

**SIC ICWC**

**Project RIVERTWIN**

# **HBV Model Testing and Adaptation to Chirchik-Akhangaran-Keles Basin**

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# HBV Model

- HBV model – river flow process modeling.
- Developed in Swedish Meteorology and Hydrology Institute (Bergstrom, 1995).
- HBV model was modified in the Institute of Hydrological Engineering, University of Stuttgart (IWS) and presented as HBV-IWS model (A.Bardossy, 1998 -1999).

- HBV (HBV-IWS) model consists of three blocks

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- 1) Water influx to basin surface in form of solid and rain precipitation;

- 2) Losses of water flowing to river basin – increase in soil moisture and evapotranspiration;

- 3) Transformation of water flowing to the basin into river runoff.

**1. Mean daily temperatures**

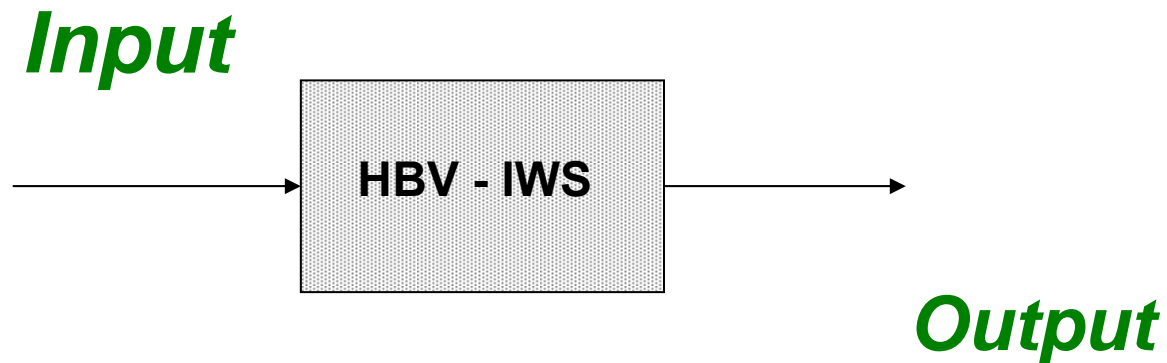
**2. Daily precipitation**

3. Long-term mean monthly temperatures and evapotranspiration

4. Soil characteristics

5. Data from gauging stations on daily runoff volumes

6. Basin configuration



**1. Daily runoff volumes**

2. Mean monthly and maximum runoff volumes

3. Evapotranspiration

4. Statistics

## Program structure

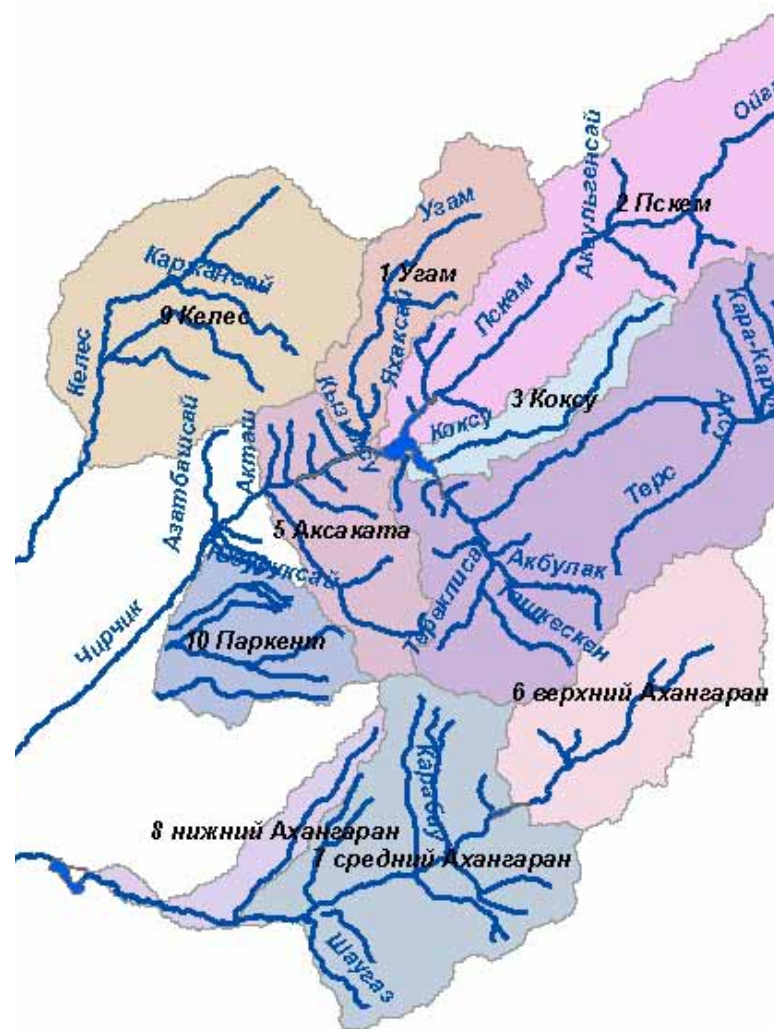
- Program is written in FORTRAN.
- The program consists of main program,
  - 27 sub-programs and
  - 3 functions – sub-programs.
- Input of data is done from 6 external text files.
- Modeling results of runoff volumes, evapotranspiration and statistical data are output to 4 external text files.

- **Catchment basin is divided into sub-basins**
- **Each sub-basin is divided into elevation zones with certain increment by elevation**

For each elevation zone:

- area estimated;
- data prepared
  - climate (temperature and precipitation),
  - soil,
  - long-term mean monthly temperature and evapotranspiration

## Structure of Chirchik-Akhangaran-Keles basin (flow formation zone)



**Flow formation zone of the rivers Chirchik, Akhangaran, Keles and of Parkent district's sais is presented in form of 10 sub-basins:**

### **3 sub-basins in Akhangaran river basin:**

- Along Akhangaran river with its tributaries upstream of Akhangaran reservoir;
- downstream of the reservoir to Sharhi waterworks facility along the rivers Dukent and Nougarkan;
- downstream of Sharhi waterworks facility to Tashcanal siphon.

### **5 sub-basins in the Chirchik river basin**

- three sub-basins along inflow to Charvak reservoir (rivers Pskem, Koxsu, Chatkal);
- two sub-basins downstream of Charvak reservoir (rivers Ugam, Aksakata).

### **1 sub-basin in Keles river**

*In flow formation zone located upstream of Stepnor gauging station.*

**1 sub-basin in Parkent district's sais, flowing into Left-bank Karasu (Parkentsai, Kyzylsai, etc.).**

**The selected 10 sub-basins of the Chirchik-Akhangaran-Keles basin are integrated into the following projects:**

- **Ahangaran-HBV Project** – sub-basing along Akhangaran river and its tributaries  
(total 3 sub-basins);
- **Chirchik-HBV Project** – sub-basins of the rivers Ugam, Pskem, Koxu, Chatkal, and Aksagata (total 5 sub-basins);
- **Keles-HBV Project** - sub-basins of Keles river and Parkent district's sais (total 2 sub-basins).

**Considered river sub-basins are divided into elevation zones 200m wide (vertical):**

- Ahangaran-HBV project - **19** elevation zones in sub-basins;
- Chirchik-HBV project - **20** elevation zones in sub-basins;
- Keles-HBV project - **14** elevation zones in sub-basins.



# Analysis of calculation results

Subcatchment	Correlation			Mean error of monthly runoff calculation, %			Error of annual runoff calculation, %		
	1980	1981	1982	1980	1981	1982	1980	1981	1982
Ahangaran, subcatchment 1	0.912	0.989	0.983	51.6	39.9	46.1	13.6	38.7	7.3
Ahangaran, subcatchment 2	0.997	0.931	0.746	16.1	22.3	35.3	5.1	23.0	25.9
Ahangaran, subcatchment 3	0.995	0.968	0.895	19.0	25.7	34.5	8.4	22.4	35.8
Ugam	0.986	0.942	0.746	15.4	19.3	28.9	6.4	3.6	20.8
Pskem	0.993	0.975	0.848	15.2	21.2	27.4	1.7	7.4	0.5
Koksu	0.989	0.988	0.898	18.7	19.9	38.6	17.6	1.5	3.6
Chatkal	0.998	0.950	0.818	12.1	32.3	31.0	4.9	13.6	9.5
Aksagata	0.987	0.945	0.831	18.4	21.7	32.5	0.6	2.3	0.9
Keles	0.990	0.951	0.935	17.1	16.6	24.8	0.3	9.1	22.5
Says of Parkent	0.996	0.968	0.901	21.1	21.3	25.5	15.5	1.8	18.8

# Анализ результатов расчета

Суббассейн	Корреляция			Средняя погрешность расчета месячных стоков, %			Погрешность расчета годового объема стока, %		
	1980г.	1981г.	1982г.	1980г.	1981г.	1982г.	1980г.	1981г.	1982г.
р.Ахангаран, суббассейн 1	0.912	0.989	0.983	51.6	39.9	46.1	13.6	38.7	7.3
р.Ахангаран, суббассейн 2	0.997	0.931	0.746	16.1	22.3	35.3	5.1	23.0	25.9
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р.Угам	0.986	0.942	0.746	15.4	19.3	28.9	6.4	3.6	20.8
р.Пскем	0.993	0.975	0.848	15.2	21.2	27.4	1.7	7.4	0.5
р.Коксу	0.989	0.988	0.898	18.7	19.9	38.6	17.6	1.5	3.6
р.Чаткал	0.998	0.950	0.818	12.1	32.3	31.0	4.9	13.6	9.5
р.Аксагата	0.987	0.945	0.831	18.4	21.7	32.5	0.6	2.3	0.9
р.Келес	0.990	0.951	0.935	17.1	16.6	24.8	0.3	9.1	22.5
Саи Паркентского района	0.996	0.968	0.901	21.1	21.3	25.5	15.5	1.8	18.8