Water balance

Water balance is assessed for a given place and a given period of time by comparing water inputs and outputs in that place and during that period. The assessment also takes into account the existing supply of stocks and future appropriation of these stocks. Water inputs are brought by precipitation. Outputs are from the combination of evaporation and the transpiration of plants, called evapotranspiration. Both quantities are estimated in terms of the amount of water per surface unit, but they are generally translated into water heights, the most currently used unit being the millimetre. As these two quantities are thus physically homogeneous, they can be compared by computing either their difference (precipitation minus evaporation), or their ratio (precipitation divided by evaporation). The balance is obviously positive whenever the difference is positive or the ratio greater than one. One expression or the other is chosen according to various conveniences or constraints. Runoff from a surface unit will be taken into account in the outputs. Infiltration is considered as stocking in the form of groundwater or capillary water in the soil. Solid precipitation represents immediately constituted stocks. These are of variable duration, inter-seasonal in the case of snow covers, inter-seasonal and inter-annual in the case of glaciers, and even inter-secular in the case of polar icecaps or of large masses on very high mountains. The study of water balances is complicated by the fact that the two commanding variables are not independent of each other. The quantity of evaporated water obviously depends on the total available quantity of water: it stops when the water volume brought by precipitation is exhausted. This has led to the introduction of the notion of potential evapotranspiration: the quantity of water that can go into the atmosphere according to its state alone, assuming that the quantity of available water is not a limiting factor. (The amount of water added to a vase of flowers in order to keep its level constant is a measure of the potential evapotranspiration, depending on the state of the atmosphere in the place where the vase is located.) It is usual, in the study of water balances, to compare precipitation, P and potential evapotranspiration, ETP, which makes it possible to distinguish different situations according to thresholds that are of special significance for a given place or period of time:
-If P -If P > ETP, the real evaporation will be equal to the ETP; there will be runoff and a building up of reserves; the period will be called surplus period.
The practical problems related to measurements and determinations about the range in quantities make it necessary to vary the methods of study and of presentation of water balances. Precipitation is generally measured by a dense network of previous observation stations considered to be reliable and offering a basis for comparison. Measurements of potential evapotranspiration are possible, using devices such as the Piche evaporimeter (inside a shelter), or the Colorado pan. But the observation network does not offer the same character of density, comparability and reliability as the network used in the observation of precipitation. Hence, in order to compute the balances, it is often necessary to carry out assessments of potential evapotranspiration. These are made on the basis of relatively well-known factors related to potential evapotranspiration. The first of these is temperature, but an effort is also made to include relative moisture, wind speed and solar radiation, etc. These computations have been the subject of much research, producing varying results, whose relative value must always be kept in mind by those using them. This is all the more true for indices or thresholds which, instead of comparing precipitation to a computed value of potential evapotranspiration, compare them to one of the quantified factors, very often the temperatures. This results in threshold indices or ratios which cannot be used for a direct physical interpretation, but only make sense when based on empirical adjustments. For example, geographers made much use of the works of bio-geographer H. Gaussen, who qualifies as a â€˜dry month' a month for which the values of precipitation expressed in millimetres are lower than the double of the values of temperatures expressed in Celsius degrees. It should be understood that this is the result of a bringing together of the results of measurements and conclusions from observations, for example on the state of the vegetation or of the variation of runoffs and of stocks. It is on the basis of these observations that the previously mentioned empirical adjustment was made, which simply states that if P(mm) The water balance takes on its full significance in relation to the periods corresponding to the principal, fundamental cycles of climatology: the daily cycle of 24 hours, and the annual cycle of 365 days. For the sake of convenience, however, it is also computed for intermediary periods, the most popular being the month.

Bibliographie