



Vodna bilanca  
Slovenije 1971–2000

*Water Balance  
of Slovenia 1971–2000*

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## *Water Balance of Slovenia 1971–2000*

Če kje na Zemlji obstaja čarobnost, se skriva v vodi.  
*If there is magic on the planet, it is contained in the water.*

*Loren Eisley*

Ljubljana 2008

## Vodna bilanca Slovenije 1971–2000 *Water balance of Slovenia 1971–2000*

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# Predgovor

## Foreword

Zadostne količine voda in njihova dobra kakovost sta ključni za vsakodnevno življenje ljudi in večino gospodarskih dejavnosti. Sta pomembna dejavnika kakovosti življenja in trajnostnega razvoja.

Krovna direktiva o vodah zavezuje države k doseganju okoljskih ciljev na področju voda, poplavna direktiva in aktivnosti v zvezi z sušami pa so dopolnitev obstoječih instrumentov vodne politike z vidika količinskega stanja voda. Načrti upravljanja vodnih območij se dopolnjujejo z analizami in rešitvami, ki bi omogočili vzpostavitev ravnotežja med razpoložljivostjo in rabo vodnih količin na posameznem vodnem območju. Za načrtovanje trajnostnega upravljanja z vodnimi viri je potrebno upoštevati posebnosti posameznih, npr. kraških območij.

Pomanjkanje vode in suše postajajo velik problem, podnebne spremembe pa stanje še poslabšujejo. Razmere vplivajo na naravne vire v obliki negativnih učinkov na biotsko raznovrstnost, kakovost voda, tveganja za gozdne požare in širjenje sušnih predelov. V takšnih okoliščinah postaja prednostna naloga priprava učinkovitih strategij za blaženje posledic suš in pomanjkanja vode ter upravljanja tveganj s sušami. Prvi korak pri spopadanju z navedeno problematiko je trajnostno upravljanje z vodnimi viri. To pomeni predvsem varčnejšo in učinkovitejšo rabo voda v vsakdanjem življenju, kot tudi v vseh od vode odvisnih gospodarskih dejavnostih.

Slovenija se uvršča med države, ki so z vidika vodnatosti, sorazmerno bogate. V zadnjih tridesetih letih pa je zelo očitno upadanje rečnega odtoka. Ker ima večina naših rek hudourniški značaj, pretoki zelo hitro narastejo in tudi hitro upadejo. Intenzivne lokalne padavine povzročijo lokalne poplave hudourniškega značaja, ki prizadenejo manjša porečja ali dele porečij. Vodotoki s hudourniškim značajem pa so še posebej ranljivi v času malih pretokov in hidrološke suše.

Obstoječa vodna politika, katere ključni izzivi so zagotavljanje dobrega stanja voda, zahteva uveljavitev učinkovite cene vode po načelu »porabnik plača«, opozarja na pomen ustrezne-

Sufficient quantities of good quality water are of key importance to people's everyday life and for the majority of economic activities. They are important factors of both quality of life and sustainable development.

The Water Framework Directive binds countries to achieving environmental objectives in the area of water, while the Flood Directive and the activities concerning droughts supplement the existing instruments of the water policy in the area of the quantitative status of water. The plans for managing water areas are supplemented by analyses and solutions that will allow a balance to be maintained between the availability and utilisation of water quantities per individual water area. In order to plan the sustainable management of water resources, it is necessary to observe the characteristics of the individual areas, e. g. karstic areas.

Droughts and the lack of water are becoming a serious problem, and climate change is only aggravating the situation. These conditions affect natural resources, having negative effects on biodiversity, the quality of the water, the risk of forest fires and the expansion of drought-prone areas. In these circumstances, the preparation of effective strategies for mitigating the consequences of droughts and the lack of water, as well as the management of drought risks, are becoming a priority task. The first step in tackling this issue is the sustainable management of water resources. This primarily means the more economical and efficient use of water in everyday life as well as in all the branches of economy that depend on water.

Slovenia ranks among the countries that are relatively rich in terms of water abundance. The decline in river runoff is quite clearly visible over the last thirty years. The majority of our rivers have a torrential character, with discharges increasing and decreasing very rapidly. Intensive local precipitation causes local floods of a torrential nature, affecting smaller river basins or parts of river basins. Watercourses with a torrential nature are especially vulnerable during the period of low discharges and hydrological drought.

ga prostorskega načrtovanja in na gospodarnost rabe vode. Prisotna je skrb za vključevanje vodne problematike v načrtovanje drugih gospodarskih dejavnosti. Politične odločitve pa morajo temeljiti na visoki kakovosti znanj in informacij o značilnostih vodnega kroga in trendov.

Priprava vodne bilance Slovenije je predvidena v Nacionalnem programu varstva okolja. Združuje podatke rednega spremljanja vseh dejavnikov vodnega kroga, od padavin, izhlapevanja, zalog in odtoka. Z njeno pomočjo lahko pridobimo prvo oceno o stanju vodnega okolja po posameznih povodjih in predstavljajo eno od podlag za ukrepanje. Zato nas veseli, da je pred nami publikacija, ki nam bo to omogočala.

*dr. Mitja Bricelj*

državni sekretar

Ministrstvo za okolje in prostor

The existing water policy, the challenges of which are assuring the good ecological status of waters, requires the establishment of an effective price for water according to the »user pays« principle, warning of the importance of suitable spatial planning and the economical use of water. It includes provisions for including the water policy in the planning of other economic activities. Political decisions must be based on high quality knowledge and information on the characteristics and trends of the water cycle.

The preparation of the Slovenian water balance is envisaged as part of the National Environmental Protection Programme. It combines the data from regular monitoring of all the water cycle elements, ranging from precipitation, evaporation and reserves through to the runoff. This will help us obtain the first estimate of the status of the water environment in the individual catchment areas and will represent one of the bases for taking measures. Therefore we are delighted that we now have a publication that will enable us to do all this.

*Mitja Bricelj, PhD*

State Secretary

Ministry of the Environment  
and Spatial Planning



FLORJANA ULAGA

Slika 1: Ob Tolminki / Figure 1: By the Tolminka River

# 1

## Uvod

### Introduction

Jože Uhan

Voda je eden najpomembnejših življenjskih naravnih virov. Podatki o njenih količinah predstavljajo pomembno izhodišče načrtovanja razvoja družbe in so podlaga globalni viziji prostorskega razvoja. Voda v prihodnje ne bo samoumevno razkošje, zagotavljanje vode različnim uporabnikom bo še težavnejše. V vodni krog vse pogosteje in vse močnejše posega človek z rabo in urejanjem voda in prostora. Poznavanje prostorske in časovne razporeditve in ocene razpoložljivih količin vode so ključne podlage upravljanju voda. Racionalnejša raba in urejanje voda za zmanjševanje posledic hidroloških suš in škodljivega delovanja voda je pomemben cilj nacionalnega programa upravljanja z vodami. Doseganje zastavljenega cilja je močno povezano z ugotovitvami obdobje nacionalne vodne bilance oz. značilnostmi prostorske in časovne razporeditve vode.

Vodna bilanca je računška shema vhodnih in izhodnih količin vode v poenostavljenem modelu vodnega kroga, ki ga je za analizo vodnih virov zasnoval geograf C. W. Thornthwaite (1899–1963) in s tem postal pionir izračunavanja vodne bilance. Uporabnost rezultatov vodne bilance temelji na razpoložljivosti in zanesljivosti podatkov iz dolgoročnih programov meritev, opazovanj in analiz procesov v hidrosferi. V rezultatih nacionalne vodne bilance se zrcali tudi stabilnost delovanja nacionalne hidrološke in meteorološke službe, ki izvajata dolgoročne programe meritev in analiz.

Za državno načrtovanje upravljanja voda je pomemben obdobje vodnobilančni izračun, ki lahko nakazuje regionalne spremembe v prostorski in časovni razporeditvi vode. Svetovna meteorološka organizacija priporoča tridesetletno bilančno analitično obdobje. Pričujoča študija predstavlja rezultate vodne bilance od leta 1971 do leta 2000 ter ugotavlja razlike glede na predhodno obdobje 1961–1990.

V študiji vodne bilance Slovenije za obdobje 1971–2000 so uvodoma predstavljeni metodološki pristop, podatkovni nabor ter nekateri

Water is one of the most important natural resources that supports life. Data on its quantity represents an important starting point for planning the development of society and is the foundation for the global vision of spatial development. In the future, water will no longer be a luxury that we can take for granted and the provision of water to various users will be even more difficult. Man is increasingly and substantially encroaching on the water cycle by utilising and arranging water bodies and space. Knowing the spatial and temporal distribution and the estimates of the water quantities available is the key foundation for managing the water resources. The rational use and organization of water in order to alleviate the consequences of hydrological droughts and harmful effects of the water are an important objective of the National Water Management Programme. Achieving this objective is strongly linked to the findings of the multi-annual national water balance and the characteristics of the spatial and temporal distribution of water.

The water balance is a calculation scheme based on the input and output quantities of water in a simplified model of the water cycle created by geographer C. W. Thornthwaite (1899–1963) for analysis of water resources, making him a pioneer in the calculation of the water balance. The applicability of the water balance results is based on the availability and reliability of data from long-term programmes of measurement, observation and analysis of the processes occurring in the hydrosphere. The national water balance results also reflect the stability of the operation of the national hydrological and meteorological services that conduct these long-term measurement and analysis programmes.

The multi-annual water balance calculation, which can indicate regional changes in the spatial and temporal distribution of water, is important for the national planning of water management. The World Meteorological Organization





Slika 2: Soča

Figure 2: The Soča River

najpomembnejši vplivni dejavniki na posamezne elemente vodnega kroga. V jedru študije so podani in pojasnjeni rezultati bilančne analize ter glavne značilnosti posameznih elementov vodnega kroga od padavin in izhlapevanja do odtoka.

Vodna bilanca Slovenije za obdobje 1971–2000 prinaša pomembne ugotovitve o spremembah padavinskega režima, ko jesenski višek padavin postaja bolj izrazit, medtem ko se v ostalih mesecih količina padavin zmanjšuje. Spremembe ugotavljamo tudi pri izhlapevanju, ki se je v primerjavi s predhodnim vodnobilančnim obdobjem povečalo. Posledice so spremenjeni pretočni režimi med katerimi se zmanjšujejo regionalne razlike. Trendi pretokov so v splošnem v upadanju. Primerjava elementov vodne bilance obdobja 1971–2000 z obdobjem 1961–1990 nakazuje povečanje izhlapevanja in zmanjšanje odtoka. Ugotovljene spremembe na regionalni ravni kratkoročno še niso povzročile pomanjkanja vode, lokalno pa se zaradi njih tveganje pri zagotavljanju vode povečuje. Po podatkih Evropske okoljske agencije ugotovljene vodnobilančne spremembe uvrščamo v velikostni red pričakovanih sprememb povprečne letne razpoložljivosti vode na območju Slovenije do leta 2030.

Vodna bilanca Slovenije 1971–2000 ponovno prinaša pomembno sporočilo o potrebni podpori razvoju nacionalne hidrološke in meteorološke službe. Hkrati je zadostno opozorilo za nujne ukrepe v nacionalni politiki upravljanja voda in prostorskega planiranja, katerim je vodnobilančna študija najprej namenjena.

recommends a thirty-year analytical period for the water balance. The present study presents the water balance results from 1971 to 2000 and establishes the differences with respect to the previous period of 1961–1990.

The study of the water balance in Slovenia for the 1971–2000 period first presents the methodological approach, the data set and some of the most important and influential factors affecting the individual elements of the water cycle. The core of the study provides and explains the results of the water balance analysis and the main characteristics of the individual water cycle elements, from precipitation and evaporation to runoff.

The water balance of Slovenia for the 1971–2000 period is providing important findings on changes to the precipitation regime, with the autumn peak becoming increasingly pronounced and the amount of precipitation in the other months is decreasing. We are also finding changes in evaporation, which has increased in comparison with the previous water balance period. The results are changing discharge regimes, during which the regional differences are diminishing. The discharge trends are generally declining. The comparison of the elements of the water balance in the 1971–2000 period with that in the 1961–1990 period indicate an increase in evaporation and a reduction in the runoff. In the short-term, the established changes on a regional level have not yet caused water shortages, though locally these changes are increasing the risks to the provision of water. According to the data of the European Environmental Agency, the established water balance changes are classified into the size order of the expected changes in the average annual availability of water in the territory of Slovenia by the year 2030.

The water balance of Slovenia in the 1971–2000 period is again delivering an important message on the necessary support for the development of the national hydrological and meteorological service. It is also a sufficient warning to require urgent measures in the national policy of water management and spatial planning, for which the water balance study is primarily intended.