Water Use Modelling With ecoinvent v3 Opens New Possibilities

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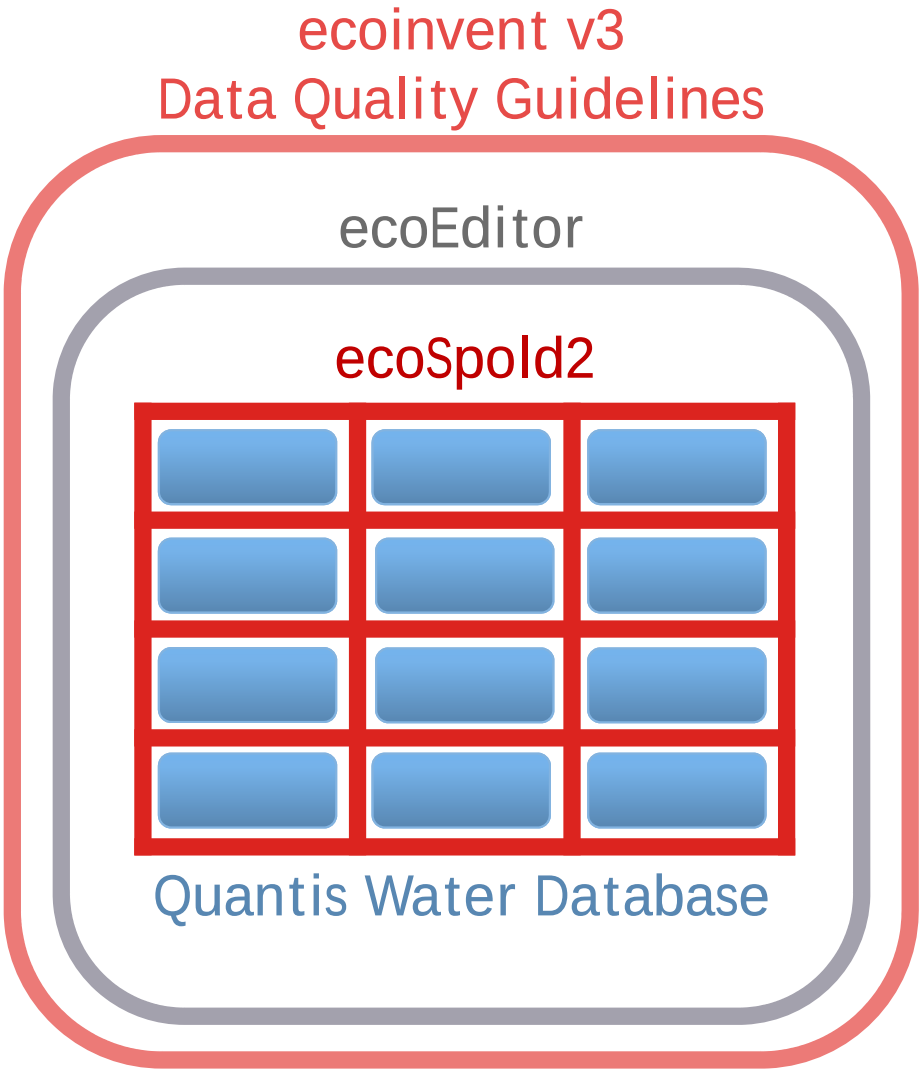
Introduction

- Increased focus on water use impacts
- New LCIA methodologies developed (Pfister, Mila i Canals, Boulay, Motoshita, etc.) to assess the impacts of water use, but no adequate LCI data available
- Data on water withdrawal partially available already in ecoivent v2.2, data on output exchanges were not available

Water use modelling in ecoinvent v2 vs v3

	ecoinvent v2.2	ecoinvent v3
input exchanges from technosphere	✓	✓
input exchanges from environment	✓	✓
output exchanges to technosphere	✓	✓
output exchanges to environment	✗	✓
water embedded in products	✗	✓
option of regionalization	✗	✓
possibility of water balance check	✗	✓

New format, software, guidelines and data



- ecoSpold2 is the format (the frame)
- ecoEditor is the tool which uses the ecoSpold2 format
- ecoinvent v3 Data Quality Guidelines are setting up the rules
- Quantis Water Database supplied the data

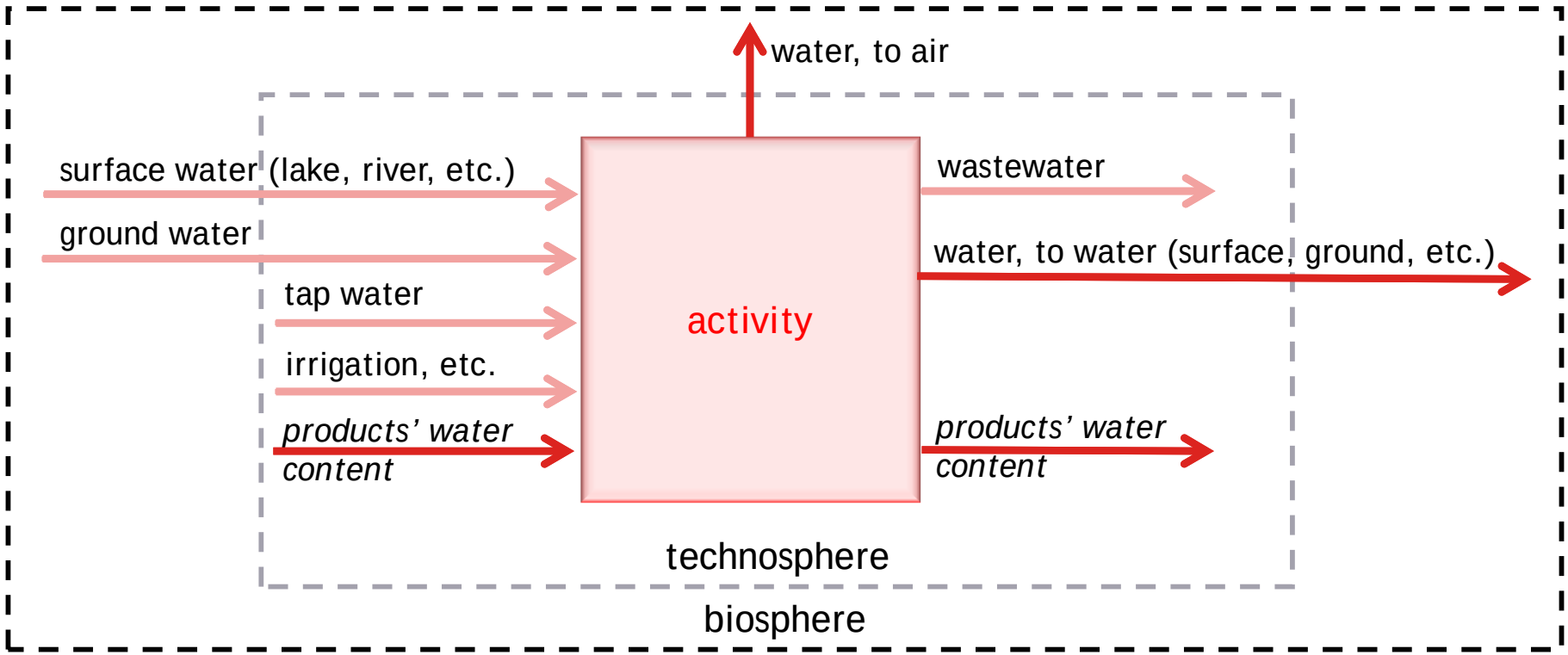
Terminology

- Terminology related to Water Use
  - consumed water (=water consumption)
  - water balance
  - water footprint
  - water use
  - water content
  - *many more …*
- www.ecoinvent.org -> Support -> Glossary

New exchanges

- Elementary exchanges (with environment) were added to all ecoinvent v2.2 activities – undefined UPR datasets

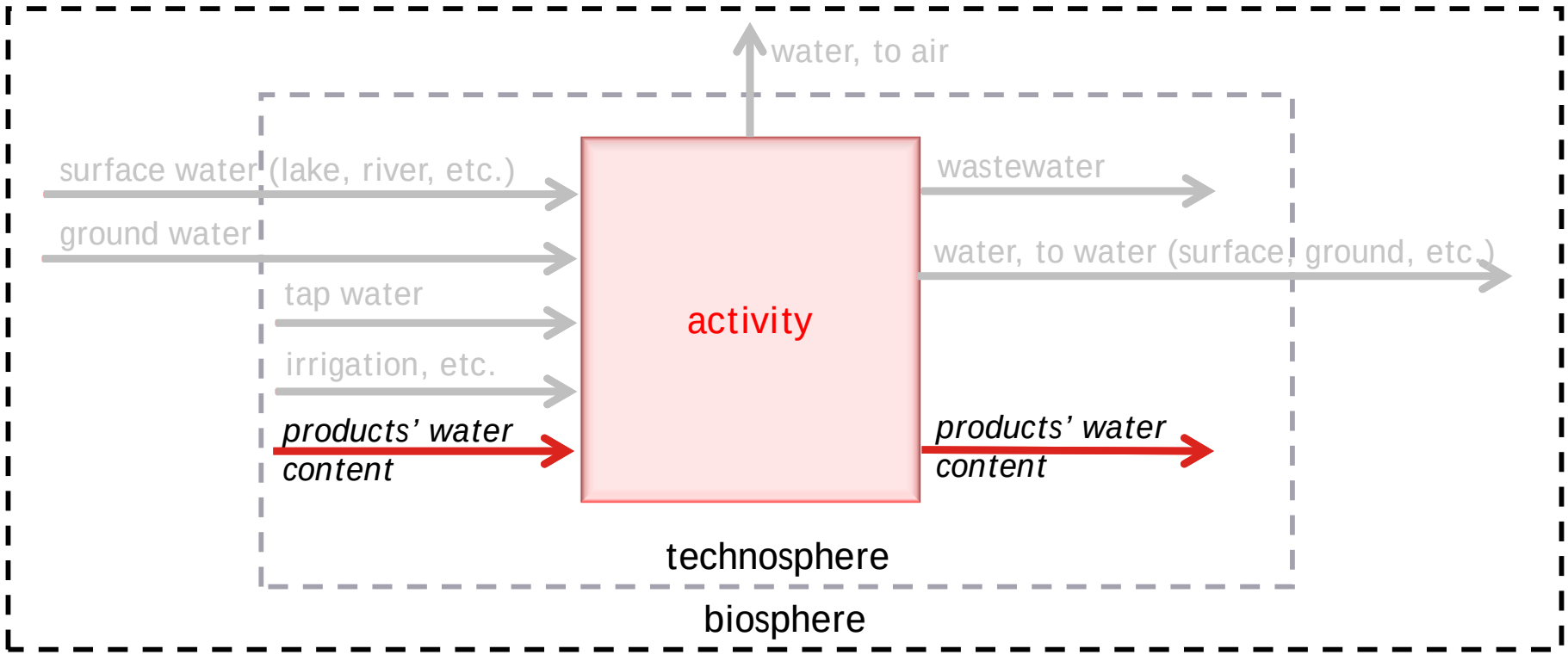
ecoinvent version 2 ➡ ecoinvent version 3



Products' water content

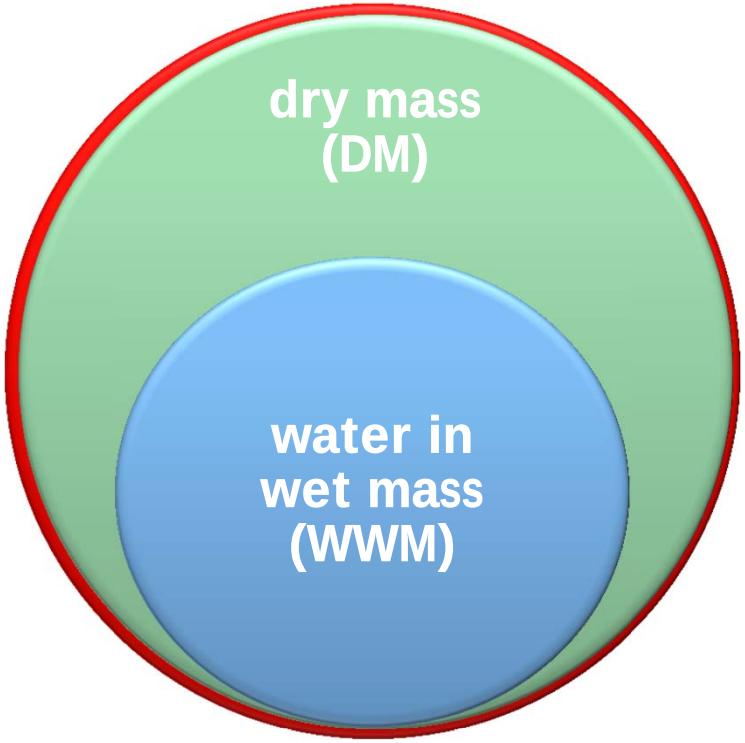
- New mandatory properties which enable calculation of water embedded in the products were added to all products with mass

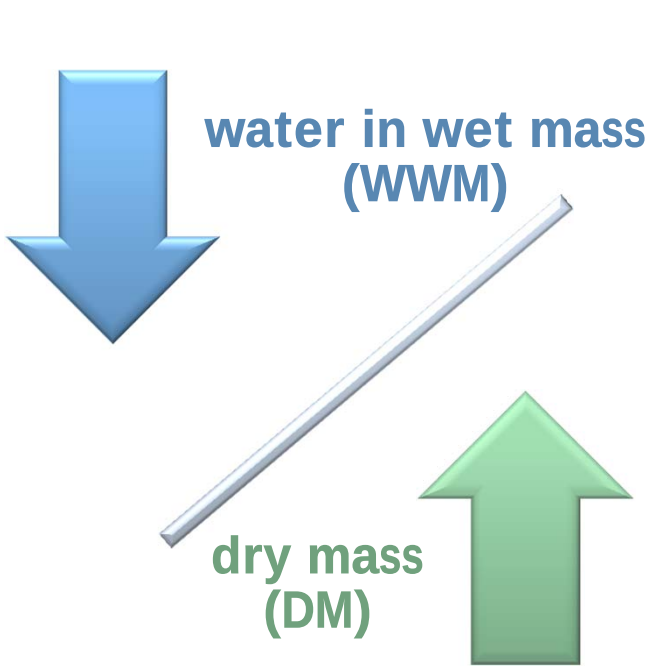
ecoinvent version 2 ➡ ecoinvent version 3



Mandatory properties

- All products with mass in the ecoinvent database have mandatory properties; water content, wet mass, dry mass, water in wet mass





Water embedded in products

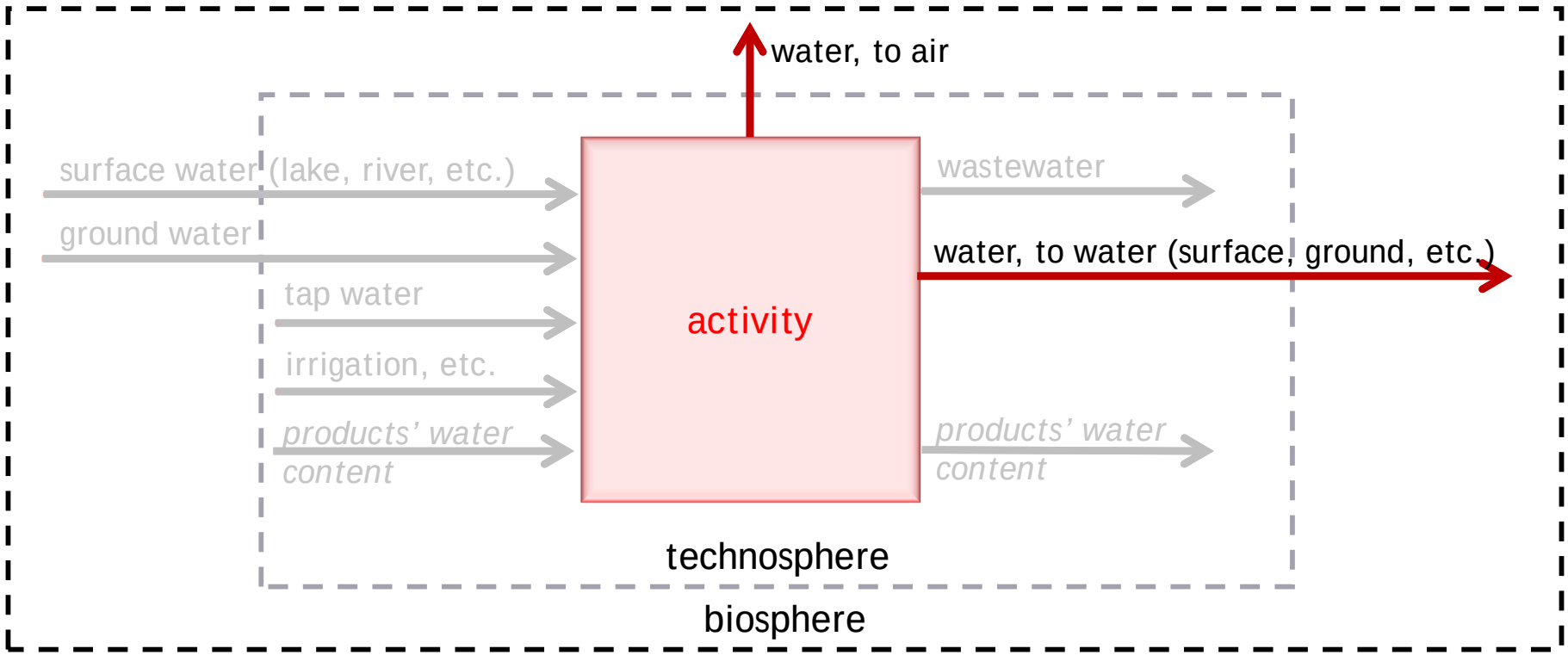
- Water embedded in a product can be calculated from its properties
- Wet mass = dry mass + water in wet mass
- Example; 0.13m^3 * 130kg/m^3 = 16.9kg of **water in wet mass** ecoEditor

Exchange				Exchange Property		plywood production, for indoor use, GLO 1996
Type	Name	Unit		Name	Unit	Amount
2 - ByProduct/...	residual wood, dry	m3		carbon content, fossil	dimensionless	0
				carbon content, non-fo...	dimensionless	0.494
				dry mass	kg	650
				price	EUR2005	38.9
				water content	dimensionless	0.2
				water in wet mass	kg	130
				wet mass	kg	780

New output exchanges to environment

- Use of new ecoSpold2 format functions

ecoinvent version 2 ➡ ecoinvent version 3



New output exchanges to environment

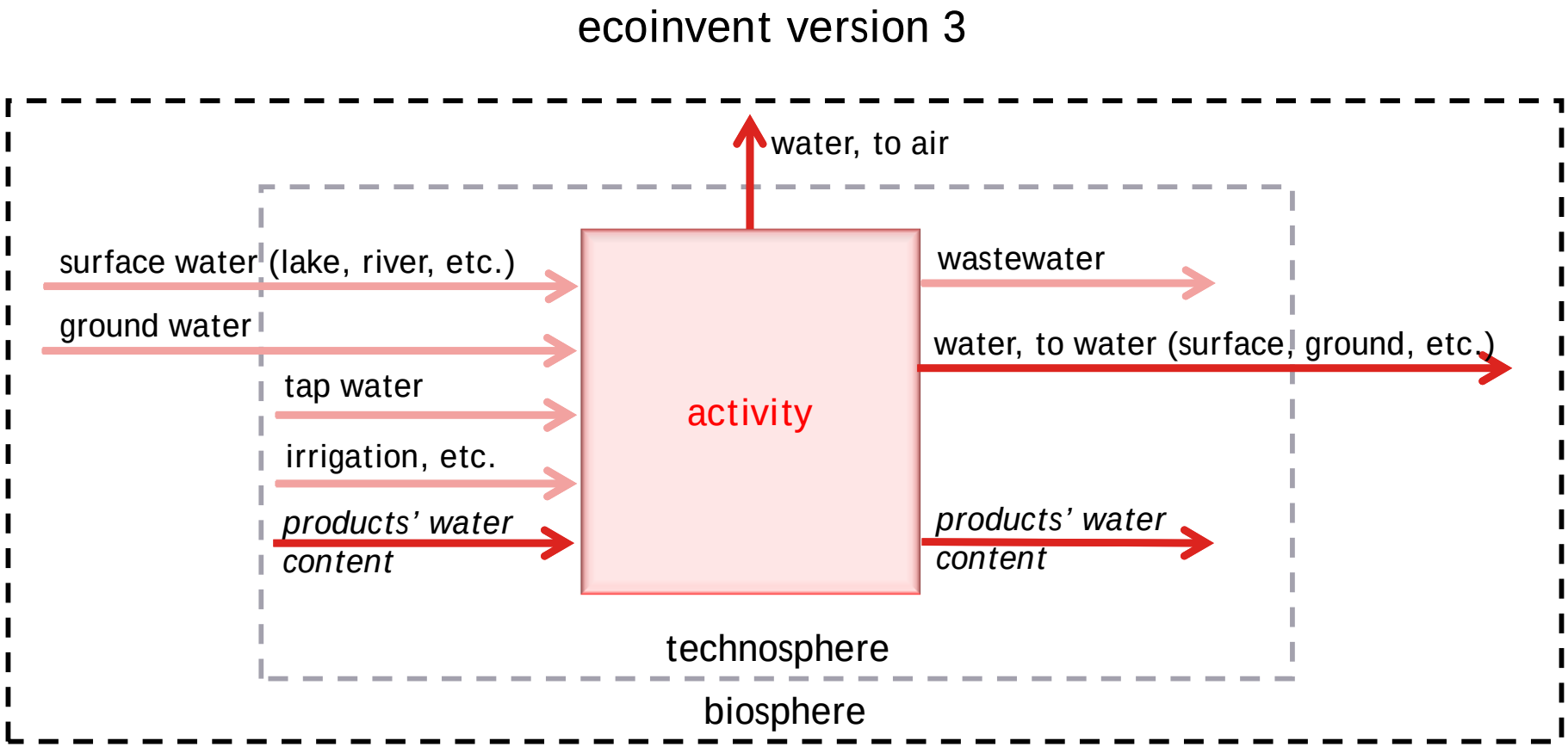
- All newly added exchanges were inserted using parameters, mathematical relations and variable names
- All users of the ecoinvent v3 database can see the calculations, assumptions, uncertainties, etc.

ecoEditor

Exchange					acetic acid production, product in 98% solution state, RER 2000		
Type	Name	Unit	Compartment	Subcompartment	Amount	Variable Name	Mathematical Relation
0 - ReferenceProduct	acetic acid, without wat...	kg			1		
2 - ByProduct/Waste	wastewater, unpolluted	m3			6.14E-05		
4 - ToEnvironment	Carbon dioxide, fossil	kg	air	unspecified	0.0371		
4 - ToEnvironment	Water	m3	water	unspecified	fx 0.047869	water_to_water_unspecified	(water_decarbonised_input/1000)*(1-fraction_WDC_to_air)+water_...
4 - ToEnvironment	Methane, fossil	kg	air	unspecified	0.00499		
4 - ToEnvironment	Methanol	kg	air	unspecified	0.00252		
4 - ToEnvironment	Hydrogen	kg	air	unspecified	0.000296		
4 - ToEnvironment	Water	m3	air	unspecified	fx 0.030285	water_to_air_unspecified	(water_decarbonised_input/1000*fraction_WDC_to_air)+(water_co...
4 - ToEnvironment	Acetic acid	kg	air	unspecified	0.005		
4 - ToEnvironment	Carbon monoxide, fossil	kg	air	unspecified	0.00632		
4 - FromEnvironment	Water, cooling, unspeci...	m3	natur...	in water	0.078	water_cooling_UNO_input	
5 - FromTechnosphere	water, decarbonised, at...	kg			0.154	water_decarbonised_input	

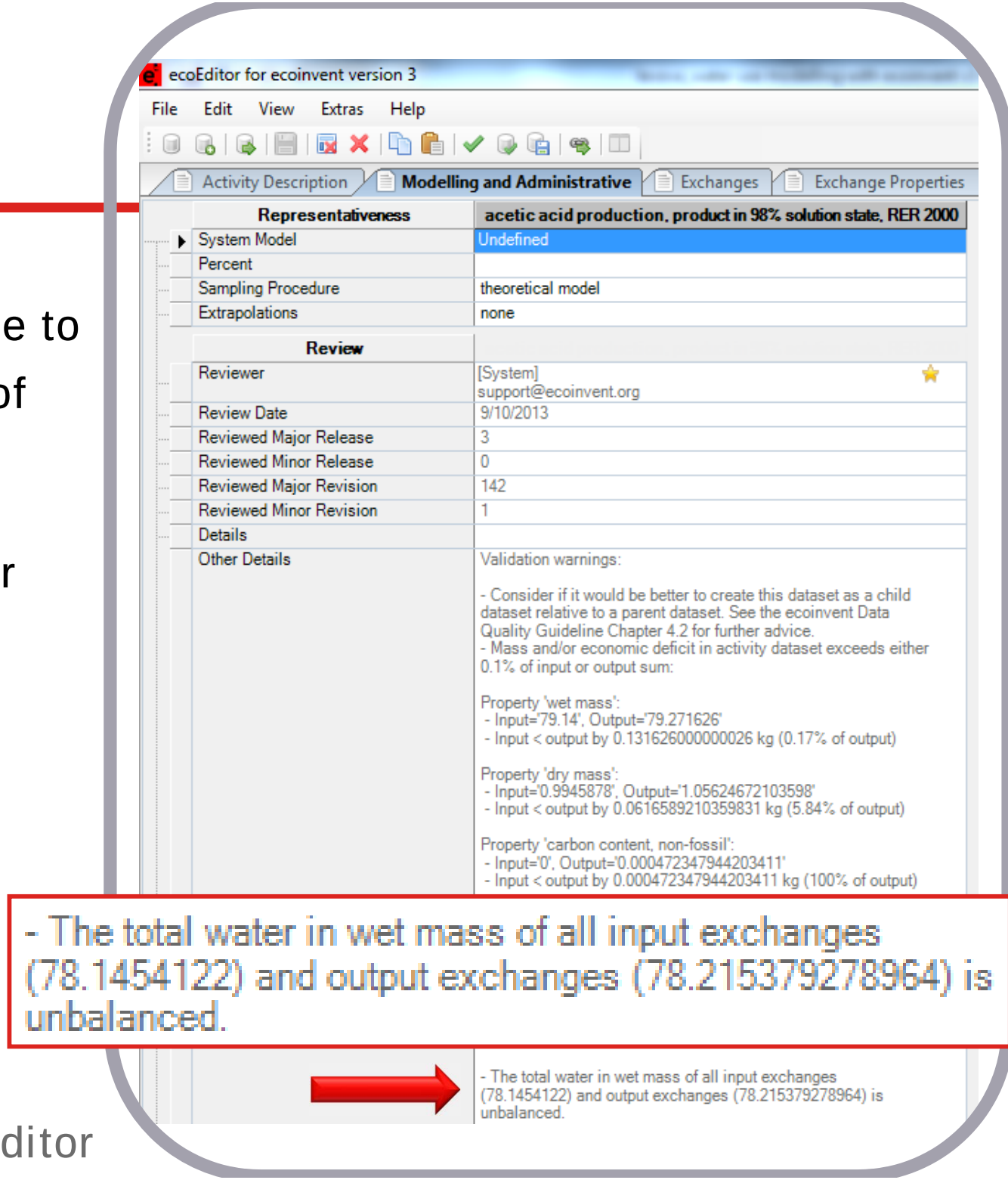
Water balance

water IN = water OUT



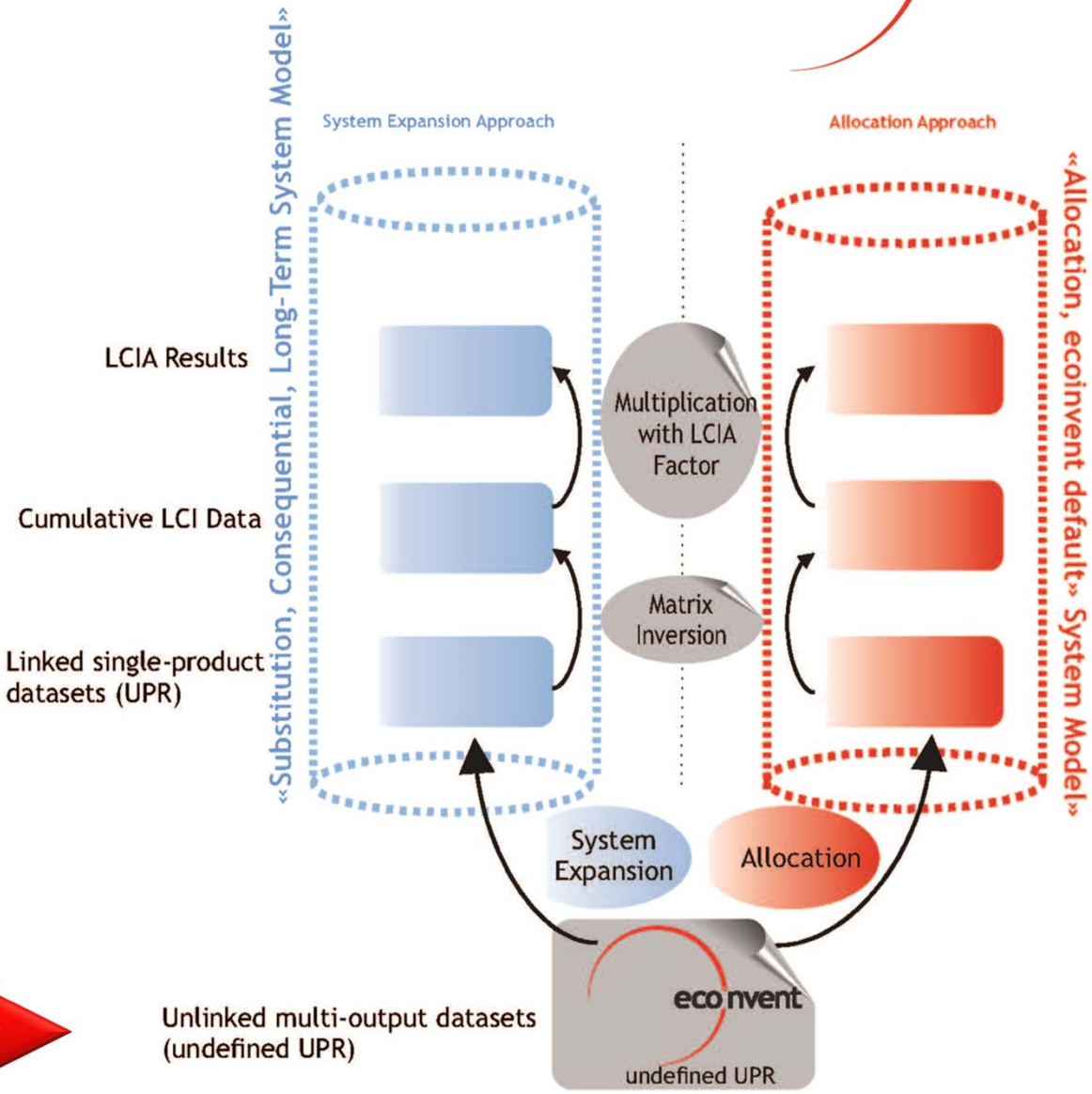
Water balance

- For the first time it is possible to establish the water balance of the undefined UPR activity
- Automatic check of the water balance in the ecoEditor



Water balance

- The undefined UPR dataset can be (and most of the times should be) water balanced
- The linked single-product inventories and subsequently the cumulative LCI cannot be water balanced when using allocation system model, but can be when using system expansion system model



Regionalisation of the supply chain

- New irrigation datasets created, ratio between ground and surface water updated
  - Brazil, China, Switzerland, Germany, Spain, France, India, Malaysia, Philippines, United States and global (GLO)
- New regional markets created for both irrigation and tap water production

Conclusion

- Old data updated
- New data added
- Supply chains updated used regionalized data
- New structure, including quality control, respecting the Data Quality Guidelines for ecoinvent v3 was set up

Thank you for your attention!

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