Global Water Balance Analysis: Continental River Discharge and Reservoir Storage

Elizabeth Clark[1], Hester Bierman[2], Dennis Lettenmaier[1]

[1] Civil and Environmental Engineering, University of Washington, Seattle WA

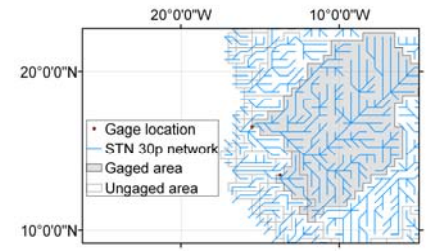
[2]Earth System Science Group, Wageningen University, Wageningen, The Netherlands

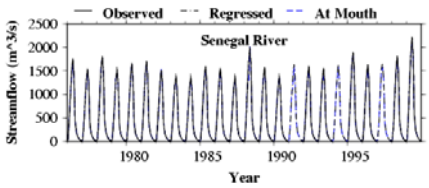
Overview

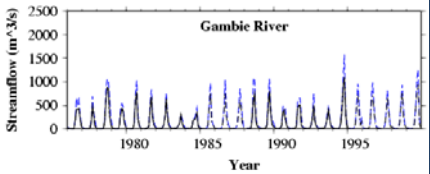
The goal of this work is to estimate continental river fluxes to the ocean from observations. Dai et al. 2009 performed a rather thorough analysis of global streamflow using data from 925 river gages. This data was extrapolated by Dai et al. 2009 using CLM 3.0 to estimate monthly flow at the river mouth and in ungaged basins that drain within the same 10° latitudinal band.

We are in the process of updating these estimates using the VIC model, which includes somewhat more realistic hydrology. We will compare results using VIC forced by 3 different atmospheric datasets.

Steps 1 and 2: fill in missing station observations using nearby station data and linear regression against modeled flows







Monthly river discharge estimates

Steps used by Dai et al. 2009 to estimate ungaged values:

1)Q(station,t) = a*Q_{obs}(nearby station, t) + b

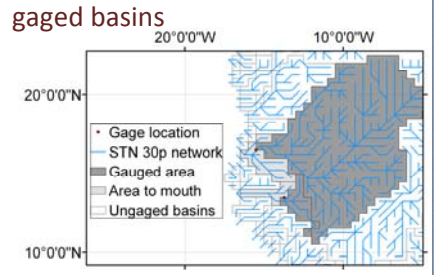
Already completed by Dai et al. 2009, who compared estimates with basin integrated precipitation.

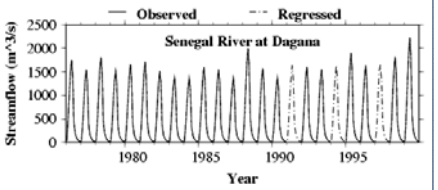
2)Q(station, t) = c*Q_{model}(station, t) + d

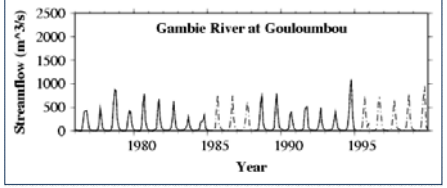
3)Q(mouth,t) = Q_{obs}(station,t)*(Q_{model}(mouth,t)/Q_{model}(station,t)

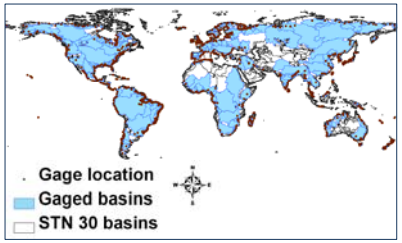
4)Q(unmonitored,t)=Q_{obs}(monitored,t)*(Q_{model}(unmonitored,t)/Q_{model}(monitored,t)

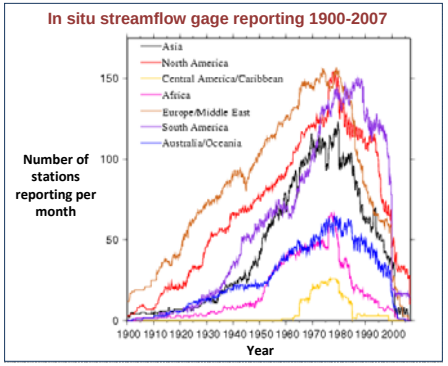
Step 3: estimate flow at mouth of gaged basins



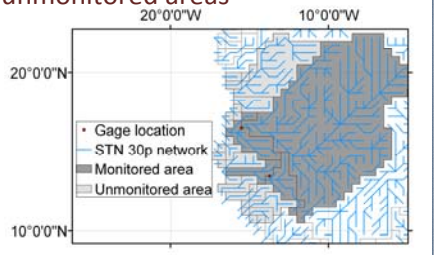


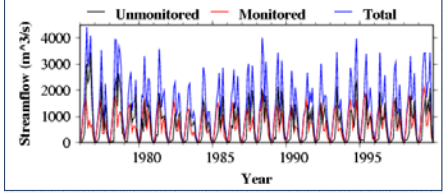






Step 4: estimate flow from unmonitored areas

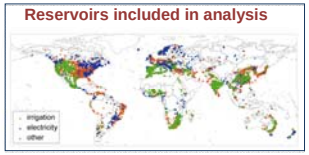


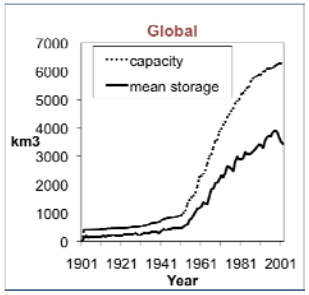


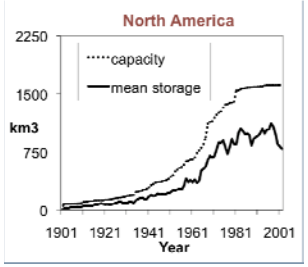
Annual reservoir capacity and storage

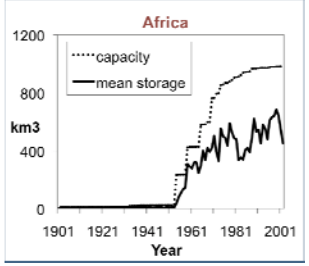
Overview

Human water use can have a major impact on the global hydrologic cycle in terms of stream flow timing and quantity. Biemans et al. (2009) describe an approach to modeling reservoir operations and irrigation withdrawals called LPJmL-water. The reservoir scheme optimizes outflow for diffferent purposes (irrigation, hydropower, flood protection, water supply/navigatio) and draws from Haddeland et al. (2006) and Hanasaki et al. (2006). Crop and grazing land are represented dynamically. Storage was modeled for 7000 dams larger than 0.1 km^2 (GRAND database).









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