CARBON DIOXIDE AND WATER VAPOR FLUXES IN TWO CONTRASTING MANGROVE ECOSYSTEMS IN NORTHWEST MEXICO

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ABSTRACT

Mangroves are biocomplex ecosystems due to diverse functional processes related to abiotic factors such as salinity, tides, continental nutrient loads and disturbance, which control net ecosystem production (NEP). However, the relative importance of these factors controlling NEP is poorly understood because we lack of information on how fluxes and CO2 pools vary at different scales in these ecosystems. The goal was to characterize CO2 (NEE) and water vapor (ET) flux dynamics from January-November of 2014 in contrasting mangrove ecosystems: a preserved site (PE) and a site influenced by agriculture from the Yaqui Valley in southern Sonora (DE). Eddy covariance systems were used to determine NEE and water vapor fluxes on four defined periods: winter, spring, summer and autumn. NEE and ET patterns were different during dry and wet seasons, showing contrasts between sites. Over the winter, daily mean NEE on PE was -1.60 μmolCO2 m-2 s-1, meanwhile DE was -0.04 μmol CO2 m-2 s-1; higher respiratory rates dominating on DE corresponds with the peak discharge season of nutrient loads from agricultural canals. During spring NEE for DE and PE were -2.09 and -4.23 μmolCO2 m-2 s-1 respectively. This suggests that during this period of higher radiation, photosynthetic activity was the dominant flux. In contrast, during summer values were lower than spring since PE presented -0.64 μmol CO2 m-2 s-1 and DE-0.63 μmol CO2 m-2 s-1. During the autumn season NEE for PE and DE were -2.59 and -1.54 μmolCO2 m-2 s-1. Mean daily ET values for PE ranged between 2.52 to 6.34 mm and for DE were 2.44 to 3.56 mm. Differences on NEE and ET patterns are modulated by temperature and solar radiation. The next stages of this research will evaluate the variability of salinity, nutrient loads and hydroperiod of these transitional ecosystems.

MANGROVE FLUX SITES IN SONORA

Figure 1. Localization of monitoring sites El Sargento Estuary (PE) and Tóbari Bay (DE), coastal mangroves in northeastern México.

Figure 2. Representative mangrove species at monitoring sites. a) Avicennia germinans b) Laguncularia racemosa. c) Rhizophora mangle.

Figure 3. Water level (a) and conductivity (b) data logger.

Figure 4. Eddy covariance systems: a) El Sargento Estuary and b) Tóbari Bay.

SEASONAL CO2 AND WATER VAPOR FLUXES DYNAMIC

Figure 5. Daily values showing the seasonal trends of NEE, LE and radiation at (PE) and (DE) during study period. Daily NEE fluctuations suggest the presence of photosynthetic and respiration processes showing contrast on sites increasing with the presence of higher radiation.

Figure 6. Diurnal behavior of NEE and LE for PE (a) and DE (b). Patterns on DE show a similar trend through January, April and July with no drastic changes. However, PE presents a significant contrast in diurnal behavior comparing with DE, a marked amplitude on NEE and LE during above the three months shown.

Table 1. Contrast on water level, water temperature and salinity average values during March and July, 2014 for PE and DE.

<table>
<thead>
<tr>
<th>Month/Site</th>
<th>Water temperature (°C)</th>
<th>Salinity (ppt)</th>
<th>Water level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March El Sargento estuary</td>
<td>18.59</td>
<td>28.20 (34.65-26.37)</td>
<td>-0.60</td>
</tr>
<tr>
<td>Tóbari Bay</td>
<td>20.96</td>
<td>33.03 (30.55-35021)</td>
<td>-0.69</td>
</tr>
<tr>
<td>July El Sargento estuary</td>
<td>26.31</td>
<td>27.16 (27.48-26.37)</td>
<td>0.15</td>
</tr>
<tr>
<td>Tóbari Bay</td>
<td>30.01</td>
<td>28.01 (28.66-27.26)</td>
<td>0.13</td>
</tr>
</tbody>
</table>

HEADLINES

NEE and LE patterns were different during dry and wet seasons. Although, PE presents a higher productivity than DE over the study period there’s a contrast on LE flux which is higher on PE than DE.

Higher respiration activity on daily on NEE values during winter for DE suggest a relationship with the peak of nutrients loads discharged by agricultural canals to the bay.

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REFERENCES


Figure 7. 8-day Ocean Net Primary Production (mg C m-2 d-1) from MODIS during October 2013 (a) and January 2014 (b) for the coast of Sonora.