

THE OGOOOUÉ RIVER

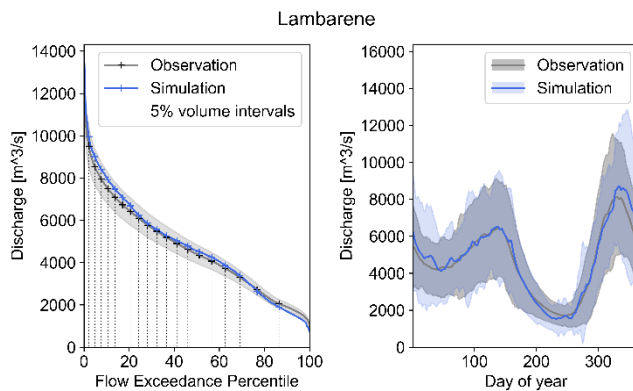
SPOTLIGHT

“The main challenge for water resources management in the region is the reconciliation of conservation and development plans. [...] Conservation of wetlands is intrinsically linked to the hydrological regime in the basin.”

| Kittel et al. 2018 |

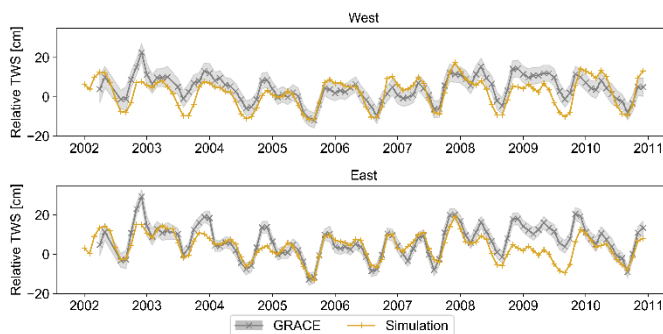
RIVER BASIN HYDROLOGY

River discharge characterization



Description: Flow duration curve and discharge climatology at Lambaréné station, lower Ogooué. The plots show the simulated discharge versus the historical in-situ gauge data. The simulated flow duration curve is within 10% of the observed historical curve and the climatology has a similarly good performance, with a weighted root mean square deviation of 0.34.

Total water storage change

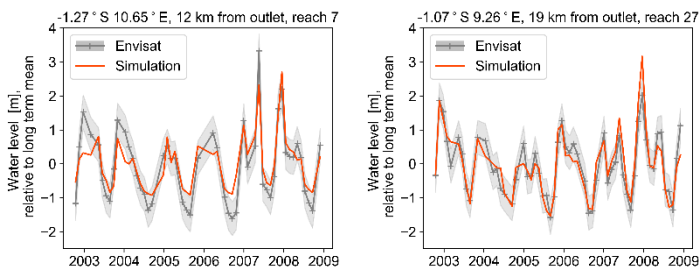


Description: Satellite-derived total water storage change from GRACE [1,5] against simulated total water storage change. The plot shows the model is capable of simulating current patterns in water storage change in the basin.

FAST FACTS

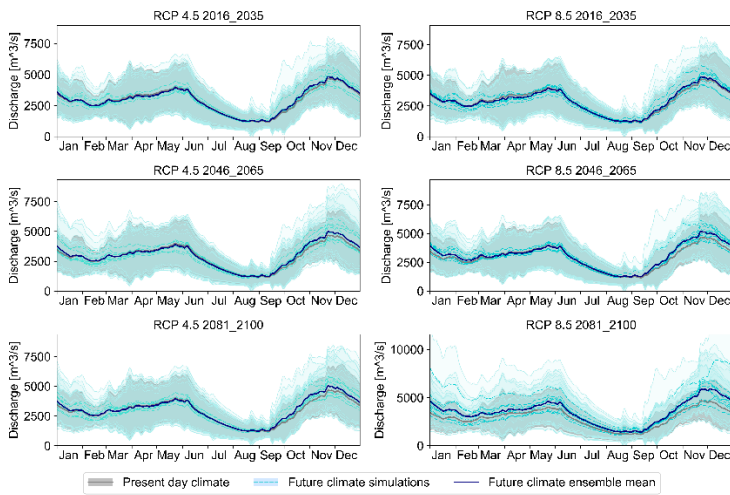
- The Ogooué river in Gabon is the fourth largest river in Africa by volume of discharge with a mean annual discharge of 4700 m³/s
- Its main tributaries include the Ngoounié and the Ivindo
- There are 9 Ramsar sites in Gabon, including the lower Ogooué and the Chutes and Rapids of the Ivindo
- The Ogooué also plays a significant role in development plans in Gabon both as part of the energy infrastructure and as a transport waterway [2]
- The Bas Ogooué wetland supports numerous threatened species, for instance gorillas, chimpanzees, elephants, buffalos, as well as various waterbirds and fish species [5]
- Thousands of endemic species have been identified close to the Grand Poubara hydropower station as well as in potential mining sites [3]
- Human activities include forestry, agriculture, hunting, fishing, tourism, transport – some of which are uncontrolled and likely to cause strain on natural systems due to pollution and overexploitation [3, 5]
- Although no specific management plans for the wetlands are in place, local level regulations protect and maintain natural resources and ecosystems and research activities are carried out [5]
- The largest challenge faced by basin authorities is currently the reconciliation of development plans and human use of the rich natural resources in the basin with conservation plans

River level simulations

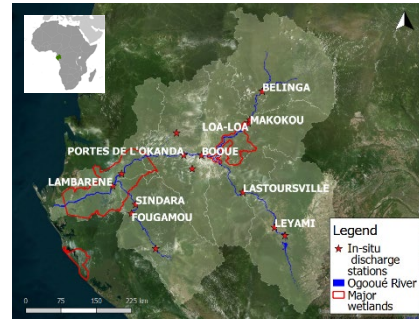


Description: Simulation of water level relative to long-term average against Envisat radar altimetry as obtained from Hydroweb [6] at the outlet of the Lower Ogooué and along the Ngounié tributary. The model replicates the water level trend at 9 different locations in the basin with a weighted root mean squared deviation below 1, suggesting the deviations are less than the standard deviation of the observations.

Simulation of climate change impact on water balance



Description: Simulation of climate change on discharge at the inlet to the Lower Ogooué. The right column is the IPCC RCP 8.5 scenario (increase in greenhouse gas emissions), whilst the right column shows the RCP 4.5 scenario (stabilization of greenhouse gas emissions before 2100). The figure shows the predicted change in mean daily discharge from applying climate factors from 11 different global climate on the forcing data and the ensemble mean. Predicted change in climate data clearly show an increase in discharge, which combined with landuse change may increase flood risk and strain the downstream wetland. The increased width of the climatology 95% confidence interval suggests the interannual variations may increase as well, particularly under scenario RCP 8.5.



Basemap of the Ogooué river basin in Gabon, East Africa with major wetlands outlined in red.

References

- [1] Kittel, C., Nielsen, K., Tøttrup, C., Bauer-Gottwein, P., 2018. Informing a hydrological model of the Ogooué with multi-mission remote sensing data. *Hydrol. Earth Syst. Sci.* 22, 1453–1472
- [2] World Bank, 2012. Gabon – Country partnership strategy for the period FY2012–FY2016., Tech. rep., World Bank, Washington DC, available at: <http://documents.worldbank.org/curated/en/4962314680303171> (last access: 21 February 2018)
- [3] Mezui, E. and Boumono Moukoumi, V.: Le Bassin de l'Ogooué: caractéristiques et importance, in: Annual International Conference on Geological and Earth Sciences (GEOS), Ministère du Pétrole, de l'Énergie et des Ressources Hydrauliques, available at: <http://slideplayer.fr/slide/177651/> (last access: 21 February 2018)
- [4] C. Mengue Medou, F. Ondamba Ombanda, C. Ndjokounda, M.-D. MOUNGANGA, E. Bayani, and R. Mikala, 2008. "Site Ramsar Bas Ogooué - Fiche descriptive sur les zones humides Ramsar (FDR)," Libreville, Gabon
- [5] Watkins, M. M., Wiese, D. N., Yuan, D.-N., Boening, C., and Landerer, F. W. 2015. Improved methods for observing Earth's time variable mass distribution with GRACE using spherical cap mascons, *J. Geophys. Res.-Sol. Ea.*, 120, 2648–2671
- [6] Cretaux J-F., Jelinski W., Calmant S., et al., 2011. SOLS: A lake database to monitor in the Near Real Time water level and storage variations from remote sensing data, *Advances in space Research*, 47, 1497-1507

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