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Coupling the high-complexity land surface model ACASA to the mesoscale model WRF

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Statistical Analysis for 13 ARB Air Basins

Table S1 presents the statistical analysis of the WRF-ACASA and WRF-NOAH near-surface temperature outputs for each of California's 13 basins. Statistical values of R-square value, Root Mean Square Error (RMSE), and Degree of Agreement are calculated for each of the basin for each of four seasons. The Coefficient of Determination or (R-square) represents the correlation of the model simulation with the surface observation. The RMSE shows the relative errors of the model simulation against the observation, while the Degree of Agreement is a statistical method to assess the agreement between the model simulations with the surface observation.

Overall, both of the models have a high degree of agreement with all 700 observation stations within the 13 ARB basins during winter, spring, and autumn. The dry summer season is more problematic than the other seasons for both of the models and more so for the WRF-ACASA model over coastal regions such as South Coast, San Diego, and San Francisco basins. This is most noticeable in the RMSE values for WRF-ACASA over the low vegetated regions of Great Basin Valley (GBV), Salton Sea (SS), and San Diego (SD), which increased dramatically during the warm season. While the Degree of Agreement for the San Francisco Basin (SFB) during the wintertime is high with values above 0.8 for both models, the R-square values show that there is little correlation between the model simulations and the surface observations. It could be due to the small range of observation data. Overall, the temperature simulations from both models agree well with the observations where the Degree of Agreement is high. Previous examination on a station-by-station basis also reveals that there is a mismatch in vegetation cover between what is in the WRF models and the actual land surface at the station (e.g., the Mountain County station from Table 2). These mismatches introduce errors that are not due to model physics, and they contribute to some of the low R-square and high RMSE values in the collective study.

Basin: South Central Coast (SCC), San Joaquin Valley (SJV), North Central Coast (NCC), South Coast (SC), Sacramento Valley (SV), San Diego county (SD), Great Basin Valleys (GBV), San Francisco Bay(SFB), Salton Sea (SS), Northeast Plateau (NEP), Mojave Desert (MD), Mountain Counties (MC), North Coast (NC)

Season: winter (DJF), spring (MAM), summer (JJA), fall (SON)

Table S1. Statistical Analysis of air temperature for all 13 Air Basins in the Air Resources Board meteorological stations network.

		R^2		RMSE		Degree of Agreement	
Season	Basin	WRF-NOAH	WRF-ACASA	WRF-NOAH	WRF-ACASA	WRF-NOAH	WRF-ACASA
DJF	SCC	0.832	0.717	1.739	2.470	0.917	0.822
MAM	SCC	0.984	0.806	1.322	2.090	0.987	0.911
JJA	SCC	0.604	0.533	2.039	2.211	0.931	0.900
SON	SCC	0.818	0.845	1.794	1.704	0.935	0.952
DJF	SJV	0.997	0.944	1.493	1.550	0.997	0.970
MAM	SJV	0.989	0.983	1.812	1.703	0.992	0.992
JJA	SJV	0.981	0.790	2.245	2.775	0.975	0.711
SON	SJV	0.996	0.836	1.956	2.840	0.997	0.887
DJF	NCC	0.739	0.625	1.434	2.153	0.886	0.704
MAM	NCC	0.977	0.805	1.216	1.659	0.988	0.953
JJA	NCC	0.891	0.796	1.917	1.789	0.968	0.947
SON	NCC	0.945	0.962	1.532	1.168	0.965	0.986
DJF	SC	0.967	0.913	1.882	1.647	0.966	0.949
MAM	SC	0.993	0.982	1.553	1.371	0.993	0.990
JJA	SC	0.589	0.581	2.064	3.495	0.832	0.596
SON	SC	0.980	0.711	1.891	2.406	0.989	0.832
DJF	SV	0.986	0.926	1.129	1.281	0.991	0.965
MAM	SV	0.981	0.981	1.294	1.214	0.988	0.992
JJA	SV	0.998	0.753	1.644	2.453	0.998	0.677
SON	SV	0.998	0.881	1.469	2.098	0.998	0.919
DJF	SD	0.951	0.764	1.469	1.986	0.967	0.858
MAM	SD	0.966	0.927	1.154	1.265	0.976	0.974
JJA	SD	0.487	0.555	2.057	3.649	0.769	0.613
SON	SD	0.876	0.565	1.473	2.124	0.947	0.801
DJF	GBV	0.813	0.754	2.774	3.405	0.953	0.909
MAM	GBV	0.936	0.937	2.362	2.208	0.962	0.970
JJA	GBV	0.853	0.804	2.644	3.017	0.856	0.740
SON	GBV	0.925	0.918	2.252	2.340	0.967	0.964
DJF	SFB	0.186	0.284	1.776	2.050	0.877	0.887
MAM	SFB	0.913	0.633	1.515	2.079	0.976	0.942
JJA	SFB	0.744	0.496	1.939	3.104	0.924	0.768
SON	SFB	0.951	0.629	1.408	1.986	0.982	0.849
DJF	SS	0.497	0.727	1.865	2.196	0.876	0.902
MAM	SS	0.994	0.910	1.290	1.677	0.996	0.965
JJA	SS	0.680	0.391	2.584	2.636	0.791	0.684
SON	SS	0.992	0.769	1.594	3.044	0.996	0.865
DJF	NEP	0.813	0.763	1.464	1.817	0.947	0.898
MAM	NEP	0.927	0.929	2.140	1.968	0.969	0.977
JJA	NEP	0.743	0.597	2.093	2.520	0.861	0.769
SON	NEP	0.988	0.937	1.542	1.837	0.994	0.973
DJF	MD	0.992	0.904	1.376	1.273	0.996	0.972
MAM	MD	0.970	0.922	1.620	1.884	0.982	0.969
JJA	MD	0.958	0.746	1.996	2.844	0.960	0.729
SON	MD	0.949	0.824	1.906	2.560	0.966	0.884
DJF	MC	0.983	0.945	1.616	1.756	0.983	0.952
MAM	MC	0.966	0.992	1.878	1.767	0.978	0.996
JJA	MC	0.899	0.830	2.130	2.396	0.894	0.835
SON	MC	0.983	0.963	1.818	1.819	0.987	0.978
DJF	NC	0.891	0.751	1.451	1.897	0.963	0.919
MAM	NC	0.677	0.649	3.479	3.174	0.872	0.912
JJA	NC	0.632	0.631	2.602	2.922	0.747	0.630
SON	NC	0.949	0.876	1.768	1.874	0.976	0.952