

WEI+

**Follow up from the exercise with the Pilot RBs
- Open Issues -**

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Background

A revision of the WEI has been introduced with the purpose of better capturing the balance between natural renewable water resources and abstraction

The proposed WEI+ aims mainly at redefining the actual potential water to be exploited (i.e. availability), since it incorporates returns and environmental requirements.

Water Requirements: The level of stress or relevant water scarcity in a catchment changes if we subtract an amount of water that is not actually available for abstraction since it needs to be left in the catchment to maintain its ecological status (in line with WFD) or other legal requirements (e.g. treaties in transboundary rivers)

Returned Water refers to the volume of water that is returned and available for re-use in the catchments, which in the case of e.g. cooling water may be a significant volume

Background_cont

WEI components	RWSI components
ABSTRACTION (<i>Eurostat definition</i>)	ABSTRACTION (<i>WISE-SoE definition</i>)
$(ABS_SW) + (ABS_GW) - (HYDROPOWER)$	$(ABS_SW) + (ABS_GW)$
LTAA AVAILABILITY	RENEWABLE WATER AVAILABILITY (RWA)
$P_{LTAA} - \text{Eta}_{LTAA} + I_{LTAA}$	$P - \text{Eta} + I + R - WR$ (ENV, treaties)

Differences:

- Annual, monthly vs. LTAA
- Returned water
- Water Requirements (WR): environmental + other (e.g. treaties in transboundary RBs)

WEI+ test exercise_summary of results

Based on the test exercise the following results have been obtained (as presented in the London Meeting)

- *Guidelines not followed by all participant (scale, time resolution)*

	WEI+	WEI+ vs. WEI	Data source
AT, country level (1961-2000)	5%	↑	Eurostat, Pilot RB exercise
AT, Rhine RB (1961-2000)	5%	↑	Pilot RB exercise
AT, Elbe RB (1961-2000)	18.5%	↑	Pilot RB exercise
AT, Danube RB (1961-2000)	5%	↑	Pilot RB exercise
BE, Scheldt RB (2007)	37%	↓	WISE-SoE#3
CZ, Morava RB (2009)	4%	-	Pilot RB exercise
UK, Thames RB (1961-1990)	23%	↑	Pilot RB exercise
EE, country level	9%	↓	Eurostat, Pilot RB exercise
FI, Paimionjoki RB (2010)	4%	-	Pilot RB exercise
IT, Serchio RB (2000-2008)	10%	↑	Pilot RB exercise
NL, country level (2007)	10%	↓	WISE-SoE#3
ES, Segura RB (1989-2009)	161%	↓	Pilot RB exercise

WEI+ test exercise_summary of results (cont.)

- New additions after the London meeting

Italy (Arno, Po, Liri-Volturno-Garigliano, *ppt by Gaia Checcucci and Claudia Vezzani*)

Hungary (Kapos, Kettos-Koros RBs analysis @ various spatial scales)

Czech Republic (extra analysis for Morava RB @ various spatial scales)

Spain (extra analysis for Segura RB @ various spatial scales)

Open Issues

1. Data sources and ambiguous calculations

- Various indicators similar to the WEI exist (WRVI-Raskin 1997, etc.)
- Different datasets exist at EU level
 - Numerous combinations are possible and subject to an open interpretation by any interested body!

Assumptions regarding data (gap filling, proxy calculations) is not a new problem, it is common in EU, even among MSs agencies who use different models, methodologies etc. The WEI parameters are no exception to that

→ **EG WSD**: clarifications must be brought up to discussion and a **harmonised approach regarding calculation proxies and assumptions** to be implemented in order to facilitate the correct representation of WS conditions and the accurate interpretation of the results

- **EMAIL to Pilots on their assumptions: create a list of options**
(e.g. UK, FI responses)



Open Issues

2. WEI+ parameters

- Hydropower should be excluded from the abstractions, because even if this is also accounted as a return, if the amount is high (as compared to the remaining abstractions) the basin can be shown as severely stressed
- The parameters of “water requirements” and “returned water” introduced in the WEI+ have scientific merit in representing a more accurate water balance and correctly depicting the prevailing conditions in line with the WFD objectives
- Returned water: method of calculation and assumptions (e.g. irrigation), relevant location
- Water Requirements: method of calculation, temporal scale

INSIGHT FROM PILOTS, REACH COMMON METHODS WHEN/WHERE

POSSIBLE

WS&D Expert Group, 14.10.2011, Venice

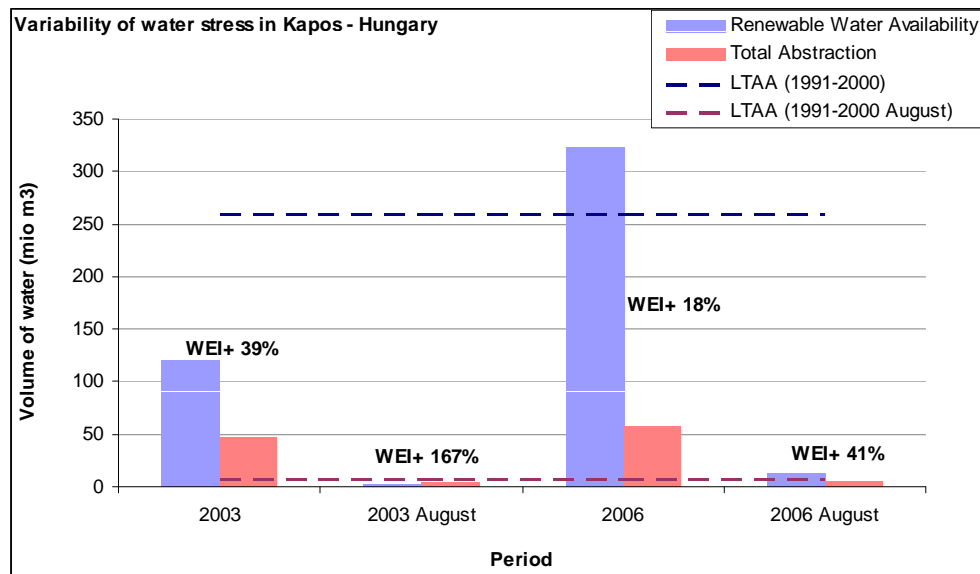
European Environment Agency
European Topic Centre on Water



Open Issues

3. WEI+ temporal scale of implementation

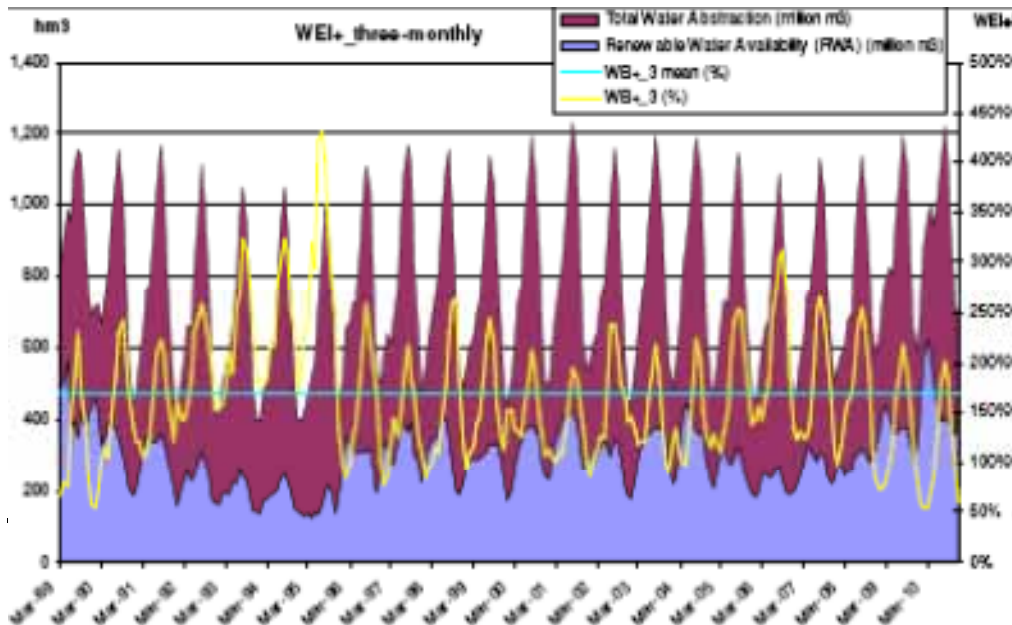
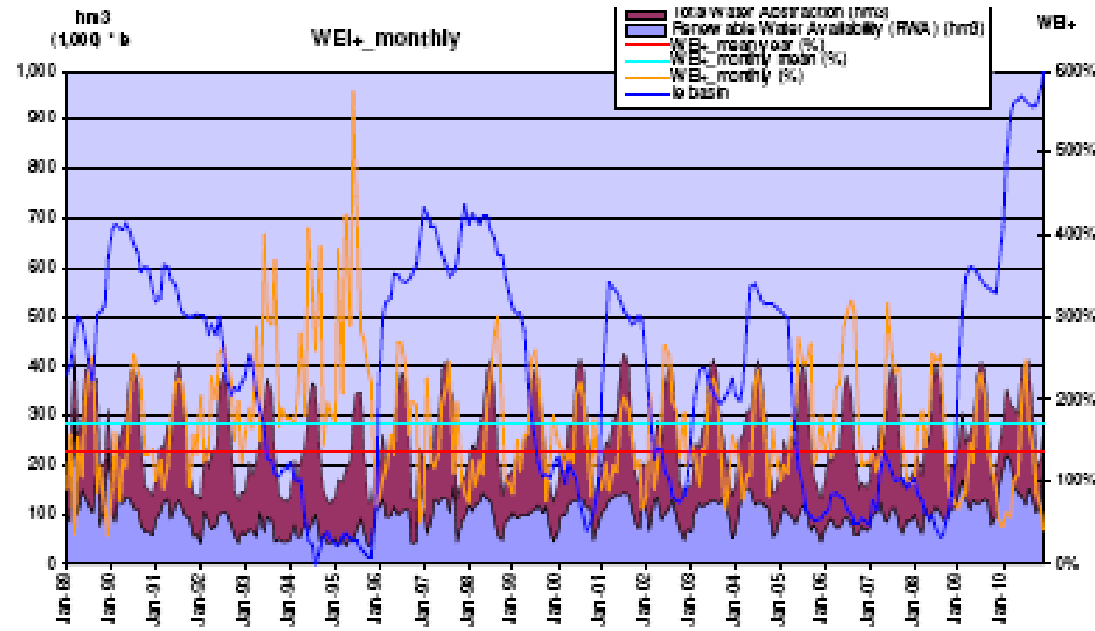
- The calculation of WEI+ under its current mathematical expression might be problematic at monthly step. During the summer months where precipitation is low or even zero areas can show as scarce, while in reality storage from a previous timestep may exist to cover needs (e.g. Finland)



- On the other hand, neglecting the seasonal variation and running calculations only at annual level also fails to depict important stress conditions that may occur over summer

SEGURA Conclusions:

- WEI+ monthly identifies quite well some of the dry periods that occurred in the basin, and that are also detected by Segura Basin State Index (le basin): 1993 to 1995 and 2005 to 2008.



To calculate WEI+_3 the same dataset as WEI+_monthly was used.

- Monthly series were accumulated to obtain 3-monthly data.
- WEI+_3 mean is 168%.
- Dry periods can also be identified by this indicator.

MORAVA Conclusions:

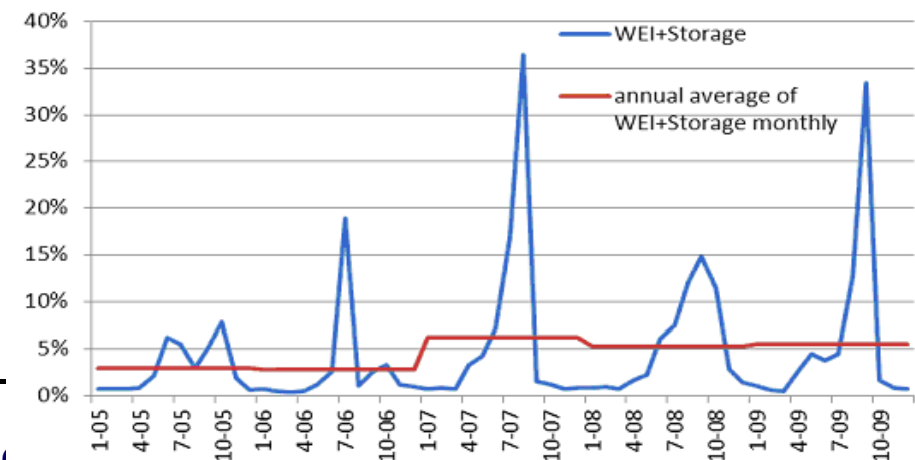
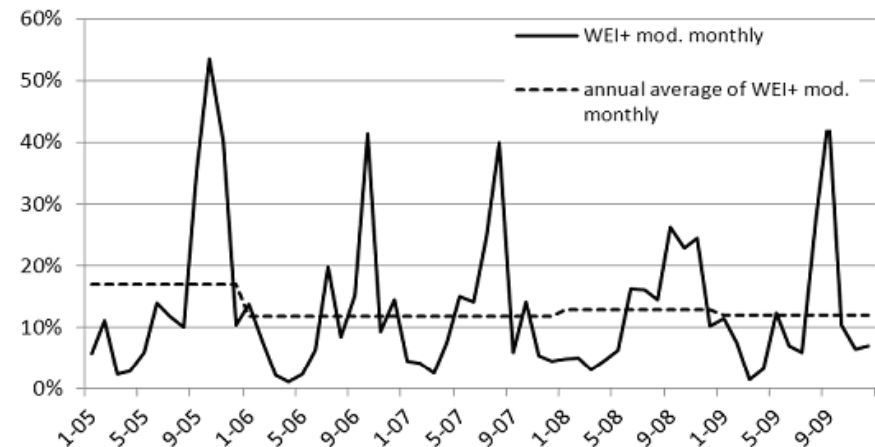
- The problem with negative Internal Flow is remaining even when calculating WEI+ for time step of three months and also for time step of four months. Positive values of Internal Flow were obtained for time step of **six months**

Alternative 1:

natural discharge (transformed into mil m³/year) applied as Internal flow knowing that the available groundwater is included only by its dynamic component – baseflow

Alternative 2:

include a component of previous time step water storage (soil and snowpack)



Open Issues

A **compromise between a scale** that is meaningful both for policy and management but also that has a correct physical meaning for awareness and communication needs to be reached

- On one hand, existing storage in the basin accumulated over a previous period can in theory and in practice mitigate scarcity for a given reference period (e.g. summer months)
- It remains though a fact that the natural water availability of that reference period was unable to meet demand in absolute terms and a water deficit was experienced in the system
- That does not mean that the basin is scarce, but rather than the basin was stressed or presented a deficit during these months although at the end the demand was covered. **This issue of possible differentiation of scales and their relation to declaring water scarcity or temporal water stress /deficit conditions needs further discussions and elaboration**

Open Issues

4. WEI+ revision of mathematical formula (thresholds, testing)

- Would a revised expression of the WEI+ would be more beneficial and easy to handle? (e.g. change from division to a deduction in the formula which is also closer to the representation of the hydrological cycle)

$P - \text{Eta} + \text{Ext.Inflow} + \text{Returned Water} - \text{Water Requirements} > \text{Abstraction}$

When is the imbalance between abstraction and availability becoming unsustainable? Beyond which levels does this equilibrium become problematic?

These questions tightly link to temporal scale issues and thresholds which relate most likely to the existing storage in the basin or a **safe yield margin.**

Open Issues

Possible approaches in defining thresholds:

- number of consecutive months with water stress/deficit: above a certain number this becomes scarcity since it is unsustainable
- relation of water deficit to the storage of a previous period (e.g. August deficit in relation to the storage of the past 4 months): when accumulated past storage fails to or barely covers the demand of the deficit period this points to waters scarcity conditions
- rate of storage volume decline during the water stressed months: if this rate is constantly increasing this points to building of water scarcity conditions
- the typical 20, 40% threshold of WEI should be revised since environmental requirements are already accounted for in the WEI+ formula

IDEAS & SUGGESTIONS.....TECHNICAL EXPERTISE.....TESTING..... ☺



Thank you !