Supplementary material for

Atmospheric effects of air pollution during dry and wet periods on São Paulo

Sergio Ibarra-Espinosa[1], Gyrlene Aparecida Mendes da Silva[2], Amanda Rehbein[1], Angel Vara-Vela[1,3], Edmilson Dias de Freitas[1]

[1] Department of Atmospheric Sciences, Institute of Astronomy, Geophysics and Atmospheric Sciences, University of São Paulo, Brazil

[2] Sea Institute, Federal University of São Paulo, Santos-SP, Brazil

[3] Federal University of Technology - Parana, Londrina, Brazil

Author correspondence: sergio.ibarra@usp.br

Table 1. Observation sites considered in this study

Area	Station	Longitude	Latitude	Area	Station	Longitude	Latitude
MASP	Santana	-46.6290	-23.5060	SAN	Cubatão-Vila Parisi	-46.3887	-23.8494
	Santo Amaro	-46.7100	-23.6550		Cubatão-Centro	-46.4185	-23.8790
	Mauá	-46.4660	-23.6685		Cubatão-Vale do Mogi	-46.3696	-23.8316
	Parque D. Pedro II	-46.6277	-23.5448		Santos	-46.3212	-23.9631
	Congonhas	-46.6635	-23.6163		Santos-Ponta da Praia	-46.3005	-23.9813
	Ibirapuera	-46.6607	-23.5918	SOR	Sorocaba	-47.4790	-23.5024
	Mooca	-46.6004	-23.5497		Tatuí	-47.8708	-23.3608
	São Caetano do Sul	-46.5564	-23.6184	CAM	Campinas-Centro	-47.0572	-22.9025
	Cerqueira César	-46.6727	-23.5535		Americana	-47.3475	-22.7245
	Diadema	-46.6116	-23.6859		Jundiaí	-46.8971	-23.1920
	Cid. Universitária-USP-IPEN	-46.7374	-23.5663		Paulínia-Sul	-47.1366	-22.7868
	Nossa Senhora do Ó	-46.6921	-23.4801		Piracicaba	-47.6497	-22.7012
	Itaquera	-46.4667	-23.5800		Paulínia	-47.1548	-22.7723
	Parelheiros	-46.6970	-23.7763		Santa Gertrudes	-47.5363	-22.4600
	Pinheiros	-46.7020	-23.5615		Campinas-Vila União	-47.1193	-22.9467
	São Bernardo do Campo-Paulicéia	-46.5847	-23.6714		Campinas-Taquaral	-47.0590	-22.8746
	Taboão da Serra	-46.7583	-23.6093		Limeira	-47.4143	-22.5636
	Osasco	-46.7921	-23.5267	SJDC	São José dos Campos	-45.8712	-23.1879
	Santo André-Paço Municipal	-46.5309	-23.6570		Jacareí	-45.9682	-23.2942
	Interlagos	-46.6750	-23.6805		São José dos Campos-Jd. Satélite	-45.8908	-23.2236
	Carapicuíba	-46.8358	-23.5314		São José dos Campos-Vista Verde	-45.8309	-23.1837
	Guarulhos-Paço Municipal	-46.5185	-23.4555		Taubaté	-45.5758	-23.0324
	Itaim Paulista	-46.4207	-23.5015				
	Capão Redondo	-46.7800	-23.6684				
	Marg. Tietê-Ponte dos Remédios	-46.7433	-23.5187				
	São Bernardo do Campo-Centro	-46.5462	-23.6987				
	Guarulhos-Pimentas	-46.4099	-23.4401				
	Guarulhos-Pimentas	-46.4962	-23.4632				
	Pico do Jaraguá	-46.7661	-23.4563				
	Mogi das Cruzes	-46.7921	-23.5267				
	Mirante de Santana	-46.6167	-23.4833				

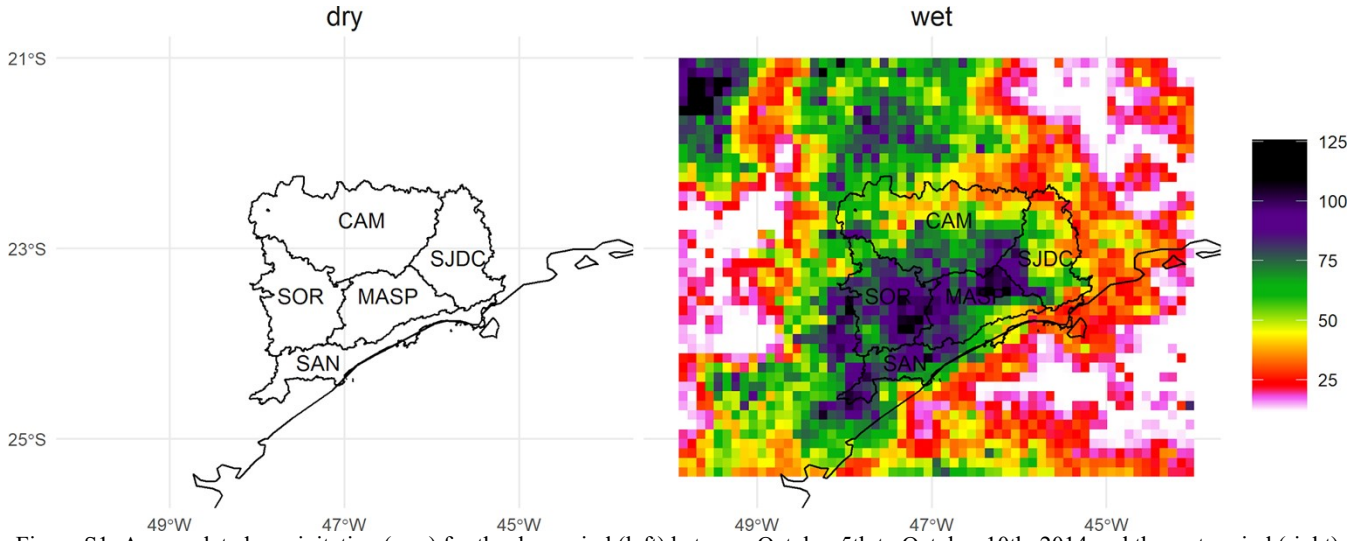

Figure S1. Accumulated precipitation (mm) for the dry period (left) between October 5th to October 10th, 2014 and the wet period (right) between October 31st to November 5th, 2014. The polygons represent the expanded metropolitan areas considered in this study Campinas (CAM), Sorocaba (SOR), Santos (SAN), São Paulo (MASP), and São José dos Campos (SJDC).

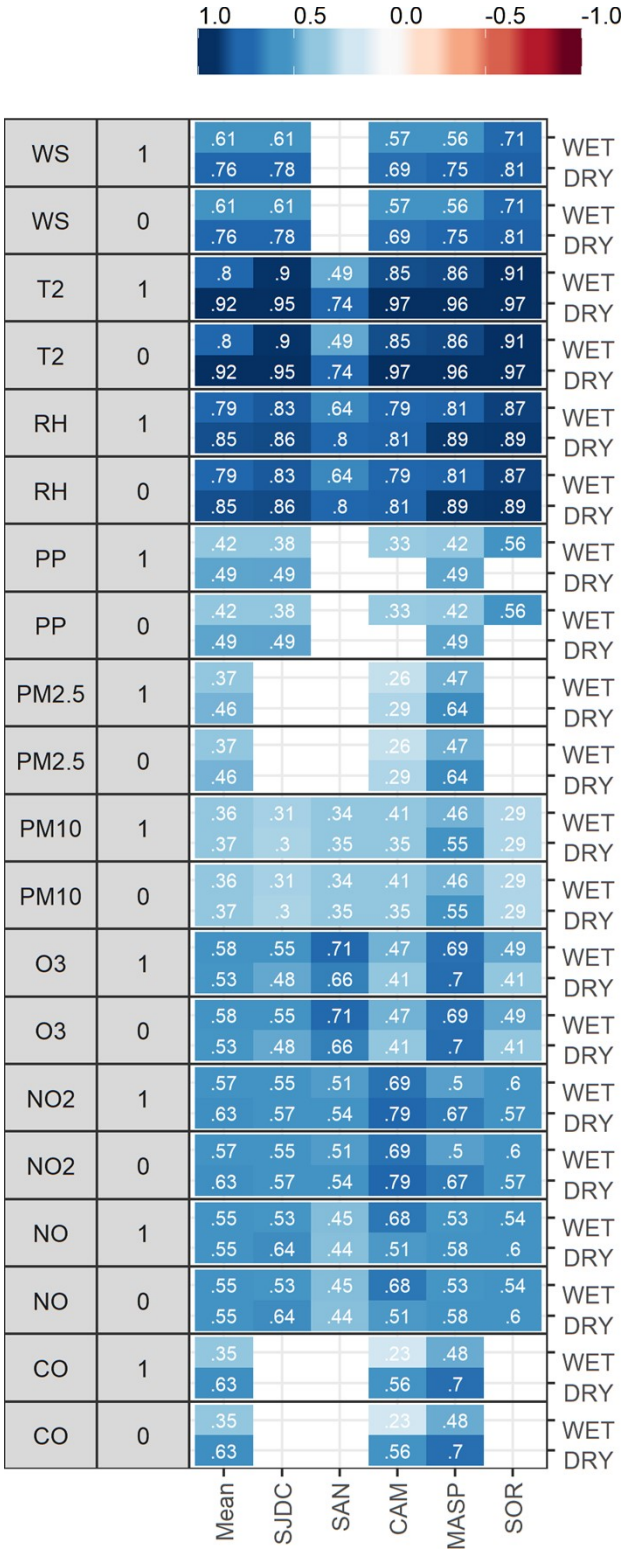

Figure S2. Correlation between observation and simulations for each period and activation of aerosol feedbacks for each region, 0 without effects and 1, including effects. Only significant correlations (p.value <0.05) are displayed.

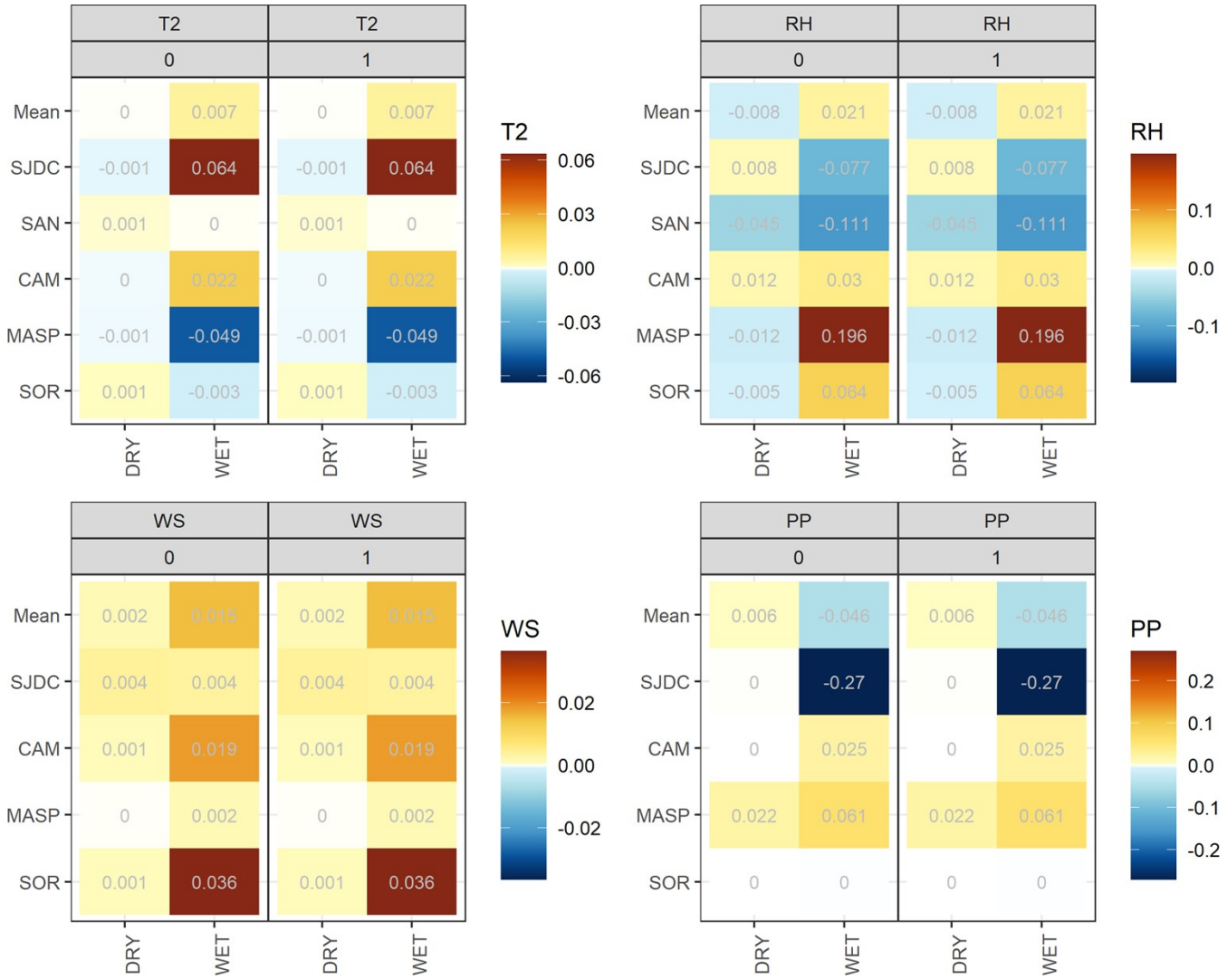

Figure S3. Mean bias of 2-meters temperature (T2 ºC), relative humidity (RH %), wind speed (WS ms^{-1}), and precipitation (PP mm) for each period and activation of aerosol feedbacks for each region. Mean bias defined as $\Sigma_{i=1}^{n}(sim_i - mod_i)^2$ where *obs* are observations and *sim*, simulations.

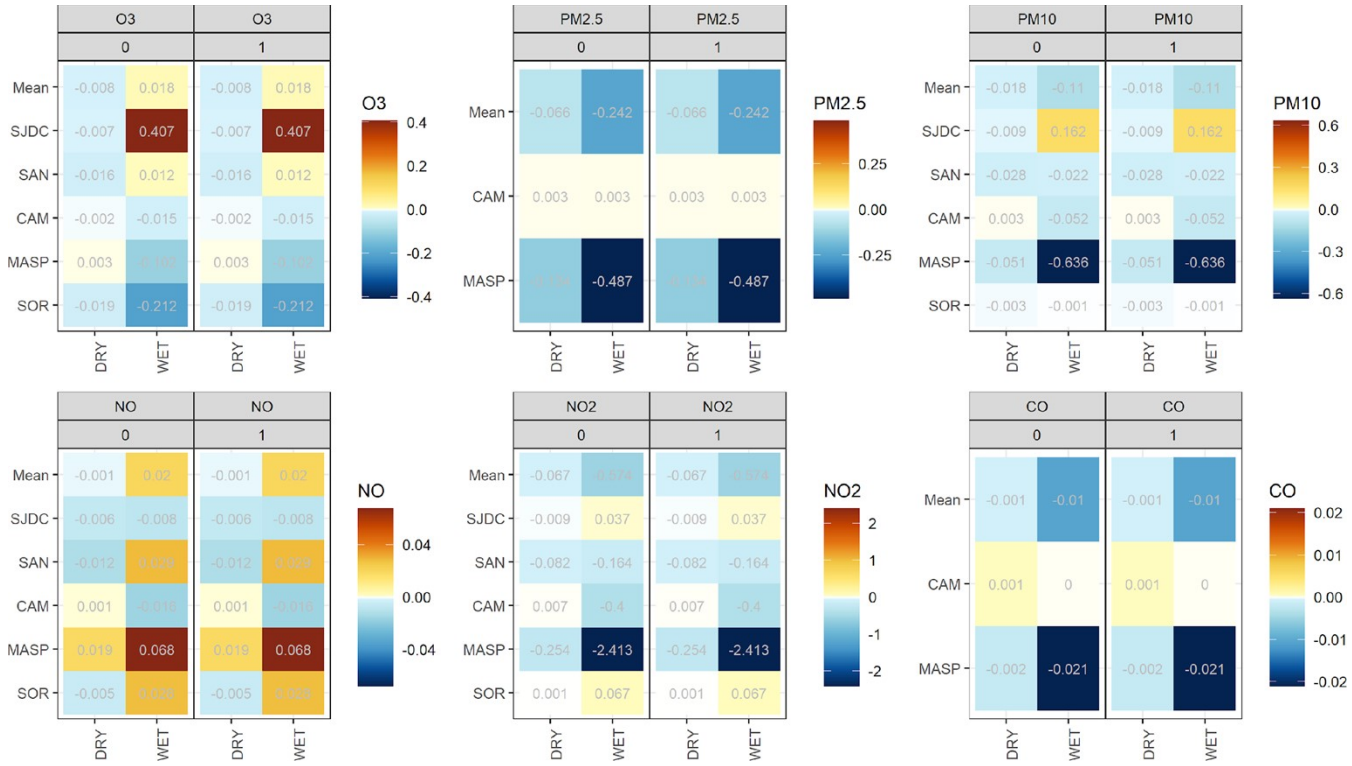

Figure S4. Mean bias of ozone (O_3 µgm^{-3}), particulate matter aerodynamical diameter equal or less than 2.5 µm ($PM_{2.5}$ µgm^{-3}) and 10 µm (PM_{10} µgm^{-3}), nitrogen monoxide (NO µgm^{-3}), nitrogen dioxide (NO_2 µgm^{-3}) and carbon monoxide (CO ppm) for each period and activation of aerosol feedbacks for each region. Mean bias defined as $\Sigma_{i=1}^{n}(sim_i - mod_i)^2$ where *obs* are observations and *sim*, simulations.

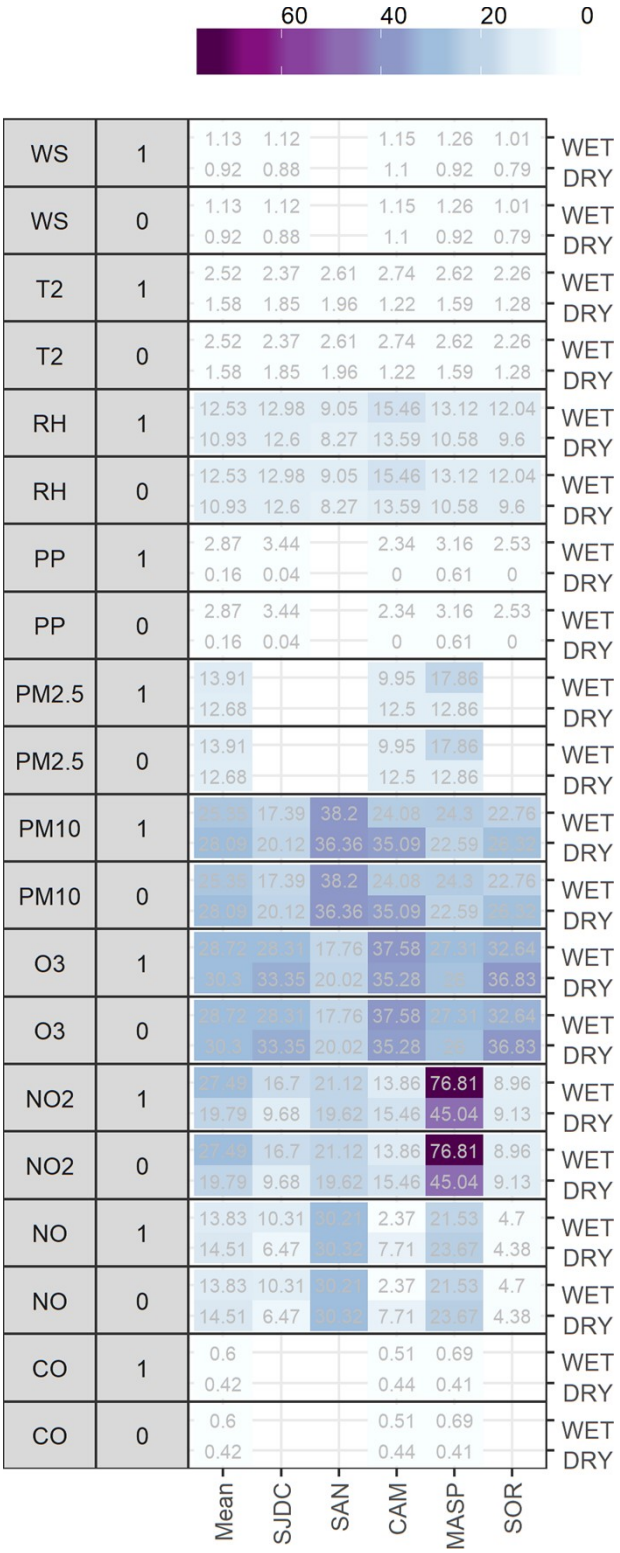

Figure S5. Root mean square error (RMSE) between observation and simulations for each period and activation of aerosol feedbacks for each region. RMSE defined as $\sqrt{\frac{1}{n}\Sigma_{i=1}^{n}(sim_i - obs_i)^2}$ where obs are observations and *sim* the *simulations* for each timestep i.

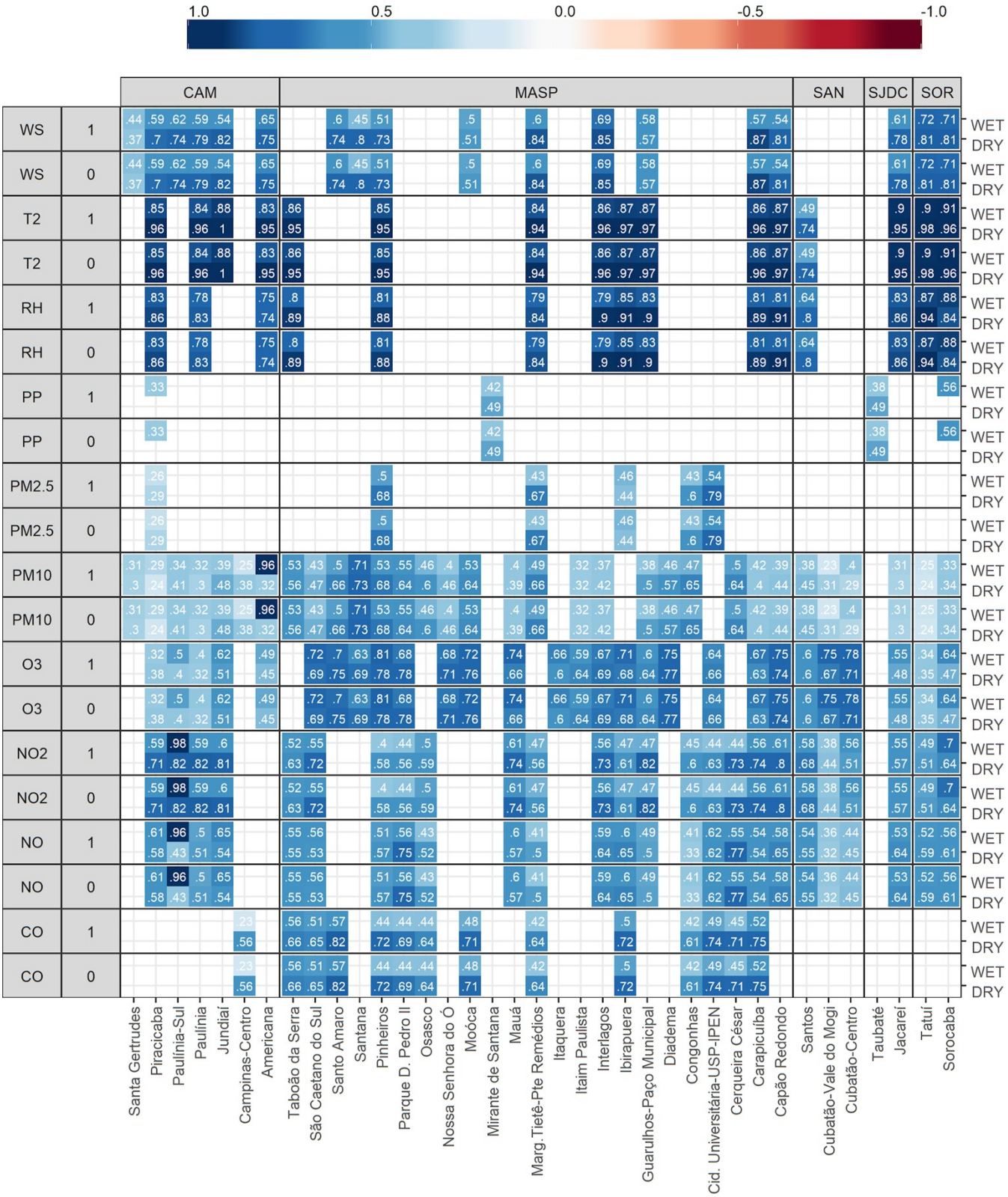

Figure S6. Correlation between observation and simulations for each period and activation of aerosol feedbacks for each Station. Only significant correlations (p.value <0.05) are displayed.

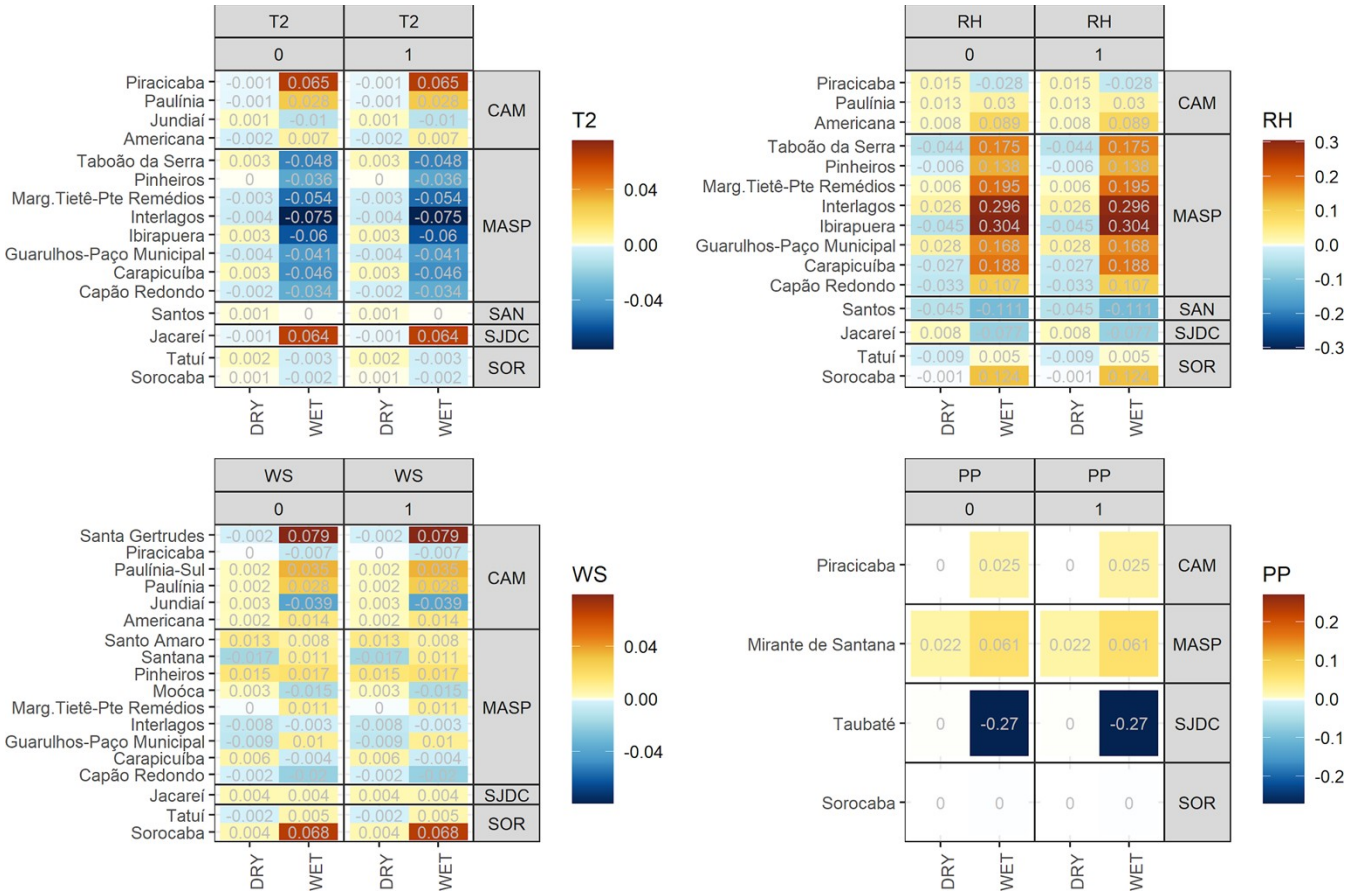

Figure S7. Mean bias of 2-meter temperature (T2 ºC), relative humidity (RH %), wind speed (WS ms^{-1}), and precipitation (PP mm) for each period and activation of aerosol feedbacks for each Station. Mean bias defined as $\Sigma_{i=1}^{n}(sim_i - mod_i)^2$ where *obs* are observations and *sim*, simulations.

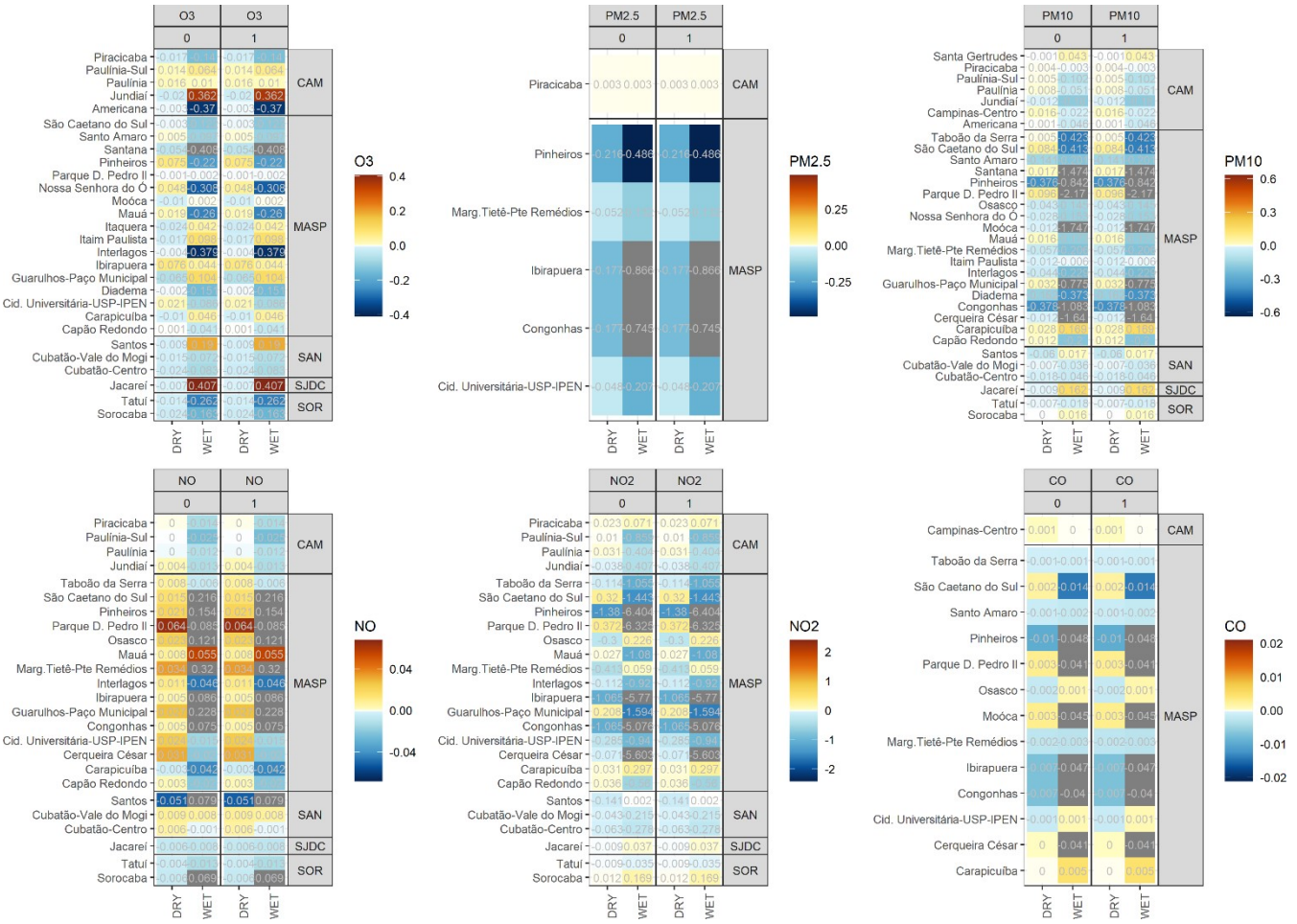

Figure S8. Mean bias of ozone (O_3 µgm^{-3}), particulate matter aerodynamical diameter equal or less than 2.5 µm ($PM_{2.5}$ µgm^{-3}) and 10 µm (PM_{10} µgm^{-3}), nitrogen monoxide (NO µgm^{-3}), nitrogen dioxide (NO_2 µgm^{-3}) and carbon monoxide (CO ppm) for each period and activation of aerosol feedbacks for each Station. Mean bias defined as $\Sigma_{i=1}^{n}(sim_i - mod_i)^2$ where *obs* are observations and *sim*, simulations.

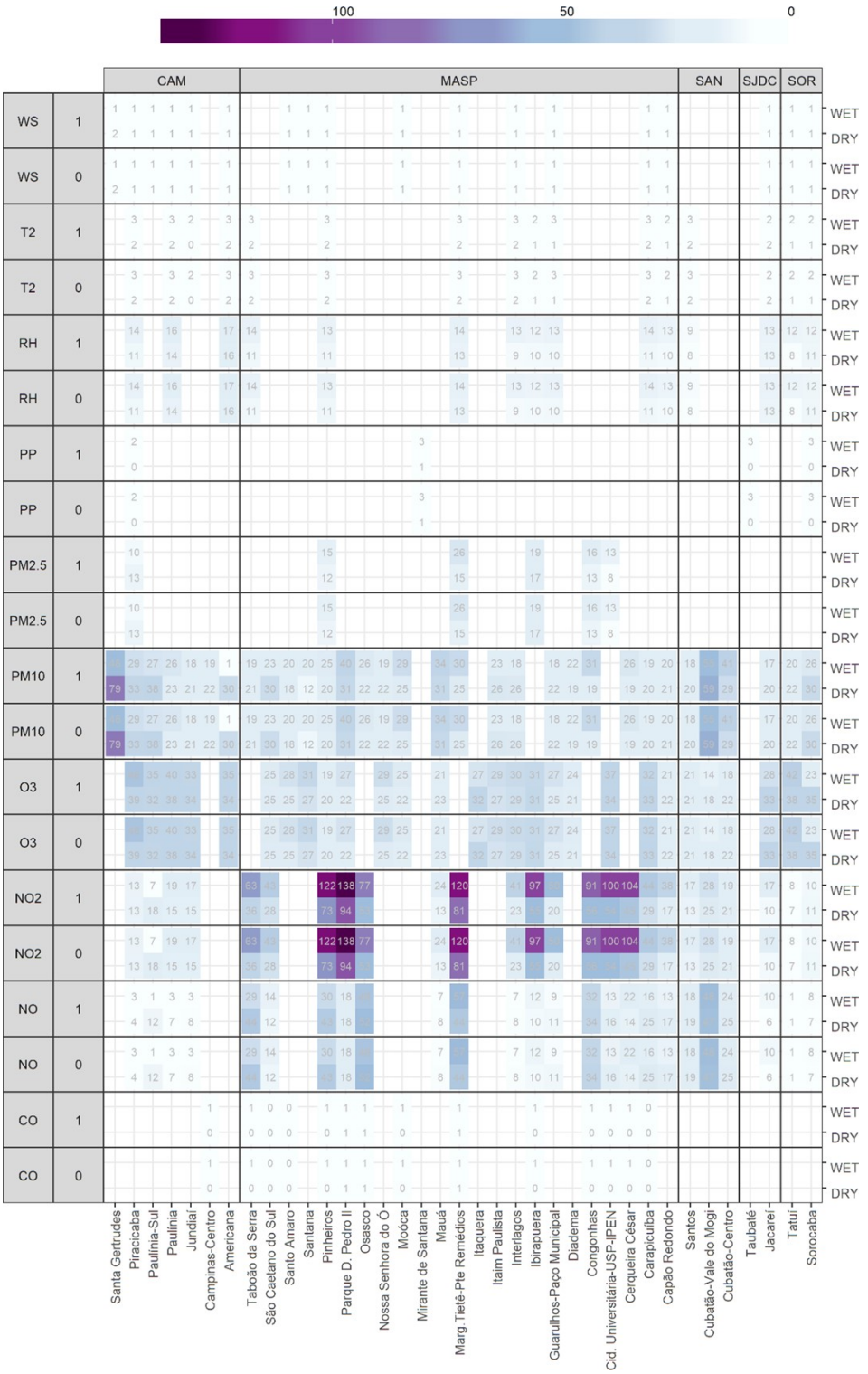

Figure S9. Root mean square error (RMSE) between observation and simulations for each period and activation of aerosol feedbacks for each Station. RMSE defined as $\sqrt{\frac{1}{n}\Sigma_{i=1}^{n}(sim_i - obs)^2}$ where *obs* are observations and *sim*, simulations.

Synoptic analysi s

Dry period: October 5th - 10th, 2014

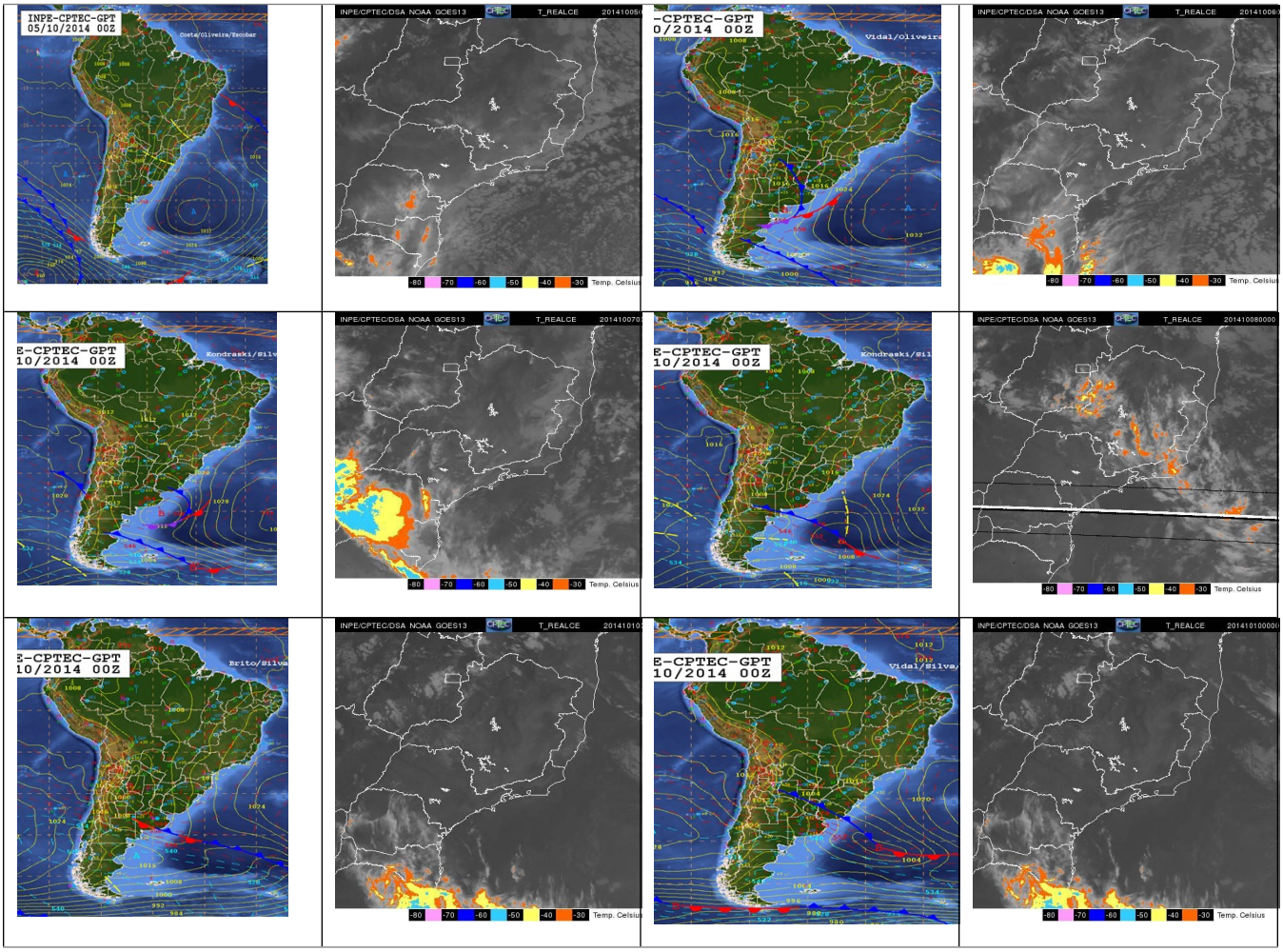

Figure S10. Synoptic charts from Center for Weather Forecasting and Climate Studies (CPTEC in Portuguese, http://tempo.cptec.inpe.br/boletimtecnico) and Geostationary Environmental Satellite (GOES-13, http://satelite.cptec.inpe.br/acervo/goes.formulario.logic?i=en) satellite images on the infrared channel (~ 11.0 µm) between October 5th - 10th, 2014, at 00 UTC.

Wet Period: October 31st - November 5th, 2014

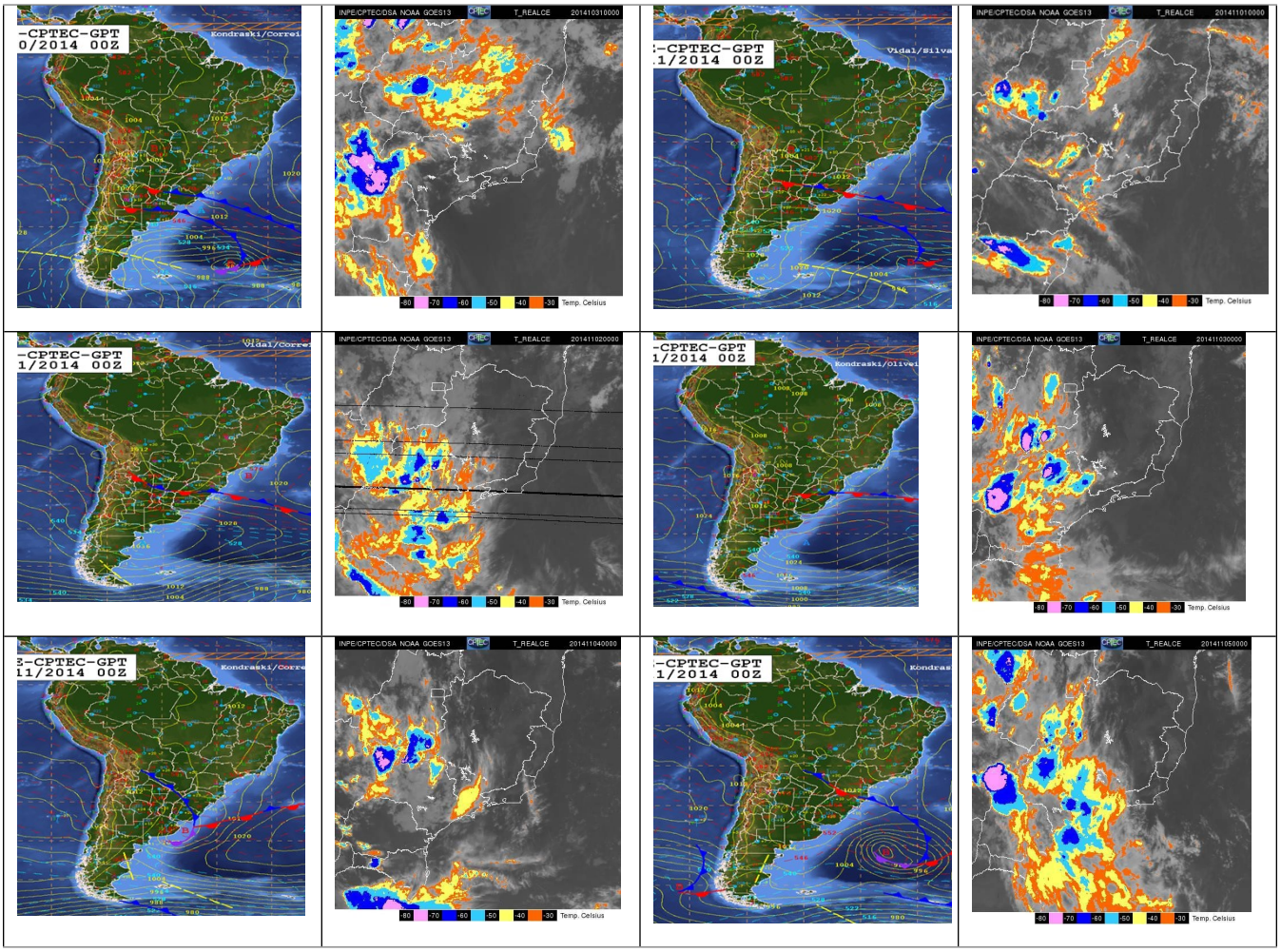

Figure S11. Synoptic charts from Center for Weather Forecasting and Climate Studies (CPTEC in Portuguese, http://tempo.cptec.inpe.br/boletimtecnico) and Geostationary Environmental Satellite (GOES-13, http://satelite.cptec.inpe.br/acervo/goes.formulario.logic?i=en) satellite images on the infrared channel (~ 11.0 µm) between October 31st - November 5th, 2014 at 00 UTC.