Geophysical Research Abstracts
Vol. 21, EGU2019-3972, 2019
EGU General Assembly 2019

Closing the hydrologic balance of the Gialova Lagoon, Greece

Stefano Manzoni (1,2), Giorgos Maneas (1,2), Anna Scaini (1,2), Håkan Berg (1,2), Georgia Destouni (1,2), Steve W. Lyon (1,2)

(1) Department of Physical Geography, Stockholm University, Stockholm, Sweden, (2) Bolin Centre for Climate Research, Stockholm, Sweden

Coastal wetlands are under pressure due to competing demands for freshwater resources and climatic changes. On one hand, consumption of freshwater resources to support human activities often reduces freshwater inputs. On the other hand, increasing temperatures and evaporation rates, and decreasing precipitation, shift the water balance of coastal wetlands. Both factors may increase salinity and cause loss or impairment of ecological functions. These pressures are particularly high in Mediterranean regions with high evaporative demand compared to precipitation, and strong seasonality that causes wide salinity and water temperature fluctuations. To manage these wetlands and maximize their provision of ecosystem services, their hydrologic balance must be quantified. However, closing the water balance of coastal wetlands is complicated due to their complex interactions with the sea and the inland freshwater bodies. Multiple channels, diffuse surface water exchanges, and diverse groundwater pathways complicate the quantification of water exchanges. To overcome this difficulty, we developed a mass balance approach based on coupled water and salt balance equations to estimate currently unknown water exchange fluxes of the Gialova lagoon – a coastal wetland in the Peloponnese, Greece. This wetland has been subject to major interventions over the past 70 years, which have led to seasonally hypersaline conditions and shifts in ecosystem function. Our approach allows quantifying both saline and freshwater exchange fluxes using measured precipitation, water depth, and salinity, and evaporation rates estimated from local meteorological data over a period of two years (2016-2017). During the hot and dry summer months, water exchanges were dominated by evaporation and saline water entering the lagoon from the sea. During the cool and wet winter months precipitation and freshwater inputs were more important, and were associated with losses of brackish water from the lagoon towards the sea. After an extreme rainfall event, this pattern of freshwater entering the lagoon and brackish water leaving towards the sea was amplified. Over the study period, we estimated that the net water storage changes in the lagoon were negligible, and that about 40% of the water input was in the form of precipitation, while about 60% could be attributed to other freshwater sources, surface water and groundwater. Approximately 75% of the outputs were due to evaporation and the remaining 25% to water leaving the lagoon towards the sea. Considering the large role played by freshwater bodies surrounding the lagoon, we argue that protecting these water sources and restoring hydrologic connectivity between surface water bodies and the lagoon is fundamental to stabilize the current pattern of wide seasonal fluctuations in salinity and to maintain ecosystem functionality.