# Letter to the NFPs

July 2013

Dear Colleagues,

Once again we performed last year a series of checks for the whole water quantity dataset and we may have encountered some issues referring to your country’s reported data, which you are kindly asked to help us resolve.

All issues are summarized in an Excel file in [your county’s folder in the CDR](http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/wise-soe-reporting-2013/validation-questions/country-folders), organized in the following categories:

* [Logical rule violations](#_Logical_rule_violations). These rule violations are considered to be **critical**.
* [Displaced stations](#_Displaced_stations)
* [Outliers in time series](#_Outliers_in_time)
* [Suspicious values by comparison of the reported data with EUROSTAT data](#_Suspicious_values_by)

In the next sections you will find more information regarding these issues, the validation rules and the methodology that has been applied. Please check if there are any issues referring to your data and proceed according to the suggested actions in order to resolve them.

Thank you once again for your cooperation

George Karavokiros

# Logical rule violations

See sheet ***logical rule violations*** in the Excel file stored in [your country’s folder](http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/wise-soe-reporting-2013/validation-questions/country-folders)

Logical rule violations are considered to be critical and refer to one or more parameters of a dataset. Possible rule violations are listed in sections 5.2 and 5.4 of this document. Some values of your past reportings may have violated one or more of these rules. If there are any findings of this category they are listed in the sheet *logical rule violations* in the Excel file stored in your country folder.

**Action**: Please identify the error and resubmit the correct data with your next reporting, using the WQ Reporting Tool. You may update the same file you have reported last year or create a new file including only the correct values. Remember to deliver one file per year, i.e. if you want to correct and resubmit data referring to two different years please produce and submit two files, one file for each year.

# Displaced stations

See sheets ***outside country borders*** and ***outside RBD borders***in the Excel file stored in [your country’s folder](http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/wise-soe-reporting-2013/validation-questions/country-folders)

The reported coordinates of the stations and reservoirs have been checked against the country’s borders and the borders of the RBD in which the station is reportedly residing. The listed stations appear to be placed outside the reported regions, assuming ETRS89 as the coordinate system.

**Action**: Please check the coordinates of your stations and submit the correct station coordinates with your next reporting in the ETRS89 or WGS84 coordinate system. For this you may use either the WQ Reporting Tool or submit a separate file (e.g. Excel file) specifying the station code and the coordinates.

# Outliers in time series

See sheet ***outliers in time series*** in the Excel file stored in [your country’s folder](http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/wise-soe-reporting-2013/validation-questions/country-folders)

The outlier list is generated automatically from the WISE-SoE#3 Water Quantity database and is based on a number of generic outlier routines (see section 6) which apply to most hydrometeorological time series. These routines check the database for extreme values and verify the temporal consistency of time series. For the parameterization of the rules the variable type and the time step of the time series have been taken into account. The identified outliers may be due to errors in the measuring or the reporting procedure. This does not necessarily mean that the listed “suspected” cases are actually wrong. In most of these cases they are probably just extreme phenomena or special cases, an assumption we would like you to confirm.

**Action**: Please do the following

1. Go to the sheet ***outliers in time series*** in the Excel file stored in your country folder and follow the link in column **Time series URL** to check the time series in question.
2. If you think that a listed outlier is not an error please let us know (with your next reporting or directly by sending an email to me), so that you will not be asked again for this validation next year. Otherwise, please correct the error with your next reporting.

# Suspicious values by comparison of the reported data with Eurostat data

See sheet ***Comparison JQ2012-WISE-SoE*** in the Excel file stored in [your country’s folder](http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/wise-soe-reporting-2013/validation-questions/country-folders)

This sheet presents data reported under the WISE-SoE which are not in good agreement with the respective data reported to Eurostat (through the OECD/EUROSTAT Joint Questionnaire on Inland Waters 2012). All values represent annual data reported at country level. In some cases the WISE-SoE value has been calculated from the reported RBD values or the WISE-SoE value has been aggregated from the reported monthly values (see comment field).

**Action**: Please make the necessary corrections and clarification and highlight the respective cells where changes have been introduced with green.

# Rules embedded in the WQ Reporting Tool

The following rules are embedded in version 1.3 and later of the Water Quantity Reporting Tool.

## Basic rules (not unique ID, mandatory field empty, false data type etc.)

| **Code** | **Definition** | **Rule viol. type** | **Remarks** |
| --- | --- | --- | --- |
| BA001 | A real number is expected for the field: XXX | error | This rule applies to a number of variables in various forms e.g. the groundwater level |
| BA002 | A positive real number is expected for the field: XXX | error | This rule applies to a number of variables in various forms e.g. the reservoir storage capacity |
| BA003 | A positive real number or zero is expected for the field/grid: XXX | error | This rule applies to a number of variables in various forms e.g. inflow/outflow volume, streamflow |
| BA004 | A positive integer number is expected for the field: XXX | error | This rule applies to a number of variables in various forms e.g. year, SRID |
| BA005 | The person responsible for the data entry should be specified | error | You may enter the correct information from the main form |
| BA006 | The email address of the person responsible for the data entry should be specified | error | You may enter the correct information from the main form |
| BA007 | A country has to be selected first | error | You may select the country from the main form |
| BA008 | A unique identifier for the station/reservoir is missing | error | This rule applies to rain gauge stations, reservoirs, stream flow stations and wells |
| BA009 | A station/reservoir with ID XXX already exists | error | This rule applies to rain gauge stations, reservoirs, stream flow stations and wells |
| BA010 | A coordinate system has to be defined | error | This rule applies to rain gauge stations, reservoirs, stream flow stations and wells |
| BA011 | A projection system should been defined | warning | This rule applies to rain gauge stations, reservoirs, stream flow stations and wells |
| BA012 | This station is neither a EIONET nor a WFD station | warning | This rule applies to rain gauge and stream flow stations |
| BA013 | No data have been entered. You may want to check the data tab | warning | This rule applies to reservoirs, stream flow stations and wells |
| BA014 | The type of the reservoir must be selected | error | This rule applies to reservoirs |
| BA015 | Column “Item class” in table XXX may have only values between 1 and 3 | error | This rule applies only to the 2nd column of the tables in the tab “Large items” in the form Water use |
| BA016 | All data must have the same reference year | error | Not all data have the same reference year as they should |

## Logical rules

| **Code** | **Definition** | **Rule viol. type** | **Remarks** |
| --- | --- | --- | --- |
| LO001 | The monthly values in table: XXX and column: XXX do not sum up to the annual value | error | This rule applies to all variables if annual and monthly data is given |
| LO002 | Min. streamflow value should be lower or equal than Max. streamflow value | error | This rule applies to stream flow stations |

## Outliers and range checks

| **Code** | **Definition** | **Rule viol. type** | **Remarks** |
| --- | --- | --- | --- |
| OU001 | A real number between -100 and 5000 is expected for Altitude | error | This rule applies to rain gauge stations, reservoirs, stream flow stations and wells |
| OU002 | An integer number between 1900 and XXX is expected for the LTAA starting year | error | This rule applies to all data related to Long Term Annual Average (LTAA) i.e. station data and regional data. The reference period must lie between 1900 and the reporting year. |
| OU003 | An integer number between 1900 and XXX is expected for the LTAA ending year | error | This rule applies to all data related to Long Term Annual Average (LTAA) i.e. station data and regional data. The reference period must lie between 1900 and the reporting year. |
| OU004 | The reported length period is too small to be representative for LTAA values. The LTAA reference period must be at least 10 years, preferably more than 20 years long | error | This rule applies to all data related to Long Term Annual Average (LTAA) i.e. station data and regional data |
| OU005 | The reported LTAA reference period should be at least 20 consecutive years long | warning | This rule applies to all data related to Long Term Annual Average (LTAA) i.e. station data and regional data |
| OU006 | Value for Longitude (ETRS89) not typical for Europe. Valid values: [-26,45] | warning | The value for Longitude appears to be outside the valid range for Europe |
| OU007 | Value for Latitude (ETRS89) not typical for Europe. Valid values: [34,72] | warning | The value for Latitude appears to be outside the valid range for Europe |

## Areal rules (regional water balance, regional water abstraction, regional water use)

### Introduction

The following logical rule definitions consist of two expressions and a relation sign. Both expressions are additions. An equation rule check is passed if one of the following conditions is met:

* all variables of the two expressions have valid real values and the two expressions are equal
* one expression has variables with invalid values. The rule is checked as an inequality, excluding the invalid value.
* both expressions have at least one invalid variable (meaning: unable to check)

An inequality rule check is passed if one of the following conditions is met:

* all variables of the greater expression have valid real values and the inequality is true.
* at least one variable of the greater expression is invalid (meaning: unable to check)

All rules apply to all temporal scales, i.e. months, seasons and years. Small differences up to 0.1 between the two expressions in equations that may arise due to roundings are tolerated

### Rule definitions

| **Code** | **Definition** | **Rule viol. type** | **Remarks / Explanation** |
| --- | --- | --- | --- |
|  | **Regional Water Balance** |  |  |
| WB001 | wb\_areal\_precipitation = wb\_internal\_flow + wb\_act\_evapotranspiration  *(Equivalent to wb\_internal\_flow = wb\_areal\_precipitation - wb\_act\_evapotranspiration)* | error | Areal precipitation **must equal** the sum of Internal flow plus Actual Evapotranspiration. Negative value for Internal flow is acceptable for a given time step (e.g. summer months). |
| WB002 | wb\_pot\_evapotranspiration > wb\_act\_evapotranspiration | error | Potential Evapotranspiration **must be more than** Actual Evapotranspiration. |
| WB003 | wb\_total\_actual\_outflow\_neighbour + wb\_total\_actual\_outflow\_sea = wb\_total\_actual\_outflow | error | Total actual outflow **must equal** the sum of the Total actual outflow into neighbouring areas and the Total actual outflow into the sea. |
| WB004 | wb\_returned\_before\_use + wb\_returned\_after\_use = wb\_return\_flow | error | Return flow **must equal** the returned flow before use and the returned flow after use. |
| WB005 | wb\_treated\_effluent + wb\_non\_treated\_effluent = wb\_returned\_after\_use | error | Returned flow after use **must equal** the sum of the treated effluent and the non-treated effluent. |
| WB006 | wb\_treated\_effluent\_uwwtp + wb\_treated\_effluent\_other\_wwtp = wb\_treated\_effluent | error | Treated effluent **must equal** the sum of the treated effluent from UWWTP and the treated effluent from other WWTP. |
| WB007 | wb\_non\_treated\_effluent > wb\_non\_treated\_effluent\_cooling + wb\_non\_treated\_effluent\_hydropower | error | Non Treated Effluent **must be more** **than** the sum of the Non treated effluent from cooling and Non treated effluent from hydropower. |
| WB008 | wb\_losses\_betwn\_use\_and\_reuse <= wu\_total\_freshwater\_used\_total | warning | Losses between use and reuse **need to be less than** the Total freshwater used.  *This rule is checked when closing the Water Balance form or the Water Use form* |
| WB009 | wb\_desalinated\_water\_domestic + wb\_desalinated\_water\_nace\_a + wb\_desalinated\_water\_nace\_b + wb\_desalinated\_water\_nace\_c + wb\_desalinated\_water\_nace\_d + wb\_desalinated\_water\_nace\_i + wb\_desalinated\_water\_other = wb\_desalinated\_water\_total | error | Total Desalinated water **must equal** to the sum of the sectoral desalinated water. |
| WB010 | wb\_reused\_water\_nace\_a >= wb\_reused\_water\_nace\_a\_irrgation | error | Reused water for NACE A **must be more than** Reused water for NACE A irrigation. |
| WB011 | wb\_reused\_water\_nace\_c >= wb\_reused\_water\_nace\_c\_cooling | error | Reused water for NACE C **must be more than** Reused water for NACE C cooling. |
| WB012 | wb\_reused\_water\_nace\_d >= wb\_reused\_water\_nace\_d\_cooling | error | Reused water for NACE D **must be more than** Reused water for NACE D cooling. |
| WB013 | wb\_reused\_water\_domestic + wb\_reused\_water\_nace\_a + wb\_reused\_water\_nace\_b + wb\_reused\_water\_nace\_c + wb\_reused\_water\_nace\_d + wb\_reused\_water\_nace\_i + wb\_reused\_water\_other = wb\_reused\_water\_total | error | Total Reused water **must equal** to the sum of the sectoral reused water. |
| WB014 | wb\_desalinated\_water\_nace\_a >= wb\_desalinated\_water\_nace\_a\_irrgation | error | Desalinated water for NACE A **must be more than** Desalinated water for NACE A irrigation. |
| WB015 | wb\_desalinated\_water\_nace\_c >= wb\_desalinated\_water\_nace\_c\_cooling | error | Desalinated water for NACE C **must be more than** Desalinated water for NACE C cooling. |
| WB016 | wb\_desalinated\_water\_nace\_d >= wb\_desalinated \_water\_nace\_d\_cooling | error | Desalinated water for NACE D **must be more than** Desalinated water for NACE D cooling. |
|  | **Regional Water Abstraction** |  |  |
| WA001 | wa\_for\_public\_wss\_sw + wa\_abstraction\_for\_self\_suply\_total\_sw\_total= wa\_total\_abstraction\_sw | error | Total freshwater abstraction from surface water **must equal** to the sum of the Total freshwater abstraction from surface water for public water supply systems and the Total freshwater abstraction from surface water for self-supply. |
| WA002 | wa\_for\_public\_wss\_gw + wa\_abstraction\_for\_self\_suply\_total\_gw\_total = wa\_total\_abstraction\_gw | error | Total freshwater abstraction from groundwater **must equal** to the sum of the Total freshwater abstraction from groundwater for public water supply systems and the Total freshwater abstraction from groundwater for self-supply. |
| WA003 | wa\_total\_abstraction\_sw + wa\_total\_abstraction\_gw = wa\_total\_abstraction | error | Total freshwater abstraction **must equal** to the sum of the Total freshwater abstraction from surface water and the Total freshwater abstraction from groundwater. |
| WA004 | wa\_for\_public\_wss\_sw + wa\_for\_public\_wss\_gw = wa\_for\_public\_wss | error | Total freshwater abstraction for public water supply systems **must equal** to the sum of the Total freshwater abstraction from surface water for public water supply systems and the Total freshwater abstraction from groundwater for public water supply systems. |
| WA005 | wa\_total\_abstraction\_sw >= wa\_total\_abstraction\_for\_hydropower | error | Total freshwater abstraction from surface water **must be more than** the Total freshwater abstraction for Hydropower. |
| WA006 | wa\_non\_freshwater\_domestic + wa\_non\_freshwater\_nace\_a + wa\_non\_freshwater\_nace\_b + wa\_non\_freshwater\_nace\_c + wa\_non\_freshwater\_nace\_d + wa\_non\_freshwater\_nace\_i + wa\_non\_freshwater\_other = wa\_non\_freshwater\_total | error | Total Abstracted non-freshwater **must equal** to the sum of the sectoral abstracted non-freshwater. |
| WA007 | wa\_non\_freshwater\_nace\_a >= wa\_non\_freshwater\_nace\_a\_irrgation | error | Abstracted non-freshwater for NACE A **must be more than** Abstracted non-freshwater for NACE A irrigation. |
| WA008 | wa\_non\_freshwater\_nace\_c >= wa\_non\_freshwater\_nace\_c\_cooling | error | Abstracted non-freshwater for NACE C **must be more than** Abstracted non-freshwater for NACE C cooling. |
| WA009 | wa\_non\_freshwater\_nace\_d >= wa\_non\_freshwater\_nace\_d\_cooling | error | Abstracted non-freshwater for NACE D **must be more than** Abstracted non-freshwater for NACE D cooling. |
| WA010 | wa\_abstraction\_for\_self\_suply\_total\_sw\_domestic + wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_a + wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_b + wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_c + wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_d + wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_i + wa\_abstraction\_for\_self\_suply\_total\_sw\_other = wa\_abstraction\_for\_self\_suply\_total\_sw\_total | error | Total freshwater abstraction from surface water for self supply **must equal** to the sum of the sectoral abstraction from surface water for self-supply. |
| WA011 | wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_a >= wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_a\_irrgation | error | Abstraction from surface water for self supply for NACE A **must be more than** Abstraction from surface water for self supply for NACE A irrigation. |
| WA012 | wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_c >= wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_c\_cooling | error | Abstraction from surface water for self supply for NACE C **must be more than** Abstraction from surface water for self supply for NACE C cooling. |
| WA013 | wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_d >= wa\_abstraction\_for\_self\_suply\_total\_sw\_nace\_d\_cooling | error | Abstraction from surface water for self supply for NACE D **must be more than** Abstraction from surface water for self supply for NACE D cooling. |
| WA014 | wa\_abstraction\_for\_self\_suply\_total\_gw\_domestic + wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_a + wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_b + wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_c + wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_d + wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_i + wa\_abstraction\_for\_self\_suply\_total\_gw\_other = wa\_abstraction\_for\_self\_suply\_total\_gw\_total | error | Total freshwater abstraction from groundwater for self supply **must equal** to the sum of the sectoral abstraction from groundwater for self-supply. |
| WA015 | wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_a >= wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_a\_irrgation | error | Abstraction from groundwater for self supply for NACE A **must be more than** Abstraction from groundwater for self supply for NACE A irrigation. |
| WA016 | wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_c >= wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_c\_cooling | error | Abstraction from groundwater for self supply for NACE C **must be more than** Abstraction from groundwater for self supply for NACE C cooling. |
| WA017 | wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_d >= wa\_abstraction\_for\_self\_suply\_total\_gw\_nace\_d\_cooling | error | Abstraction from groundwater for self supply for NACE D **must be more than** Abstraction from groundwater for self supply for NACE D cooling. |
| WA018 | wa\_abstraction\_for\_self\_suply\_total\_sw\_total + wa\_abstraction\_for\_self\_suply\_total\_gw\_total = wa\_abstraction\_for\_self\_suply\_total | error | Total freshwater abstraction for self-supply **must equal** to the sum of the Total freshwater abstraction from surface water for self-supply and the Total freshwater abstraction from groundwater for self-supply |
| WA019 | wa\_available\_groundwater ≥ wa\_total\_abstraction\_gw | error | Available groundwater **must be more than** Total freshwater abstraction from groundwater |
| WA020 | wa\_total\_abstraction\_gw + wb\_water\_imports + wb\_bottled\_imports + wb\_reused\_water\_total + wb\_desalinated\_water\_total >= wu\_total\_freshwater\_used\_total | warning | *Will be checked after the submission of the data. Not implemented in the WQ reporting tool.* |
|  | **Regional Water Use** |  |  |
| WU001 | wu\_total\_freshwater\_used\_domestic + wu\_total\_freshwater\_used\_nace\_a + wu\_total\_freshwater\_used\_nace\_b + wu\_total\_freshwater\_used\_nace\_c + wu\_total\_freshwater\_used\_nace\_d + wu\_total\_freshwater\_used\_nace\_i + wu\_total\_freshwater\_used\_other = wu\_total\_freshwater\_used\_total | error | Total freshwater used **must equal** to the sum of the sectoral freshwater used. |
| WU002 | wu\_total\_freshwater\_used\_nace\_a >= wu\_total\_freshwater\_used\_nace\_a\_irrgation | error | Total freshwater used for NACE A **must be more than** Total freshwater used for NACE A irrigation. |
| WU003 | wu\_total\_freshwater\_used\_nace\_d >= wu\_total\_freshwater\_used\_nace\_d\_cooling | error | Total freshwater used for NACE D **must be more than** Total freshwater used for NACE D cooling. |
| WU004 | wu\_total\_freshwater\_used\_nace\_c\_food\_ind + wu\_total\_freshwater\_used\_nace\_c\_basic\_metals + wu\_total\_freshwater\_used\_nace\_c\_transport + wu\_total\_freshwater\_used\_nace\_c\_textiles + wu\_total\_freshwater\_used\_nace\_c\_paper + wu\_total\_freshwater\_used\_nace\_c\_chemicals + wu\_total\_freshwater\_used\_nace\_c\_other\_manufact\_ind <= wu\_total\_freshwater\_used\_nace\_c | error | Total freshwater used for NACE C **must be more than** the sum of the freshwater used for all the subcategories of the NACE C. |
| WU005 | wu\_total\_freshwater\_used\_nace\_c >= wu\_total\_freshwater\_used\_nace\_c\_cooling | error | Total freshwater used for NACE C **must be more than** Total freshwater used for NACE C cooling. |
| WU006 | wu\_public\_water\_supply\_domestic + wu\_public\_water\_supply\_nace\_a + wu\_public\_water\_supply\_nace\_b + wu\_public\_water\_supply\_nace\_c + wu\_public\_water\_supply\_nace\_d + wu\_public\_water\_supply\_nace\_i + wu\_public\_water\_supply\_other = wu\_public\_water\_supply\_total | error | Total freshwater used from public water supply **must equal** to the sum of the sectoral freshwater used from public water supply. |
| WU007 | wu\_public\_water\_supply\_nace\_a >= wu\_public\_water\_supply\_nace\_a\_irrgation | error | Freshwater used from public water supply for NACE A **must be more than** Freshwater used from public water supply for NACE A irrigation. |
| WU008 | wu\_public\_water\_supply\_nace\_d >= wu\_public\_water\_supply\_nace\_d\_cooling | error | Freshwater used from public water supply for NACE D **must be more than** Freshwater used from public water supply for NACE D cooling. |
| WU009 | wu\_public\_water\_supply\_nace\_c\_food\_ind + wu\_public\_water\_supply\_nace\_c\_basic\_metals + wu\_public\_water\_supply\_nace\_c\_transport + wu\_public\_water\_supply\_nace\_c\_textiles + wu\_public\_water\_supply\_nace\_c\_paper + wu\_public\_water\_supply\_nace\_c\_chemicals + wu\_public\_water\_supply\_nace\_c\_other\_manufact\_ind <= wu\_public\_water\_supply\_nace\_c | error | Freshwater used from public water supply for NACE C **must be more than** the sum of the freshwater used for all the subcategories of the NACE C. |
| WU010 | wu\_public\_water\_supply\_nace\_c >= wu\_public\_water\_supply\_nace\_c\_cooling | error | Freshwater used from public water supply for NACE C **must be more than** Freshwater used from public water supply for NACE C cooling. |
| WU011 | wu\_self\_supply\_domestic + wu\_self\_supply\_nace\_a + wu\_self\_supply\_nace\_b + wu\_self\_supply\_nace\_c + wu\_self\_supply\_nace\_d + wu\_self\_supply\_nace\_i + wu\_self\_supply\_other = wu\_self\_supply\_total | error | Total freshwater used from self-supply **must equal** to the sum of the sectoral freshwater used from self-supply. |
| WU012 | wu\_self\_supply\_nace\_a >= wu\_self\_supply\_nace\_a\_irrgation | error | Freshwater used from self-supply for NACE A **must be more than** Freshwater used from self-supply for NACE A irrigation. |
| WU013 | wu\_self\_supply\_nace\_d >= wu\_self\_supply\_nace\_d\_cooling | error | Freshwater used from self-supply for NACE D **must be more than** Freshwater used from self-supply for NACE D cooling. |
| WU014 | wu\_self\_supply\_nace\_c\_food\_ind + wu\_self\_supply\_nace\_c\_basic\_metals + wu\_self\_supply\_nace\_c\_transport + wu\_self\_supply\_nace\_c\_textiles + wu\_self\_supply\_nace\_c\_paper + wu\_self\_supply\_nace\_c\_chemicals + wu\_self\_supply\_nace\_c\_other\_manufact\_ind <= wu\_self\_supply\_nace\_c | error | Freshwater used from self-supply for NACE C **must be more than** the sum of the freshwater used for all the subcategories of the NACE C. |
| WU015 | wu\_self\_supply\_nace\_c >= wu\_self\_supply\_nace\_c\_cooling | error | Freshwater used from self-supply for NACE C **must be more than** Freshwater used from self-supply for NACE C cooling. |
| WU016 | wu\_recycled\_water\_domestic + wu\_recycled\_water\_nace\_a + wu\_recycled\_water\_nace\_b + wu\_recycled\_water\_nace\_c + wu\_recycled\_water\_nace\_d + wu\_recycled\_water\_nace\_i + wu\_recycled\_water\_other = wu\_recycled\_water\_total | error | Total recycled water used **must equal** to the sum of the sectoral recycled water used. |
| WU017 | wu\_recycled\_water\_nace\_a >= wu\_recycled\_water\_nace\_a\_irrgation | error | Recycled water used for NACE A **must be more than** Recycled water used for NACE A irrigation. |
| WU018 | wu\_recycled\_water\_nace\_d >= wu\_recycled\_water\_nace\_d\_cooling | error | Recycled water used for NACE D **must be more than** Recycled water used for NACE D cooling. |
| WU019 | wu\_recycled\_water\_nace\_c >= wu\_recycled\_water\_nace\_c\_cooling | error | Recycled water used for NACE C **must be more than** Recycled water used for NACE C cooling. |
| WU020 | wu\_public\_water\_supply\_total + wu\_self\_supply\_total = wu\_total\_freshwater\_used\_total | error | Total freshwater used **must equal** to the sum of the Total freshwater used for public water supply systems and the Total freshwater used from self-supply |

# Outlier rules in hydrological time series

## Extreme value checks

|  |  |  |
| --- | --- | --- |
| Function | Rule definition | Description |
| lower\_limit(l) | l ≤ xi | All values xi must be greater than or equal a given lower limit l |
| upper\_limit(u) | xi ≤ u | All values xi must be smaller than or equal a given upper limit u |
| upper\_limit\_area(u) | xi / Ax ≤ u | All values xi per area Ax of the region to which the time series refers, must be smaller than or equal a given upper limit u. The rule can be applied only to time series which refer to geographical areas with known extent. |
| limit\_stdev(k,λ) | μ - λσ ≤ xi ≤ μ + λσ | All values should satisfy the given inequality, where μ is the mean value, σ the standard deviation and λ a given coefficient. The rule applies only to time series which are sufficiently long (≥ k values) |

## Temporal consistency checks

|  |  |  |
| --- | --- | --- |
| Function | Rule definition | Description |
| tc1(e1) | e1 > |xi -xi+1| | The absolute value of the difference between two subsequent values must remain below a given limit e1. |
| tc2(e2,k) | ∀i xi>k, xi+1>0:  e2 > |xi - xi+1| / max(xi, xi+1) | This rule calculates the absolute value of the difference between two subsequent values of the time series over the maximum of the two values. The resulting value must be smaller than a given limit (e2). This way, unlike rule tc1, which compares absolute numbers, rule tc2 checks for specific patterns in time series and has therefore a broader application. The function (ratio) results to values between 0 and 1. Time series values lower than a given number k are ignored. The rule is most useful to validate time series expected to have low variability. In the contrary, the rule has little usage to time series, which are expected to show steep increase/decrease of values (e.g. hourly streamflow). In general, aggregated time series obey to smaller values for e2 than the same observations in disaggregated form. Similarly time series with coarse time step tend to obey to smaller e2 values than refined time steps of the same parameter. |
| tc3(k,l,λ) | ∀i ∃j i+k<j ≤i+l and k<l:  xj ≤ λ⋅xi | A peak in the time series must be reduced to a lower level within a specified time period. This rule applies mainly to discharge or rainfall time series with a daily or smaller time step. k is an integer representing a number of values after the i-th value. Special case for precipitation: The value must return to zero within a specified period of time steps. Very small values are replaced by a minimum value. |