

Water Accounts

System of Environmental-Economic Accounting Central Framework (SEEA-CF)

<http://www.unescap.org/our-work/statistics>

Outline

- Learning objectives
- Review of Level 0 (5m)
- Level 1 (Compilers)
 - Concepts (15m)
 - Group exercise & Discussion (30m)
- Level 2 (Data providers)
 - Data options, examples & issues (15m)
 - Group exercise & Discussion (15m)
- Closing Discussion (10m)



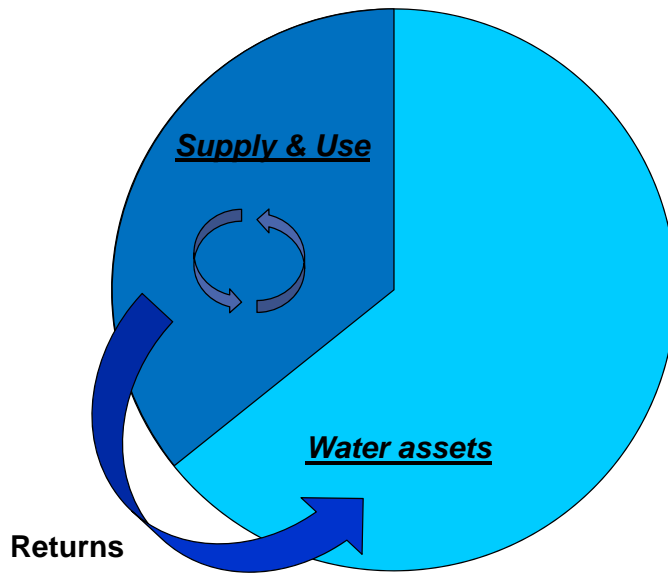
Learning objectives: Levels 1 and 2

- Level 1:
 - Understand why Water Accounts are important and how they link to policy
 - Understand the basic concepts of Water Accounting
 - Understand how water is treated in the SEEA
 - Learn the steps of compiling a Water Account
- Level 2:
 - Understand the data options and sources
 - Understand the important conceptual issues
 - Be aware of how other countries have approached Water Accounting

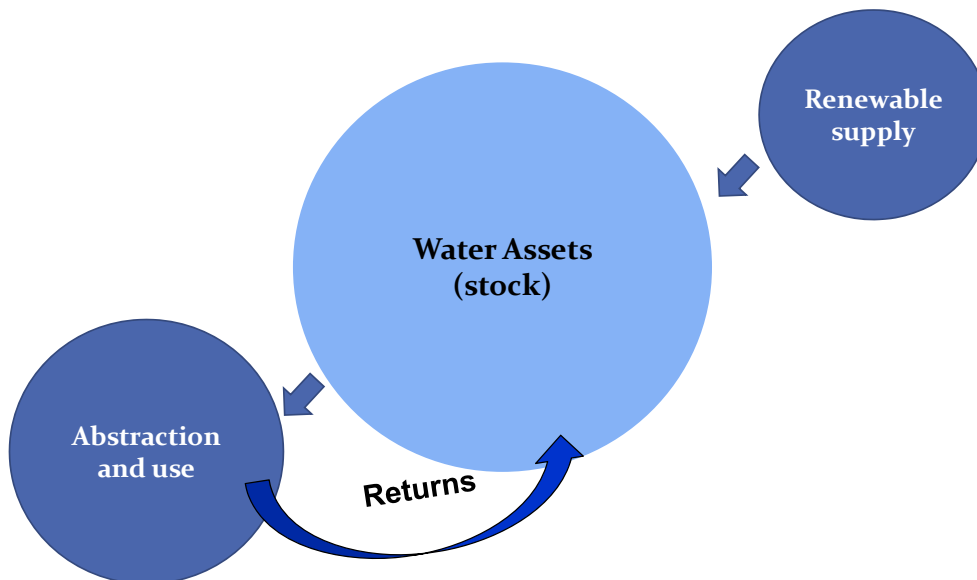


Water Account

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Are we depleting our water assets?





What?

- Availability (stocks) and changes (flows) of water resources
- Supply and use of water within the economy

Why?

- Policies on water security, water resources management
- Links to economic accounts
- Basis for SEEA-WATER, SEEA-EEA
- Indicators:
 - Total water use (by source, purpose, etc.)
 - Water intensity/productivity
 - Variability in water resources, trends (droughts, floods)



What does a Water Account look like?

Physical supply table for water							Physical use table for water															
Abstraction of water; production of water; generation of return flows							Abstraction of water; internal use; generation of return flows					Final use as a plus		Flows to the rest of the world								
							Mining and quarrying, manufacturing and construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	Accommodation	Exports	Flows to the environment	Total use
(I) Sources of abstracted water							(I) Sources of abstracted water															
Inland water resources							Inland water resources															
Surface water							Surface water															
Groundwater							Groundwater															
Soil water							Soil water															
Total							Total															
Other water sources							Other water sources															
Precipitation							Precipitation															
Sea water							Sea water															
Total							Total															
Total supply abstracted water							Total supply abstracted water															
(II) Abstracted water							(II) Abstracted water															
For distribution							For distribution															
For own-use							For own-use															
(III) Wastewater and reused water							(III) Wastewater and reused water															
Wastewater							Wastewater															
Wastewater to treatment							Wastewater to treatment															
Own treatment							Own treatment															
Reused water produced							Reused water produced															
For distribution							For distribution															
For own use							For own use															
Total							Total															
(IV) Return flows of water							(IV) Return flows of water															
To inland water resources							To inland water resources															
Surface water							Surface water															
Groundwater							Groundwater															
Soil water							Soil water															
Total							Total															
To other sources							To other sources															
Total return flows							Total return flows															
of which: Losses in distribution							of which: Losses in distribution															
(V) Evaporation of abstracted water, transpiration and water incorporated into products							(V) Evaporation of abstracted water, transpiration and water incorporated into products															
Evaporation of abstracted water							Evaporation of abstracted water															
Transpiration							Transpiration															
Water incorporated into products							Water incorporated into products															
Total supply							Total supply															
(VI) Return flows of water							(VI) Return flows of water															
Returns of water to the environment							Returns of water to the environment															
To inland water resources							To inland water resources															
To other sources							To other sources															
Total return flows							Total return flows															
(VII) Evaporation of abstracted water, transpiration and water incorporated into products							(VII) Evaporation of abstracted water, transpiration and water incorporated into products															
Evaporation of abstracted water							Evaporation of abstracted water															
Transpiration							Transpiration															
Water incorporated into products							Water incorporated into products															
Total use							Total use															

Note: Dark grey cells are null by definition.



What do you need to compile a Water Account?

- **Data:**
 - Water stocks by source
 - Supply (abstraction, production, return flows)
 - Use (abstraction, intermediate consumption, return flows);
- **Expertise:**
 - Statisticians
 - Hydrologists
 - Water industry specialists



Examples of water-related SDG indicators

- **6.1.1:** Proportion of population using safely managed drinking water services
- **6.3.1:** Percentage of wastewater safely treated
- **6.4.1:** Percentage change in water use efficiency over time
- **6.4.2:** Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

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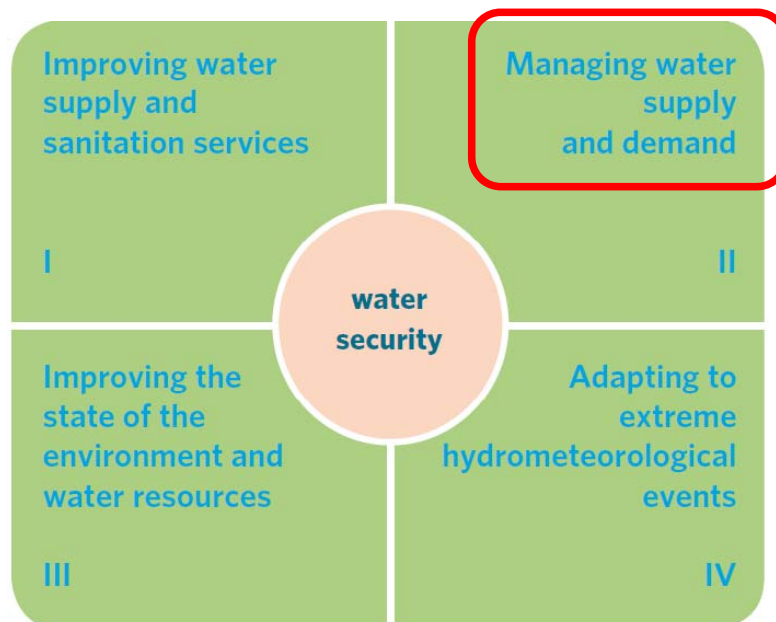
Accounts and data

“Lack of *integrated* water data is a systematic impediment to informed decision making related to the sustainable use of water resources. Data are needed to provide information not just about water quantity, both on the surface and underground, but also about its ***quality, social and economic relations as well as environmental dimensions.***”

Conclusion from Session 6.4 “Data for All” of the 5th World Water Forum

Accounts provide a framework for arranging data. They enable data from different sources to be integrated. They also enable gaps and deficiencies in primary data sources to be identified and addressed.

Water policy issues

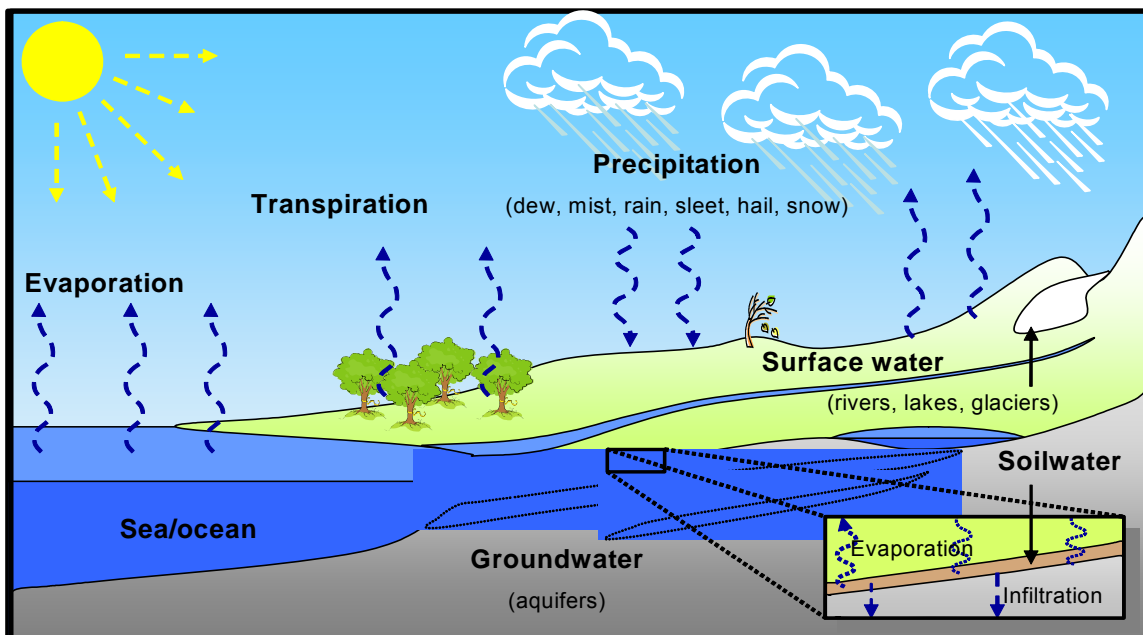


* http://unstats.un.org/unsd/envaccounting/WWAP_UNSD_WaterMF.pdf

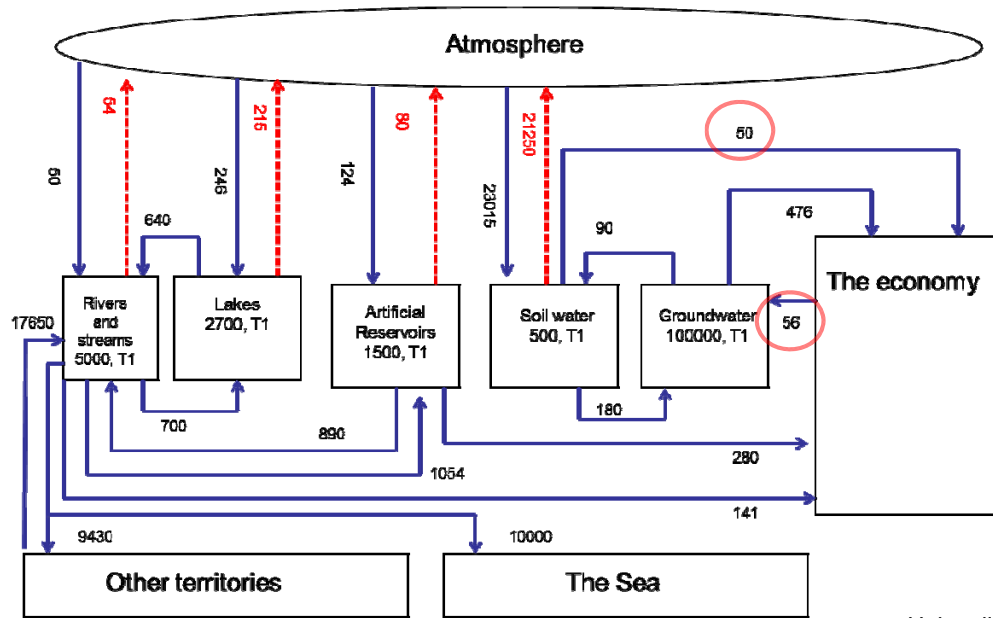
Concepts

- The hydrological cycle
- Stocks, supply, abstraction and use

The Hydrological Cycle



Water asset account diagram

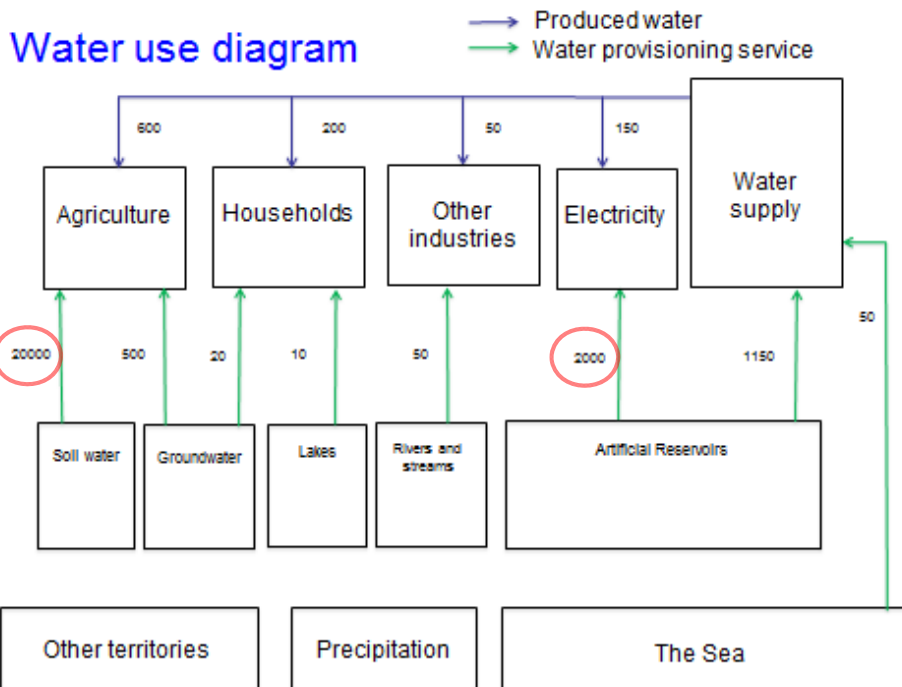


Unit: million m³

Water asset account (from diagram)

	Type of water resources						Total
	Surface water				Groundwater	Soil water	
	Artificial reservoirs	Lakes	Rivers and streams	Glaciers, snow and ice			
Opening stock	1,500	2,700	5,000	-	100,000	500	109,700
Additions to stock							
Returns (from Economy)	-	-	-	-	56	-	56
Precipitation	124	246	50	-	23,015	-	23,435
Inflows from other territories	-	-	17,650	-	-	-	17,650
Inflows from other inland water	1,054	700	640	-	180	90	2,664
Discoveries of water in aquifers	-	-	-	-	-	-	-
Total additions to stock	1,178	946	18,340	-	236	23,105	43,805
Reductions in stock							
Abstraction (to Economy)	280	-	141	-	476	50	947
Evaporation and evapotranspiration	80	215	54	-	-	21,250	21,599
Outflows to other territories	-	-	9,430	-	-	-	9,430
Outflows to the sea	-	-	10,000	-	-	-	10,000
Outflows to other inland water	890	640	1,754	-	90	180	3,554
Total reductions in stock	1,250	855	21,379	-	566	21,480	45,530
Closing stock	1,428	2,791	1,961	-	99,670	2,125	107,975

Unit: million m³



Unit: million m³



Physical Water Use Table (from Diagram)

	Use of water					Total use
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning	Water collection, treatment and supply	Other industries	Households	
Sources of abstracted water						
Inland water resources						
Surface water	-	2,000	1,150	50	10	3,210
Groundwater	500	-	-	-	20	520
Soil water	20,000	-	-	-	-	20,000
Sea water	-	-	50	-	-	50
Total abstracted water	20,500	2,000	1,200	50	30	23,780
Abstracted water						
Distributed water (to other economic units)	-	-	1,000	-	-	1,000
Use of water (from other economic units)	600	150	-	50	200	1,000
Own use	20,500	2,000	200	50	30	22,780
Total use of water (abstracted and distributed water)	21,100	2,150	200	100	230	23,780

Unit: million m³



Compilation Group Exercise (30m)

- **Situation:**
 1. Have a simplified Stock and Flow Diagram
 2. Have a simplified Water Use Diagram
- **Objective (Groups of 3-5):**
 1. Compile a Water Asset Account
 2. Compile a Water Use Table
 3. Report results



Group Exercise: Exercise 1 – Water Asset Account

Stock and Flow Diagram (m³)

Water Asset Account (m³)

	Type of water resources				Total
	Artificial reservoirs	Rivers and streams	Groundwater	Soil water	
(A) Opening stock					
Additions to stock					
(B) Returns from Economy					
(C) Precipitation					
(D) Inflows from other territories					
(E) Inflows from other inland water					
(F) Discoveries of water in aquifers					
(G) Total additions to stock					=B+C+D+E+F
Reductions in stock					
(H) Abstraction (to Economy)					
(I) Evaporation and evapotranspiration					
(J) Outflows to other territories					
(K) Outflows to the sea					
(L) Outflows to other inland water					
(M) Total reductions in stock					=H+I+J+K+L
Closing stock					=A+G-M

→ Calculate Totals, Opening Stock, Closing Stock



Group Exercise: Exercise 2 – Water Use Table

Water Use Diagram (m³)

Legend:
→ Produced water
→ Water provisioning service

Water Use Table (m³)

	Use of water					Total use
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Other industries	Households	
Sources of abstracted water						
Inland water resources						
(A) Surface water						
(B) Groundwater						
(C) Soil water						
(E) Sea water						
(F) Total abstracted water						=A+B+C+D+E
Abstracted water						
(G) Distributed water (to other economic units)						
(H) Use of water (from other economic units)						
(I) Chem use						
Total use of water (abstracted and distributed water)						=H+I

→ Calculate Total abstracted water, Total water use

Note: Surface water = Lakes + Rivers and Streams + Artificial Reservoirs



- Is everyone clear on the objectives?
- 30 minutes group work
- Please ask questions!
- Results:
 - Each group report:
 1. Opening and closing stock
 2. Total use of water
 - Bonus questions:
 1. What was the largest source of reductions in stock?
 2. What is the main use of water?

	Type of water resource				Total
	Surface water	Artificial reservoirs	Rivers and streams	Groundwater	
(A) Opening stock					
Additions to stock					
(B) Returns (to Economy)					
(C) Precipitation					
(D) Inflows from other territories					
(E) Inflows from other inland water					
(F) Overflows from aquifers					
(G) Other additions to stock					
Reductions in stock					
(H) Abstraction (to Economy)					
(I) Evaporation and evapotranspiration					
(J) Outflows to other territories					
(K) Outflows to the sea					
(L) Outflows to other inland water					
(M) Total reductions in stock					
Closing stock					

	Use of water					Total use
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Other industries	Households	
Sources of abstracted water						
Inland water resources						
(A) Surface water						
(B) Groundwater						
(C) Soil water						
(E) Sea water						
(F) Total abstracted water						=A+B+C+D+E
Abstracted water						
(G) Distributed water (to other economic units)						
(H) Use of water (from other economic units)						
(I) Chem use						
Total use of water (abstracted and distributed water)						=H+I



The answers

Water Asset Account

Opening Stock =
56,700 m³

Closing Stock =
57,410 m³

Largest source of
reductions =
Evaporation from
Soil water

	Type of water resources				Total
	Surface water		Groundwater	Soil water	
	Artificial reservoirs	Rivers and streams			
(A) Opening stock	1,500	5,000	50,000	200	56,700
Additions to stock					
(B) Returns (from Economy)	-	-	20	-	20
(C) Precipitation	50	20	-	10,000	10,070
(D) Inflows from other territories	-	1,000	-	-	1,000
(E) Inflows from other inland water	1,000	500	100	-	1,600
(F) Discoveries of water in aquifers	-	-	-	-	-
(G) Total additions to stock	1,050	1,520	120	10,000	12,690
Reductions in stock					
(H) Abstraction (to Economy)	200	100	100	20	420
(I) Evaporation and evapotranspiration	40	20	-	9,000	9,060
(J) Outflows to other territories	-	-	-	-	-
(K) Outflows to the sea	-	900	-	-	900
(L) Outflows to other inland water	500	1,000	-	100	1,600
(M) Total reductions in stock	740	2,020	100	9,120	11,980
Closing stock	1,810	4,500	50,020	1,080	57,410



The answers

Water Use Table

Total use of water =
11,890 m³

The main use of
water is Soil Water
for Agriculture,
Forestry and
Fishing

	Use of water					Total use
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Other industries	Households	
Sources of abstracted water						
Inland water resources						
(A) Surface water	-	1,000	575	25	5	1,605
(B) Groundwater	250	-	-	-	10	260
(C) Soil water	10,000	-	-	-	-	10,000
(E) Sea water	-	-	25	-	-	25
(F) Total abstracted water	10,250	1,000	600	25	15	11,890
Abstracted water						
(G) Distributed water (to other economic units)	-	-	500	-	-	500
(H) Use of water (from other economic units)	300	75	-	25	100	500
(I) Own use	10,250	1,000	100	25	15	11,390
Total use of water (abstracted and distributed water)	10,550	1,075	100	50	115	11,890

Water Account

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4. **Level 2 (Data providers)**
 - Data options, examples & issues (15m)
 - Group exercise & Discussion (15m)
5. Closing Discussion (10m)

Learning objectives

- Level 2:
 - Understand the data options, sources and methods used
 - Understand the important conceptual issues
 - Be aware of how other countries have approached Water Accounting

Data options

- Types of water data
 - Stock
 - Supply
 - Use
- Sources of national and global water data

Data options

- Data sources by type:
 - Survey data (e.g. agricultural survey)
 - Administrative data (e.g., water consumption)
 - Hydrological/meteorological data (e.g., rainfall)
 - Research data (e.g., case studies)

Data options

- Data sources by agency:

- Government agencies responsible for:
 - Water, meteorology, hydrology, statistics, agriculture, environment, energy (especially hydro-power), planning, finance, geology
 - National, state/provincial or local government
- Water suppliers and wastewater treatment
- Water research organisations (e.g. government agencies, universities)
- Non-government organisations (e.g. water industry associations, farmer associations, conservation groups, etc.)

Data options

Accounts	Data items	Typical national data sources	Remarks
Asset account (SEEA-CF table 5.25) (Unit: millions cubic metres)	Surface water (artificial reservoirs, lakes, rivers and streams, glaciers, snow and ice)	<ul style="list-style-type: none"> • Agencies responsible for hydrological and meteorological data such as water, meteorology, geology, irrigation, environment and natural resources, agriculture, and statistics 	<ul style="list-style-type: none"> • Data on stocks and their changes in terms of the volume and inflows from/outflows to other water resources
	Groundwater		
	Precipitation		<ul style="list-style-type: none"> • From water bodies such as rivers, lakes and artificial reservoirs • Typically estimated using models
	Inflows from neighboring territories		
	Evaporation		<ul style="list-style-type: none"> • From water bodies such as rivers, lakes and artificial reservoirs • Typically estimated using models
	Actual evapotranspiration from plants		
	Outflows to neighboring territories		<ul style="list-style-type: none"> • From water bodies such as rivers, lakes and artificial reservoirs • Typically estimated using models
	Outflows to the sea		
	Returns and abstraction (by economic units)	<ul style="list-style-type: none"> • Data from physical supply and use tables 	

Data options

Accounts	Data items	Typical national data sources	Remarks
Physical supply and use tables (SEEA-CF table 3.6) (Unit: millions cubic metres)	Abstraction of water for own use	<ul style="list-style-type: none"> Household surveys as well as surveys and administrative data of the main users (agriculture, manufacturing, electricity, water supply, sewerage) Could be estimated from water-related transactions in the national accounts Relevant data in universities, research organizations, NGOs or industry associations 	<ul style="list-style-type: none"> Data by industries and inland water sources (surface water, groundwater, and soil water) Household is considered as part of the "water collection industry" when abstracting water for own use
	Abstraction of water for distribution	<ul style="list-style-type: none"> Water authorities 	

Data options

Accounts	Data items	Typical national data sources	Remarks
Physical supply and use tables (SEEA-CF table 3.6) (Unit: millions cubic metres)	Collection of precipitation	<ul style="list-style-type: none"> Household surveys of statistics offices and the main users (agriculture, water supply) Relevant data in universities, research organizations, NGOs or industry associations 	<ul style="list-style-type: none"> Data by industries Household is considered as part of the "water collection industry" when abstracting water for own use
	Abstraction from the sea	<ul style="list-style-type: none"> Surveys and administrative data of the main users (agriculture, manufacturing, electricity, water supply, sewerage) 	<ul style="list-style-type: none"> Data by industries

Data options

Accounts	Data items	Typical national data sources	Remarks
Physical supply and use tables (SEEA-CF table 3.6) (Unit: millions cubic metres)	Wastewater to treatment/sewerage	<ul style="list-style-type: none"> Surveys or administrative data of the wastewater industry 	<ul style="list-style-type: none"> Data by industries and households Wastewater directly discharged to the environment is part of the returns of water
	Own treatment of wastewater		
	Reused water produced and used (by economic units)	<ul style="list-style-type: none"> Surveys and administrative data of the main users (agriculture, manufacturing, electricity, water supply, sewerage) 	<ul style="list-style-type: none"> Data by industries and households Excludes recycled water within the same establishment (on site)
	Returns of water to inland water resources	<ul style="list-style-type: none"> Surveys or research data of the sectors concerned (agriculture, manufacturing, electricity, water supply, sewerage, municipalities, households) 	<ul style="list-style-type: none"> Data by industries, households and inland water sources (surface water, groundwater, and soil water) Data by industries and households
	Returns of water to the sea		

Data options

Accounts	Data items	Typical national data sources	Remarks
Physical supply and use tables (SEEA-CF table 3.6) (Unit: millions cubic metres)	Losses of water in distribution	<ul style="list-style-type: none"> Water authorities 	
	Evaporation of abstracted water	<ul style="list-style-type: none"> Water authorities Surveys, administrative data or research data of the sectors concerned (agriculture, manufacturing, electricity, water supply, sewerage, municipalities, households) 	<ul style="list-style-type: none"> Data by industries and households. Could be viewed as the water that has entered the economy but has not returned to inland water sources or the sea (i.e., "water consumption") and calculated as the difference between total water use and total water supply.
	Transpiration (by plants)		
	Water incorporated into products		

Data options

- Global data sources
 - Data on water and land cover are available from international agencies or research organisations:
 - FAO Aquastat
<http://www.fao.org/nr/water/aquastat/main/index.stm>
 - WHO World Climate Data and Monitoring Program (WCDMP)
http://www.wmo.int/pages/prog/wcp/wcdmp/index_en.php
 - WMO World Hydrological Cycle Observing System (WHYCOS)
<http://www.whycos.org/whycos/>

Guidelines on methods

- International Recommendations for Water Statistics (IRWS)
- Guide to Meteorological Instruments and Methods of Observation
- Guidelines on the Role, Operation and Management of National Hydrological Services
- International Benchmarking Network for Water and Sanitation Utilities
- A System of Integrated Agricultural Censuses and Surveys
- ISO (e.g. ISO 19115 for geographic information)
- Statistical Data and Metadata Exchange (or SDMX)
- World Meteorological Organisation Core Metadata Standard
- Infrastructure for Spatial Information in the European Community (INSPIRE)
- Global Annual Assessment of Sanitation and Drinking Water
- MDG reporting standards (for water supply and sanitation)

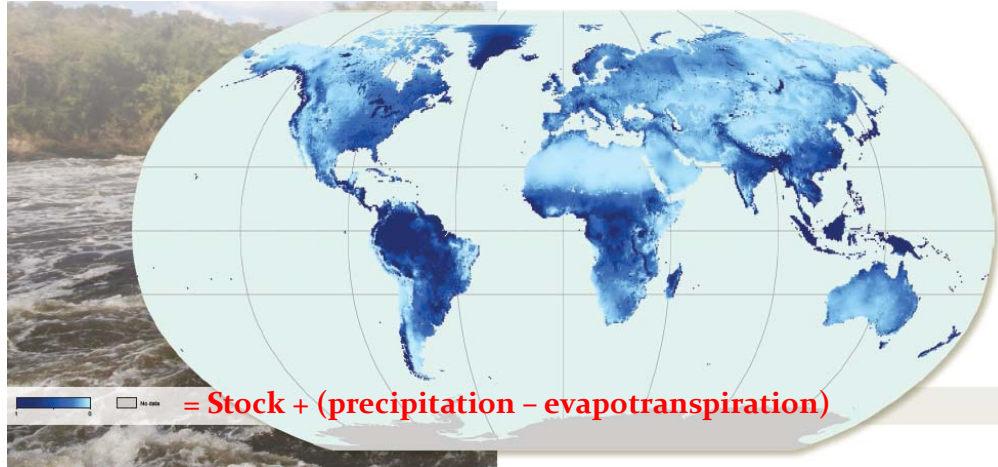
Common problems in compilation of water accounts

- **Classification of units to industry** especially those engaged in multiple activities (e.g. water supply, sewerage and hydro-electricity generation)
- In most countries national accounts do not separate the **water supply and sewerage industries**
- Recording of **losses in distribution** and the flows for use of water in **hydro-electricity** and water for **cooling**
- Boundary between **environment and the economy**, especially artificial reservoirs
- **Spatial referencing** – economic data refers to administrative boundaries while hydrological data refers to river basins
- **Confidentiality** of business data
- Data **quality**
- **Scale** of data (national level data may hide regional variation)
- **Seasonality**: Annual averages may hide seasonal variation and **extremes** (e.g., floods and droughts)

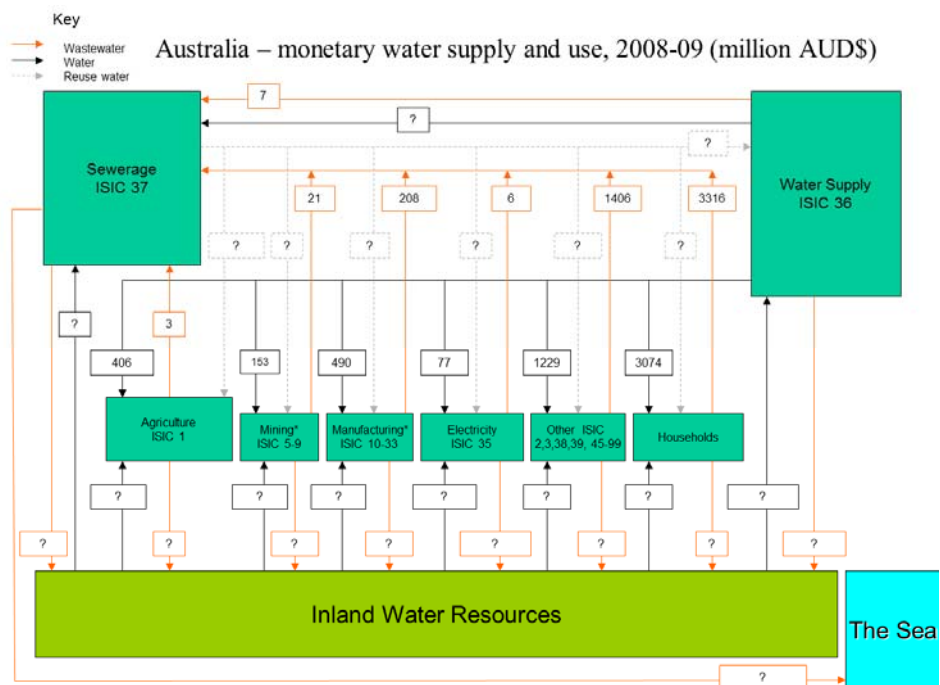
Some Global and country examples

- **UNEP-WCMC**: Composite map of global ecosystem assets (Freshwater component)
- **Australia, Samoa, Fiji**

UNEP-WCMC: Composite map of global freshwater resources

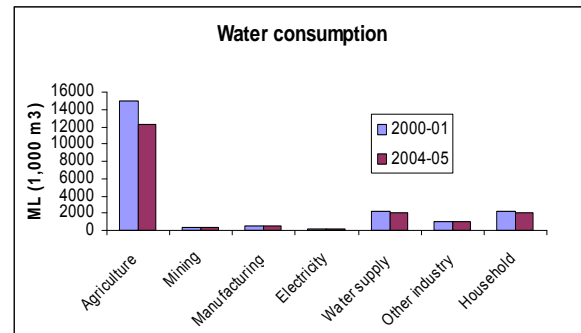
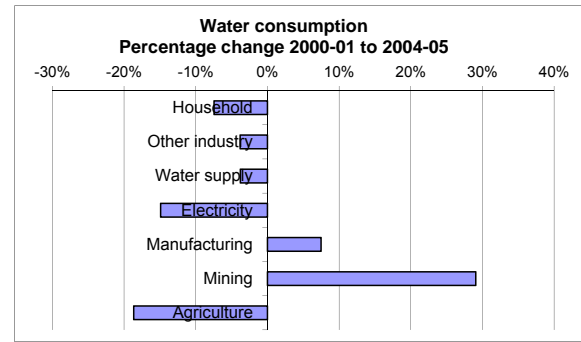
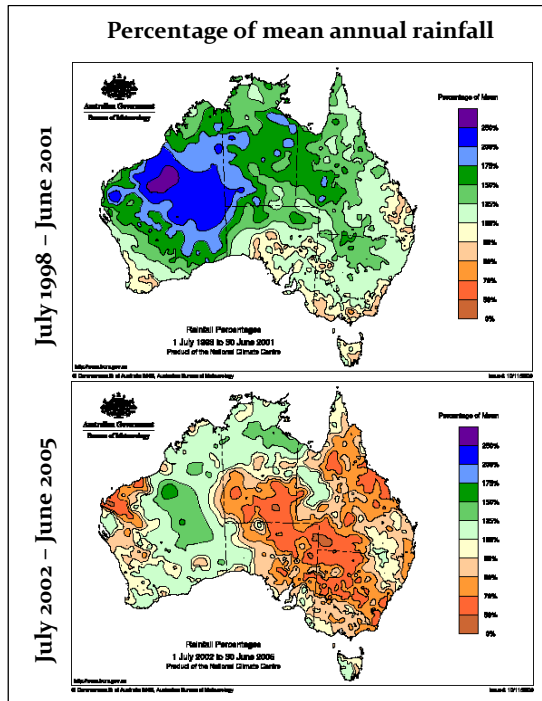


Source: Dickson, Blaney et al. (2014)

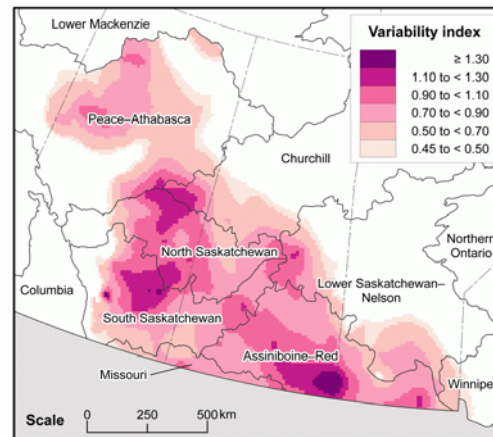
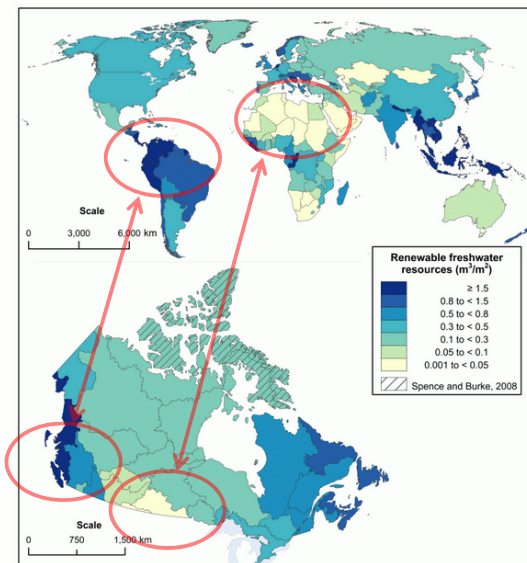




Australia's water accounts are not just tables



Canada's Freshwater Supply and Demand

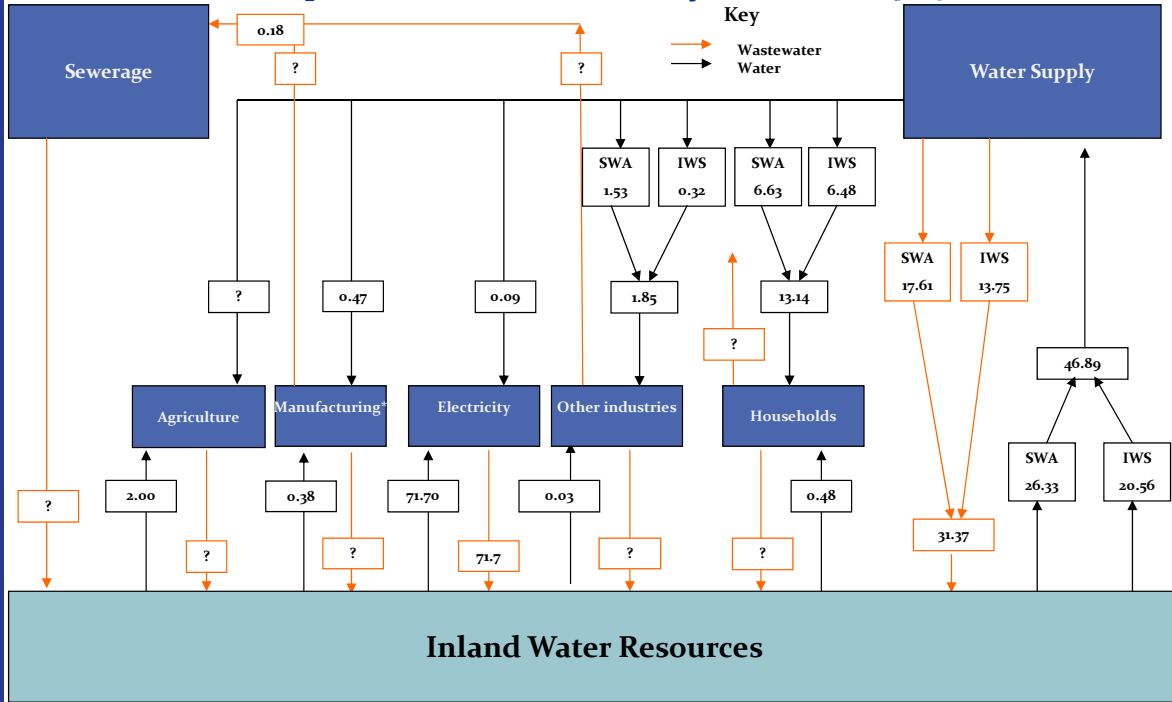


Note(s): Includes all or part of drainage regions 6, 9, 10, 11, and 12, the Peace-Athabasca, Missouri, North Saskatchewan, South Saskatchewan, and Assiniboine-Red.

Sources(s): Statistics Canada, Environment Accounts and Statistics Division, 2010. special tabulation.

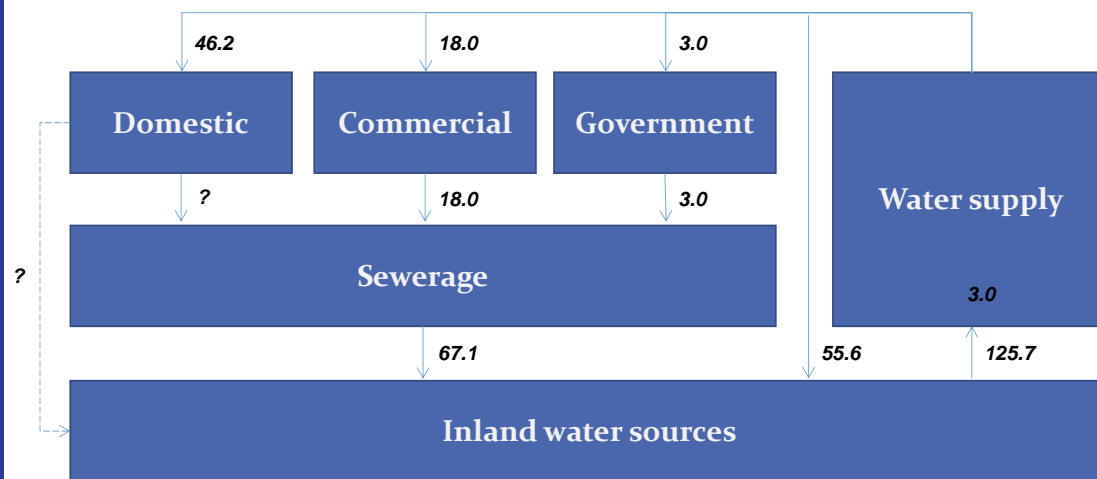
Source: Statistics Canada, 2010

Experimental water accounts for Samoa, 2013-14 (Millions m³)



*Draft Experimental Water Accounts for Samoa, 2011-12 to 2013-14, version 1.2 (29 September 2015)

Preliminary water accounts for Fiji (piped water), 2016 (Millions m³)



A lot of progress can be made quickly...

- It is not necessary to compile complete water accounts
 - Address national policy priorities with available data
- National data, global data and guidance are available to get started
 - Many countries already have much of the data needed to compile water supply and use tables and water asset accounts
 - Data are usually dispersed in many agencies
 - Agricultural agencies collect information on irrigation water, water ministries collect information to construct water balances, etc.
 - Cooperation is needed
 - Within statistical offices
 - Between statistical offices, water departments, economic/planning departments and agricultural departments
 - With the water supply industry
 - With the scientific and research communities
 - Between users and producers of information

A lot of progress can be made quickly..

- For example, Samoa, China, Mexico, Jordan and Dominican Republic were all able to produce preliminary accounts within 6 months
- For many countries and agencies is a matter of re-arranging current data to match the format of the standard tables and to ensure they are consistent with the definitions and classifications of SEEA
- In this process data gaps and deficiencies may be identified and, if important enough, these can be addressed



Group exercise (15m) (Groups of 3-5)

1. What is the main water issue in your country?
2. Suggest **three** measures that could be used to address it?
3. Report:
 - The water issue you selected
 - The three measures you selected
 - Are **national** data available in your country for these measures?
4. Discussion:
 - What other measures could you suggest?
 - What other data sources could you suggest?



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Further Information

- [System of Environmental-Economic Accounting, Central Framework](#) (2012)

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 - https://unstats.un.org/unsd/envaccounting/eea_project/default.asp
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