SEGURA PRB

Water Exploitation Index+ (WEI+) Testing exercise 2

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Calculating Water Resources (WR)

Acording to the technical notes, we have utilized two options for calculating Water Resources:

WATER RESOURCES	
OPTION 1	**OPTION 2**
WR = P- ETa + ExIn - ΔSnat	WR = Outflow + Abstraction – Return + ΔSart

Option 1:

- **In the Segura RB we have calculated Water Resources Option 1 using the hydrological model SIMPA, that calculate P-Eta- ΔSnat (natural Runoff or natural contribution)**

WR = Natural Contributions + External Inflow

Natural Contributions = P – ETa - ΔS_{nat}

- **Natural Contributions (NC) are obtained from the model SIMPA (1979/80 to 2004/05), corrected and completed with data from gauge stations in the regulated area of the basin, from 1982/83 to 2009/10.**

Option 2:

- **In the Segura RB, Surface Outflow is the flow measured at the gauge station of Guardamar, located at the estuary of the Segura river (1980/2011). Water for treaties equals zero and groundwater Outflow is unknown, but not significant.**

- **Abstraction includes desalinated water.**

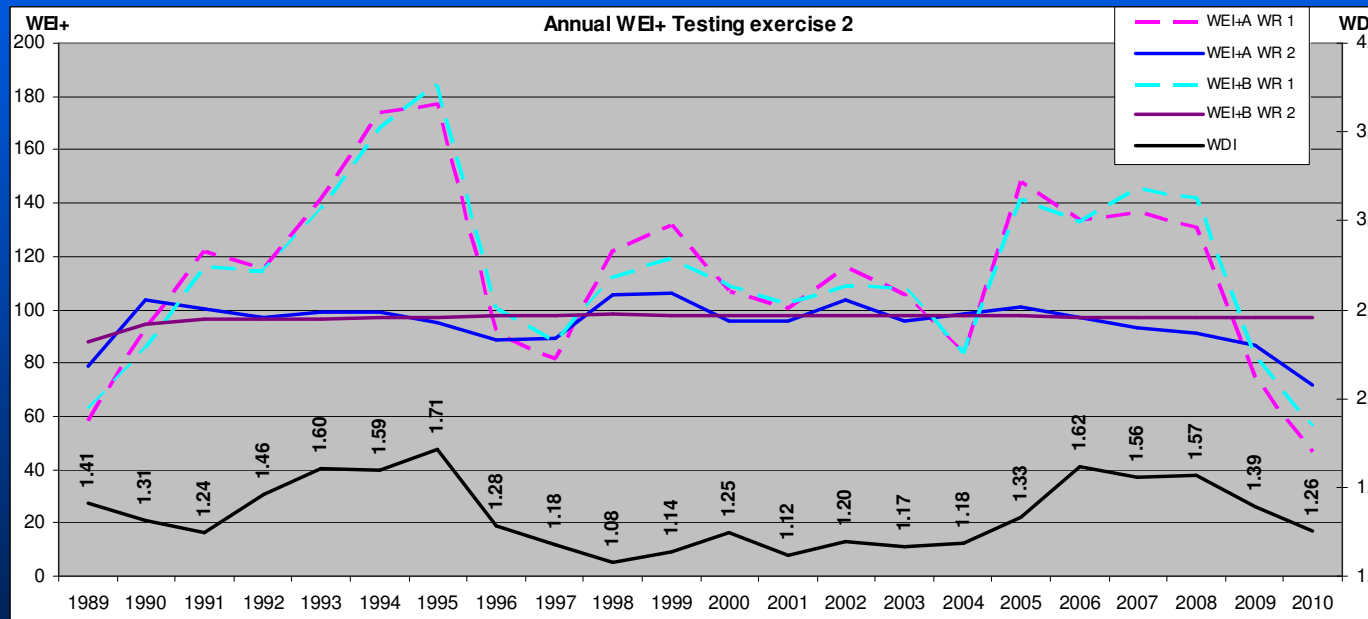**Total Abstraction = Abstraction – Desalinated water**

WEI+ testing exercise 2: RESULTS

There were also two options for calculating WEI+:

Option A:
$$WEI = \frac{Abstractions - \text{Re}\,turns}{Water\,\text{Re}\,sources}$$

Option B:
$$WEI = \frac{Abstractions - \text{Re}\,turns}{Water\,\text{Re}\,sources - \Delta Sart}$$
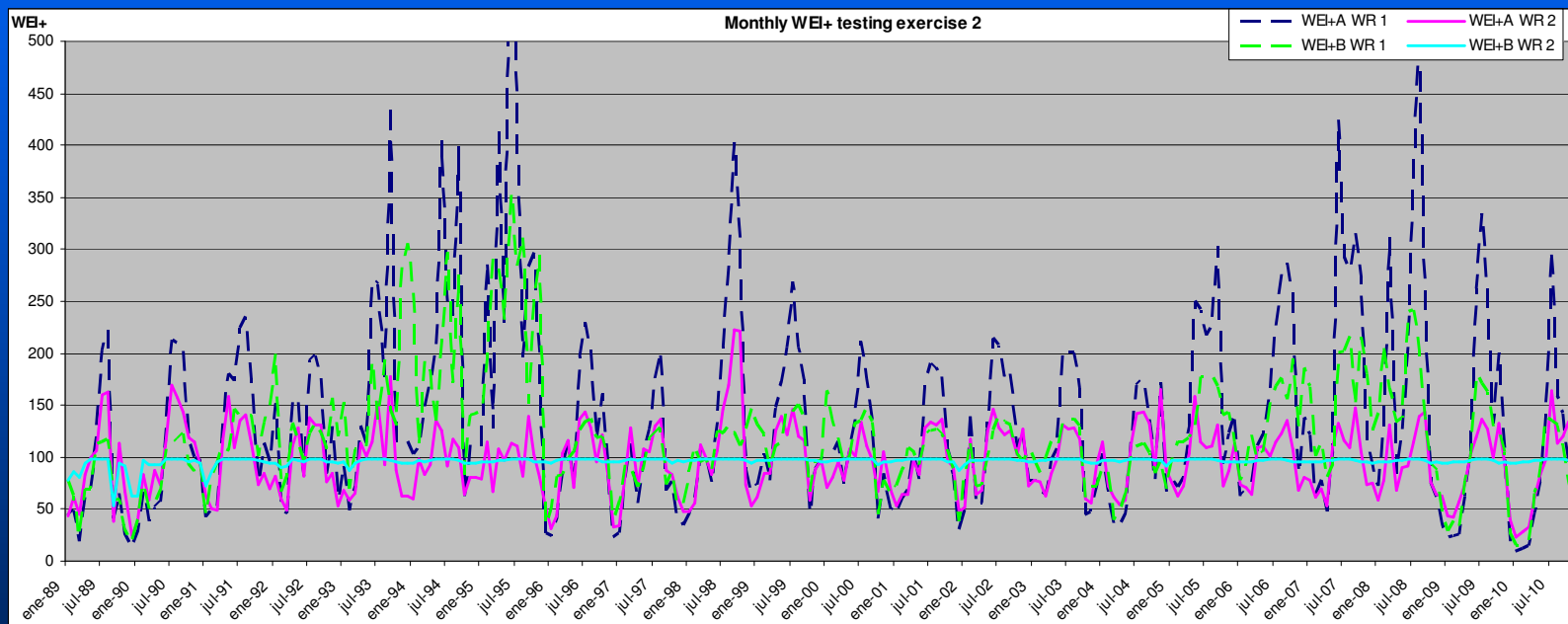
Annual testing exercise:

It seems that option 1 for calculating WR gives bigger variability of the WEI data but similar average values

WEI+ testing exercise 2: RESULTS

Monthly testing exercise:

As in annual calculation option 1 gives bigger variability of the WEI data but similar average values

WEI+ testing exercise 2: RESULTS

	FORMULA OPTIONS			
	OPTION A		**OPTION B**	
	WEI+A WR 1	WEI+A WR 2	WEI+B WR 1	WEI+B WR 2
	$WEI = \dfrac{Abstractions - Re\,turns}{Water\ Re\,sources}$		$WEI = \dfrac{Abstractions - Re\,turns}{Water\ Re\,sources - \Delta Sart}$	
Annual Average	113,1	95,1	113,6	96,8
Monthly Average	138,3	95,9	120,5	96,0

WEI+ testing exercise 2: CONCLUSIONS

Conclusions

- **In the Segura RB, it is more suitable to use <u>Option 1</u> to calculate <u>Water Resources</u> since data required for this option are available and it leads to a better estimation of renewable water resources.**

- **Also, in the Segura RB we consider the <u>WEI+ option B</u> the best option, since it takes into account the artificial storage, which is a resource that plays an important role in this basin.**

Water Demand Index (WDI)

Water Demand Index it's been calculated as:

WDI = Water Demand / Water Abstraction

- **As water demand is a theoretical maximum value is always higher than Abstraction, therefore WDI is greater than 1.**

Time series 1989/10	Water Abstraction	Water Demand	WDI = water demand / water abstraction
1989	1328,9	1879,8	1,41
1990	1437,0	1882,7	1,31
1991	1516,4	1882,5	1,24
1992	1286,5	1876,0	1,46
1993	1167,4	1871,1	1,60
1994	1175,2	1871,4	1,59
1995	1091,8	1867,9	1,71
1996	1456,2	1868,4	1,28
1997	1598,3	1878,6	1,18
1998	1753,1	1893,8	1,08
1999	1659,4	1889,3	1,14
2000	1532,2	1910,5	1,25
2001	1715,3	1914,8	1,12
2002	1599,0	1917,7	1,20
2003	1649,3	1928,6	1,17
2004	1632,8	1932,2	1,18
2005	1459,4	1938,7	1,33
2006	1196,4	1933,5	1,62
2007	1244,7	1936,1	1,56
2008	1231,6	1928,7	1,57
2009	1382,1	1919,3	1,39
2010	1515,4	1905,3	1,26
Annual Average	**1437,7**	**1901,2**	**1,3**
Monthly Average	**119,8**	**158,4**	**1,3**

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WEI+ testing exercise 2: SOME CONSIDERATIONS

- **In this testing exercise 2, when we consider Water Resources using Option 2, we are including non-renewable groundwater resources.**

- **Since Option 2 is base on restitution of the natural regime non-renewable resources shouldn't be taken into account. Therefore we have recalculated Water Resources Option 2 and WEI+ removing non-renewable resources:**
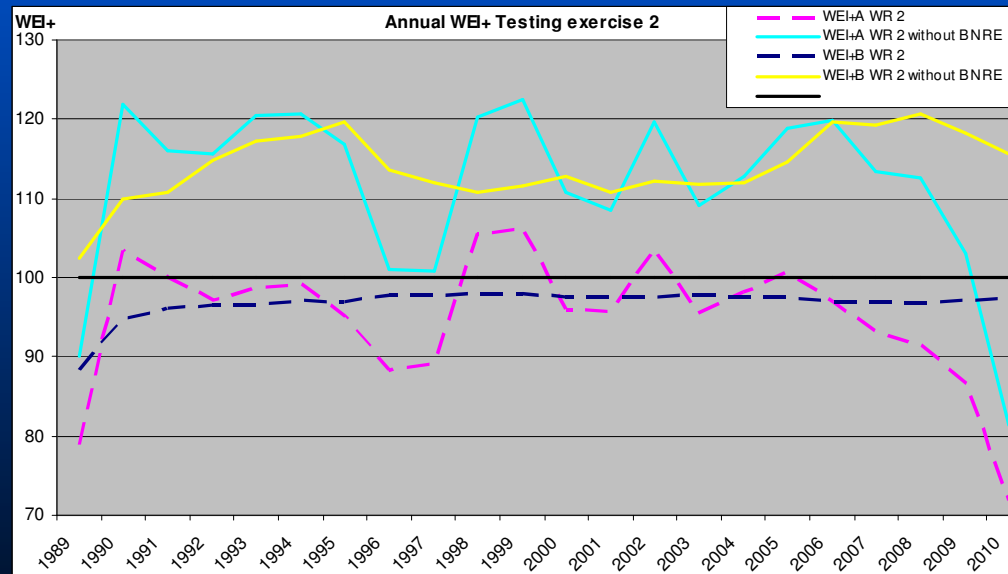
| | WATER RESOURCES | |
YEAR	OPTION 1 WR = P- ETa + ExIn - ΔSnat	OPTION 2 WR = Outflow + Abstraction – Return + ΔSart
Water Resources with Non-renewable resources	1.138,8	1.214,4
Water Resources without Non-renewable resources	1.138,8	1.040,8

- **As a result Water Resources Option 2 decreases.**

WEI+ testing exercise 2: SOME CONSIDERATIONS

- **As a consequence WEI+, calculated using WR option 2, increases above 100%.**

FORMULA OPTIONS		OPTION A		OPTION B	
		WEI+A WR 1	WEI+A WR 2	WEI+B WR 1	WEI+B WR 2
		$WEI = \dfrac{Abstractions - Re\,turns}{Water\,Re\,sources}$		$WEI = \dfrac{Abstractions - Re\,turns}{Water\,Re\,sources - \Delta Sart}$	
Water Resources with Non-renewable resources	Annual Average	113,1	95,1	113,6	96,8
	Monthly Average	138,3	95,9	120,5	96,0
Water Resources without Non-renewable resources	Annual Average	113,1	111,6	113,6	114,0
	Monthly Average	138,3	114,9	120,5	113,0

Annual WEI+ Testing exercise 2

- WEI+A WR 2
- WEI+A WR 2 without BNRE
- WEI+B WR 2
- WEI+B WR 2 without BNRE

(*) BNRE: Non-renewable resources