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Marine heatwaves in the dynamics of the Pantanal´s historical drought and unprecedented fires

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Fire is a natural disturbance in the Neotropical savannas, and rather frequent in the relatively dry and well-drained seasonal savannas of the Brazilian Cerrado. The neighboring Pantanal, on the other hand, is a seasonally flooded savanna and the largest wetland in the world (≈138,000 km 2). Due to its wetter condition, fires in the Pantanal are much less frequent and spatially restricted. But, given an ongoing extreme drought, the 2020's fires in the Pantanal have been unprecedented in extent and duration: About one third (≈45,000 km 2) of the area of this important wetland has gone up in flames since last January. Regarding this historical drought, climate change has been identified as one of the most important threats to the Pantanal. Reductions in precipitation may cause significant disturbances in its ecological functioning, affecting hydrological, floodplain inundation dynamics, as well as fire regime. Climate change models from a recent study (Thielen et al. 2020, doi:10.1371/journal.pone.0227437) indicate that, for the Pantanal, extended severe droughts are to be expected from the warming of Sea Surface Temperatures (SST) at Northern Hemisphere oceans.
The present study analyses the spatial and temporal dynamics of precipitations during the series 1981-2020 in the Upper Paraguay River Basin (UPRB), which comprises the Pantanal and the neighboring Highlands, along with a co-evaluation of the SST trends at three oceanic regions from Northern Hemisphere. Precipitation anomalies were analyzed by mean of the Standardized Precipitation Drought Index (SPDI) based on the 1981-2010 climate normals. Results show that for the UPRB, negative precipitation anomalies occur in pulses lasting several years. A drought starting in 2019 has been the strongest and most extended on record, persistently reaching the Extremely Dry condition (SPDI≤-2.0) during 2020. As early as Mar, over 64% of the Pantanal is affected by such drought, and around 83% by Dec. For the UPRB, four distinctive groups of subregions were identified according to their temporal dynamics of mean SPDI values, mainly during Sep2019/Feb2020 and Mar2020/Dec2020. Here, precipitation anomalies from southernmost subregions of the Pantanal were less intense and even not

affected by the drought.
As for SST, the Northeast Pacific region (PAC-NE) showed the most important dynamics. In this region, SSTs have been anomalously warm since Jun 2019, with 64% of the time SSTA surpassing the 90 th percentile: reaching the Heatwave condition. With a lead of one to two months, PAC-NE showed the strongest (and negative) correlation with precipitation at UPRB (r=-0.87) during Jan2019 to Dec2020. There is a significant trend for an increase in SST at the

Northeast Pacific, a trend that will certainly generate a rather continuous Heatwave in PAC-NE. As a result, one expects an extension of the current extreme drought in the Pantanal area, at least during 2021, and the intensification of fires with unprecedented duration and intensity, extending now to areas historically flooded or perhumid. Concomitantly, we predict a most definite impact on non-fire-resistant vegetation cover, as well as ecosystem functioning and biodiversity.