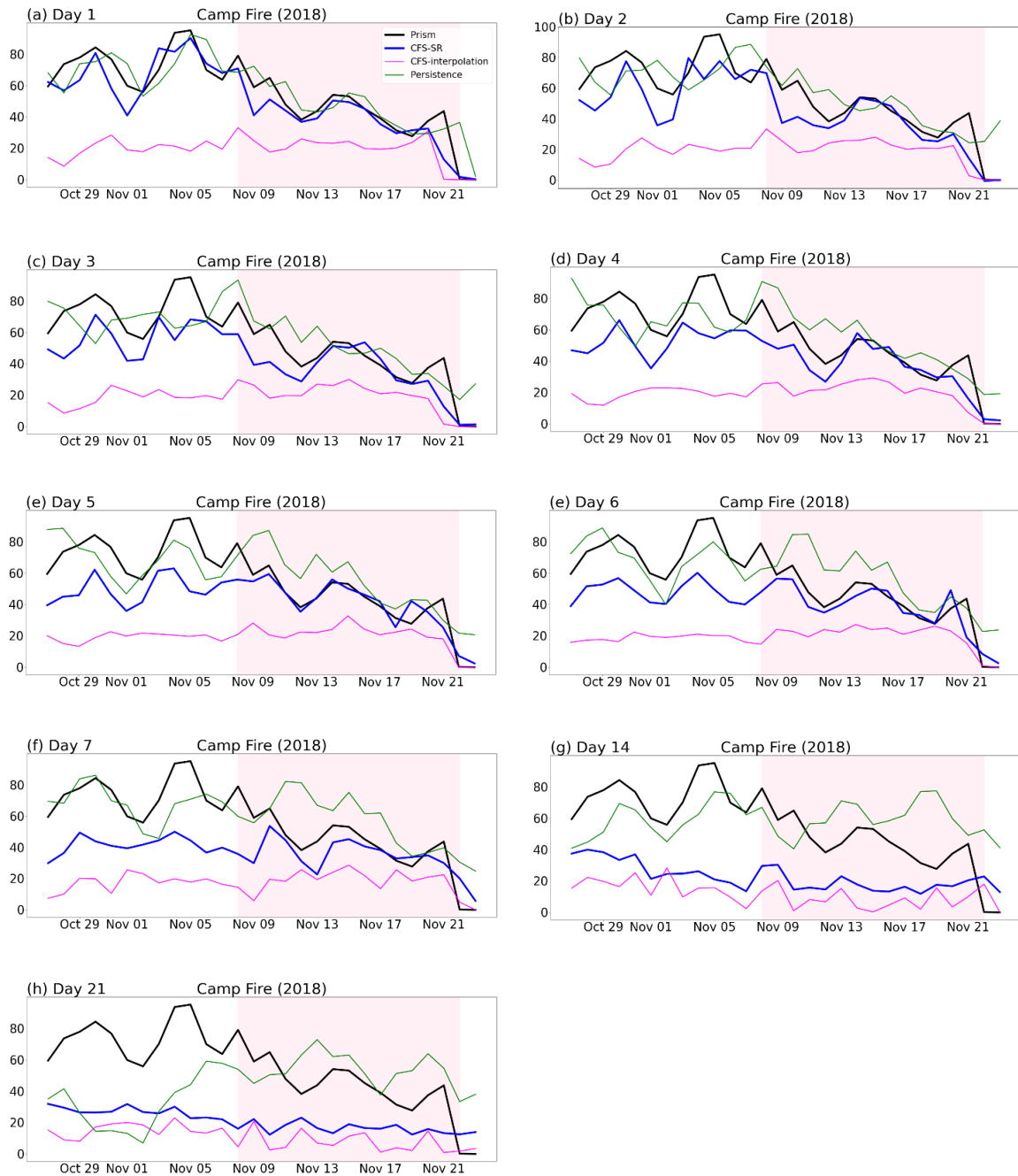


Figure S3. Comparison of the time-series of forecasted FWI in Butte county. Time-series of FWI averaged over Mendocino county for PRISM (black), CFS-SR (blue), persistence forecast (red) and interpolated FWI from CFSv2 (green). **a-h.** The lead time 1 to 21 days are individually compared for the outbreak of Camp Fire (08/11/2018~, light red shade).

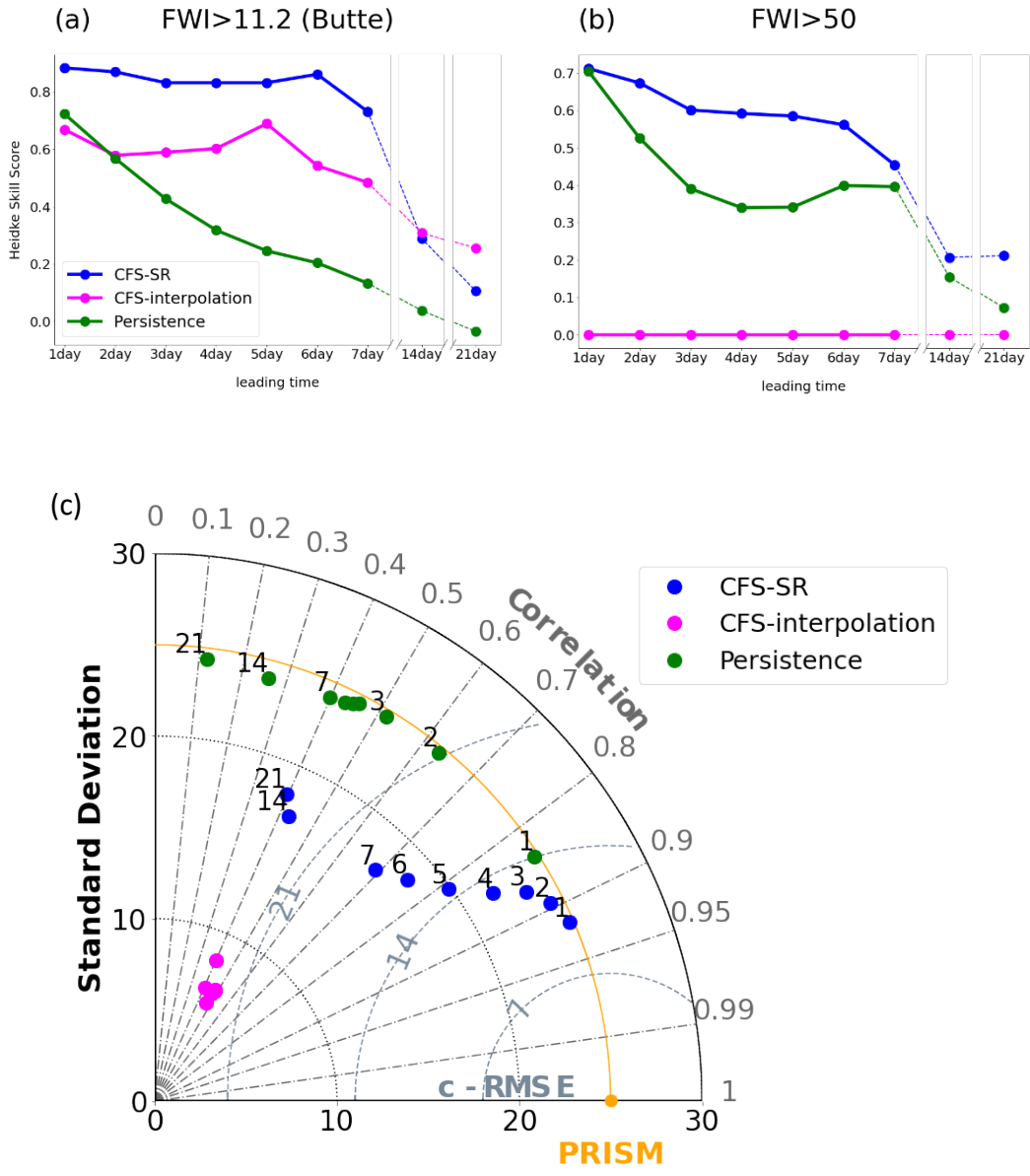


Figure S4. Forecasting skill comparison in Butte county. Heidke Skill Score (HSS) is compared for the dichotomous forecasting performance in **a.** the moderate danger state (FWI > 11.2) and **b.** the extreme danger state (FWI > 50.0). **c.** Talyor diagram compares the three different forecast for Butte county, which are CFS-SR (blue), the interpolated FWI from CFSv2 (magenta) and Persistence forecast (green) for leading time 1-21days (annotated with numbers). Prism (target) is marked by orange point.

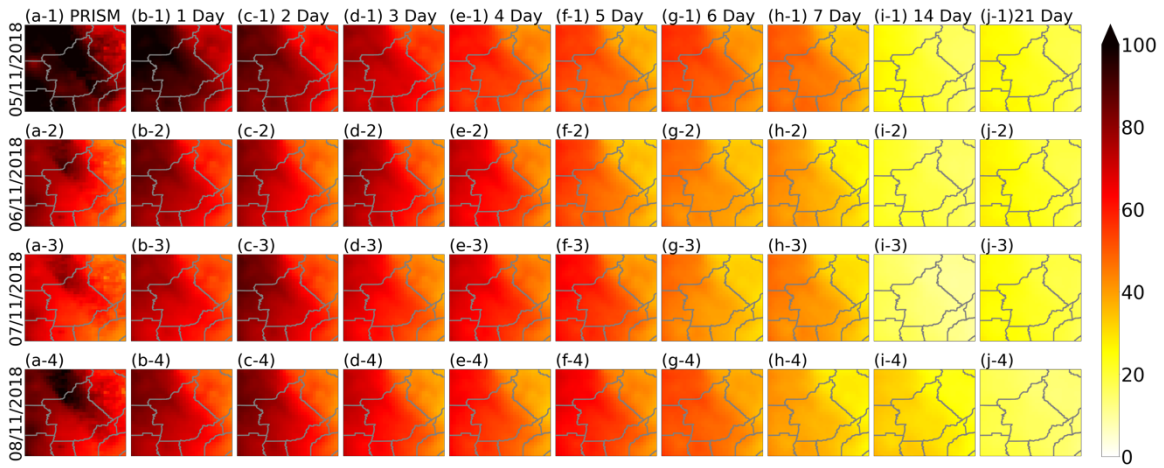


Figure S5. FWI map before the Camp Fire occurrence. a. PRISM, b-j. CFS-SR forecasting results leading time from 1 to 21 days. The mapping domain is set (122.3-120.9W, 39.1-40.3N) to include fire damage area: Butte county.

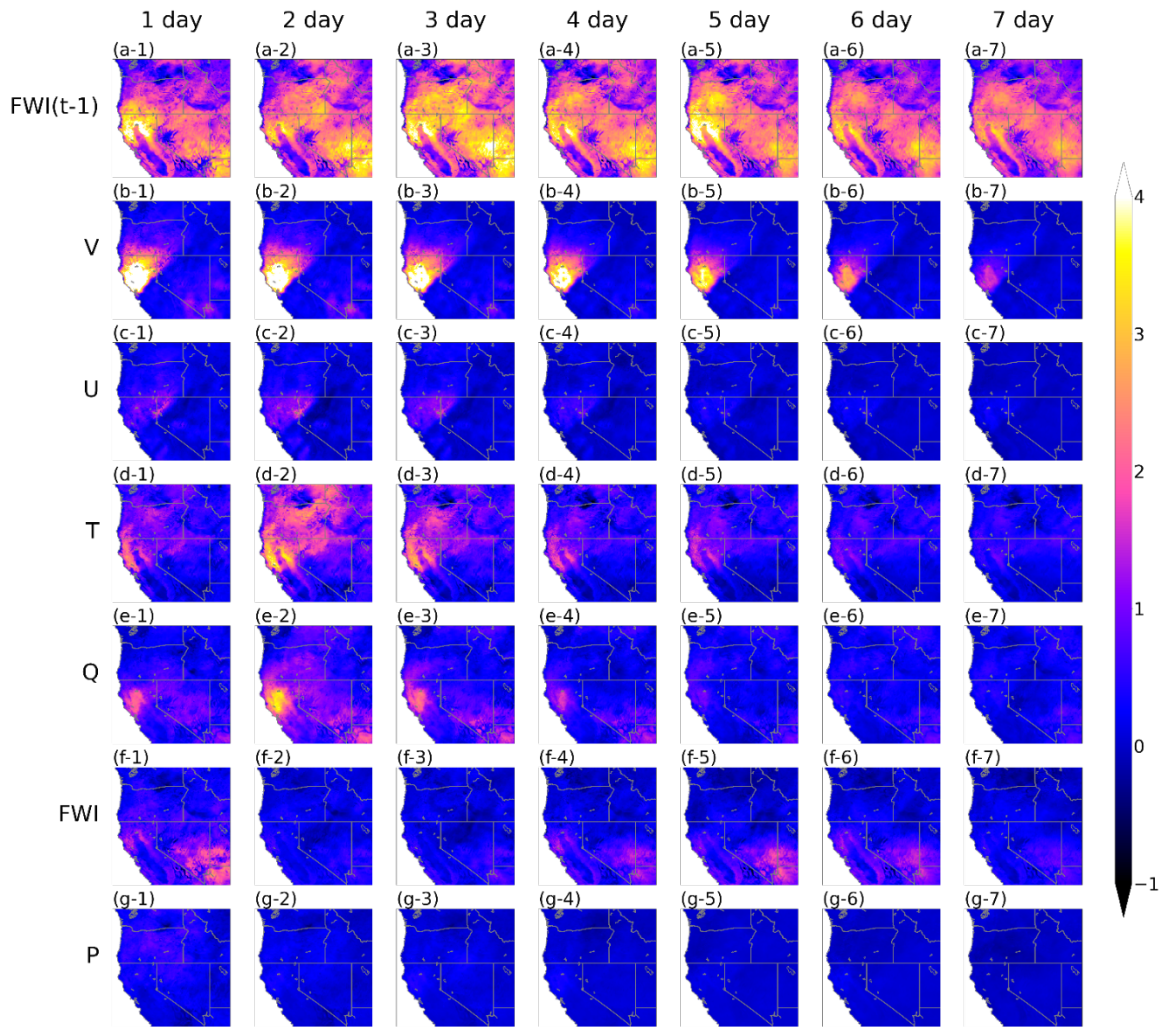


Figure S6. The spatial comparison of occlusion sensitivity test for all test period. The rate of changes in forecasting errors are spatially compared by occluding each input variable in all test period (01/06/2018-30/11/2019). Each column is sorted from 1 to 7 day of leading time and the rows are arranged by each variable.

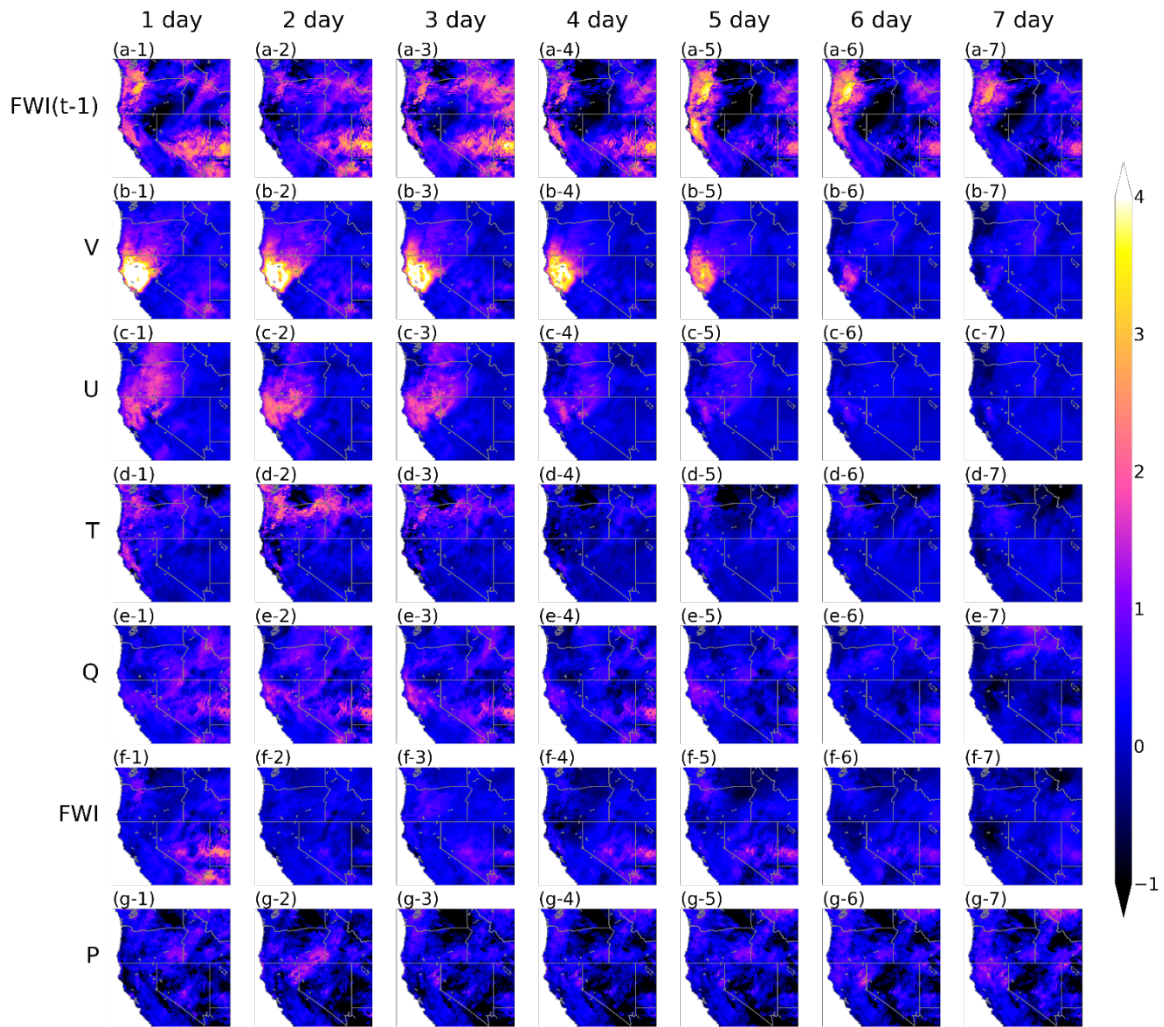


Figure. S7. The spatial comparison of occlusion sensitivity test for extreme wildfire risk days. The rate of changes in forecasting errors are spatially compared by occluding each input variable for days where FWI recorded higher than 50 test period in the test period (01/06/2018-30/11/2019). Each column is sorted from 1 to 7 day of leading time and the rows are arranged by each variable.

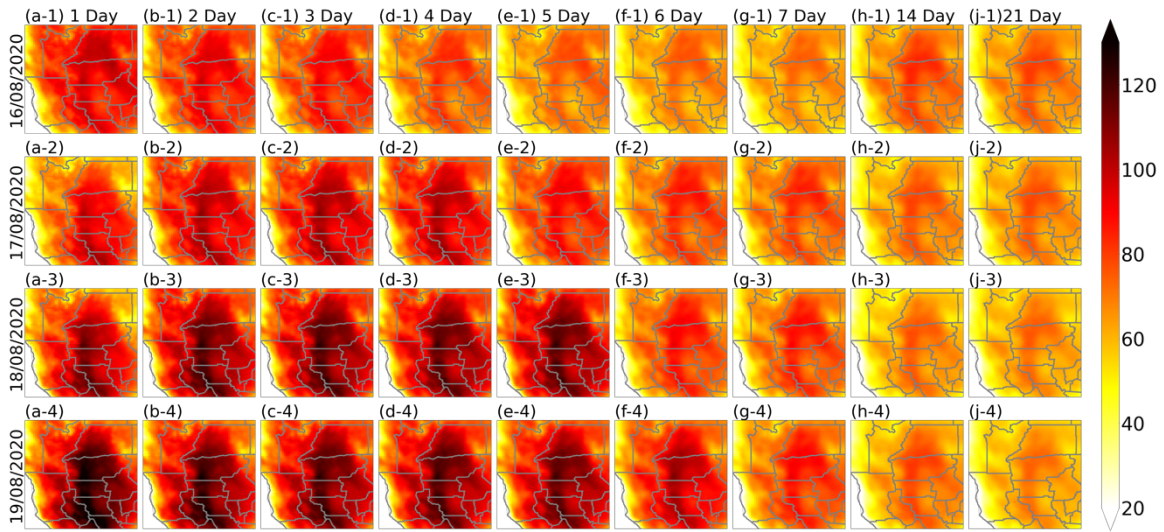


Figure S8. FWI forecasting map for the August complex Fire (16-19/08/2020). CFS-SR forecasting results leading time from 1 to 21 days. The mapping domain is set (124-121.2W, 38.8-41.3N) to include fire damage area: Glenn, Lake, Mendocino, Tehama, Trinity and Shasta county.

Table S1. Fire danger classes with FWI ranges. (<https://effis.jrc.ec.europa.eu/about-effis/technical-background/fire-danger-forecast/>)

Fire danger classes	FWI ranges
Very low	< 5.2
Low	5.2 ~ 11.2
Moderate	11.2 ~ 21.3
High	21.3 ~ 38.0
Very high	38.0 ~ 50.0
Extreme	> 50.0

Table S2. Contingency table.

		Observation	
		Yes	No
Forecast	Yes	hits (A)	false alarms (B)
	No	misses (C)	correct rejection (D)