SWOT measurements for understanding hydrology and biogeochemistry of tropical lakes, reservoirs and wetlands

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Tropical lakes and wetlands include:

- Large, deep lakes
- Volcanic crater lakes
- High elevation lakes and peatlands
- Extensive floodplains
- Flooded grasslands and forests
- Coastal mangroves
African rift valley:

Large freshwater lakes (e.g., Tanganyika, Malawi, Victoria)

Shallow freshwater and saline lakes

Extensive papyrus swamps
Volcanic crater lakes, western Uganda
As lakes levels fall and salinity increases, biodiversity tends to decrease.

(Williams, Boulton & Taaffe 1990 Hydrobiologia 197:257-266)
Key SWOT values (1):

Lake levels variations throughout a region in lakes of a wide range of sizes as an indication of climatic changes with consequences for biological diversity and productivity

In large lakes evidence for internal wave activity and eddy structures as indications of mixing with consequences for productivity
Pandemic damming challenges monitoring of the hydrologic cycle and alters solute fluxes
Balbina Reservoir

Topex/POSEIDON Radar Altimetry
21 +/- 10+ cm

JERS-1 SAR Interferometry
12 +/- 2.4 cm

(Alsdorf et al. 2001. GRL 28:2671-2674)
Key SWOT values (2):

Water level variations in reservoirs

as a measure of water resources

and hydroelectric power potential
Key aspects of floodplain systems

Amplitude
frequency
predictability
gradients
of flooding
Okavango swamp, southern Africa
Tonle Sap and lower Mekong (number of JERS-1 scenes)
Amazon Basin < 500m: wetlands and lakes ca. 20%
Water Balance on a Floodplain

- $h(0,t)$: Water level at the main channel
- $h(x,0)$: Water level across the floodplain
- $Q(0,t)$: Inflow from the channel
- $P$: Precipitation
- $E$: Evaporation
- $Q_{tf}$: Outflow from the floodplain
- $h(x_L,t)$: Water level at the river terraces
- Floodplain
- Storage
- River Terraces (*Terra-Firme*)
Exchanges driven by gradients in slope

River to/from Floodplain

Local stream to Floodplain

Groundwater to/from Floodplain

Among habitats within Floodplain
<table>
<thead>
<tr>
<th>Source</th>
<th>N(%)</th>
<th>P(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct rainfall</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Surface runoff</td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td>Groundwater</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>Adjacent lakes</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Amazon River</td>
<td>24</td>
<td>51</td>
</tr>
</tbody>
</table>
Key SWOT values (3):

Water level variations in time and space as a driver of hydrologic exchanges and movements of sediments, solutes, pollutants and organisms with consequences for primary and secondary productivity