Water Account
(Levels 1 and 2)

Project: Advancing the SEEA Experimental Ecosystem Accounting

United Nations
UNEP
Convention on Biological Diversity
NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

Overview: Water Account

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

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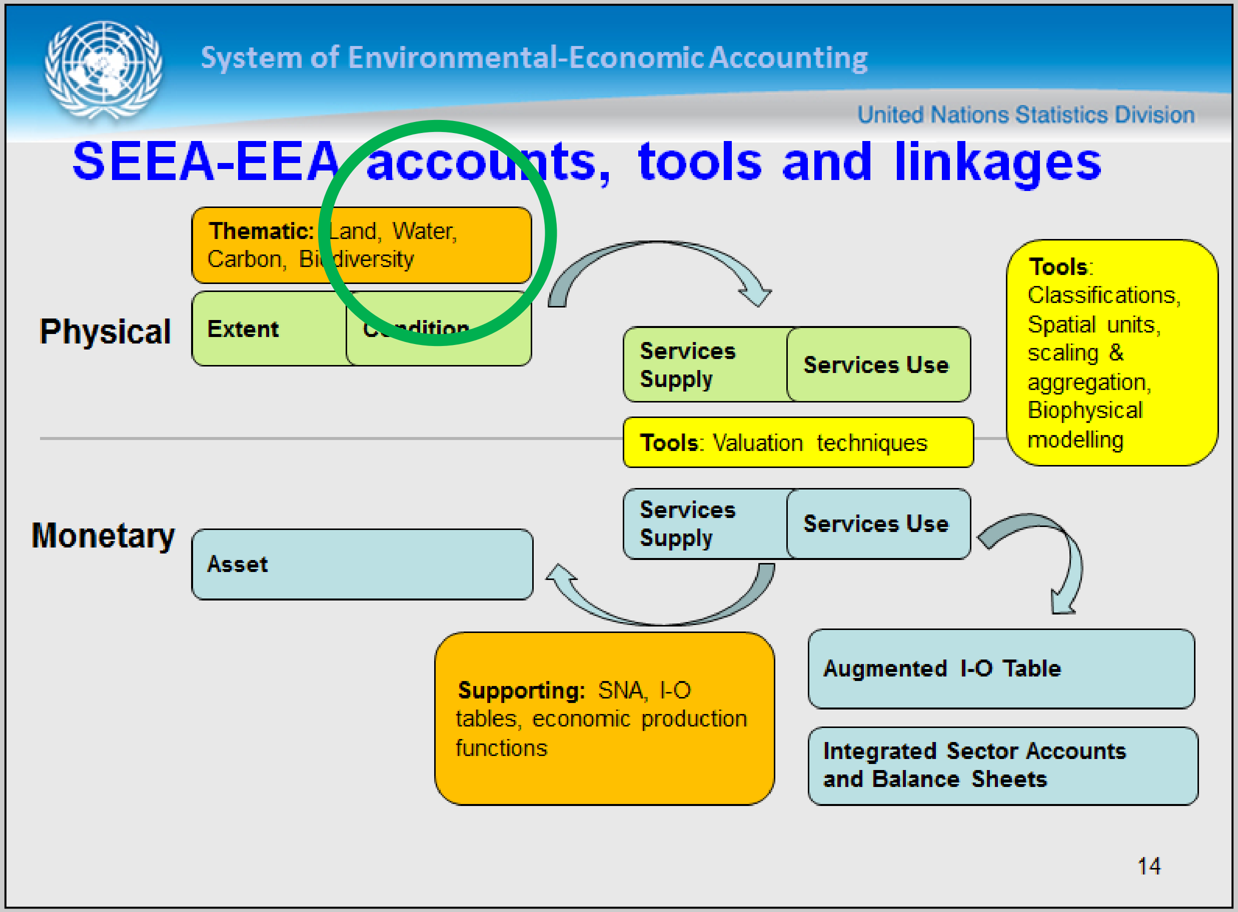
Levels 1 and 2: Water Account

- **Learning objectives**
  - 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

Review of Level 0: Water Account

Account 3: Water



Level 0: Account 3: Water

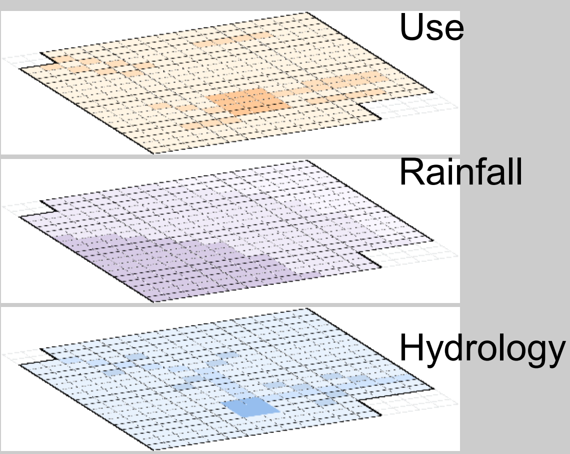
- **What?**
  - Spatially-detailed version of SEEA-CF Water Account to capture:
    - Inter-ecosystem flows of water (SEEA-EEA 4.62),
    - Water quality and
    - Supply/use for ecosystems
- **Why?**
  - Policies on water security, water quality, impacts of water abstraction on ecosystems
  - Links to other accounts (**Condition**, **Services Supply & Use**)
  - Links to SEEA-CF; SEEA-WATER
  - Indicators:
    - Local water supply/use, quality (use > supply?)
    - Variability in supply, trends (droughts, floods)

Level 0: Account 3: Water

- **What does a Water Account look like?**

Maps

Tables



	Use of water							
	Agriculture, forestry and fishing	Mining & quarrying, manufacturing and construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	**Total use**
	millions m^3							
Source of abstracted water								
Inland water resources								
Surface water								
Goundwater								
Soil water								
Total								
Other water sources								
Precipitation								
Sea water								
Total								
Total use of abstracted water								
Abstracted water								
Distributed water								
Own use								

Spatial units
Classifications
Biophysical modelling
Socio-economic data

Level 0: Account 3: Water

- **What does a Water Account look like?**
  - Spatially-detailed data on:
    - Stock
    - Supply, and
    - Use including soil moisture & groundwater
  - Water quality measures (contribution to **Condition Account**)

Level 0: Account 3: Water

- **What do you need to compile a Water Account?**
  - Ecosystem Extent Account
  - SEEA-CF Water Account (national level)
  - Common spatial infrastructure (Spatial Units)
  - **Data:**
    - Spatially-detailed supply (rainfall, transfers)
    - Use (abstraction, inter-ecosystem transfers);
    - Water quality measures
  - **Expertise:**
    - Geographers (GIS and remote sensing)
    - Hydrologists
    - Ecologists
    - Climatologists

Level 1:
Water Account

Level 1: Account 3: Water

- **Learning objectives**
  - 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 1: Account 3: Water

Why water and ecosystem accounts?

- Increasing human pressure on water and ecosystems from:
  - Extraction of water
  - Pollution of water
  - Degradation and depletion of ecosystems (e.g. conversion of forests to palm oil plantations) changes the local water balance
- Comprehensive information on water and ecosystems will support assessing the impact of:
  - Changes in vegetation cover and land use on water stocks and water provisioning and filtration services
  - Policies for managing water and ecosystems on the economy:
    - e.g., restricting human activity in catchments used for water supply
    - e.g., limiting the amount of water available for extraction by industry (e.g. agriculture).

Level 1: Account 3: Water

Accounts and data

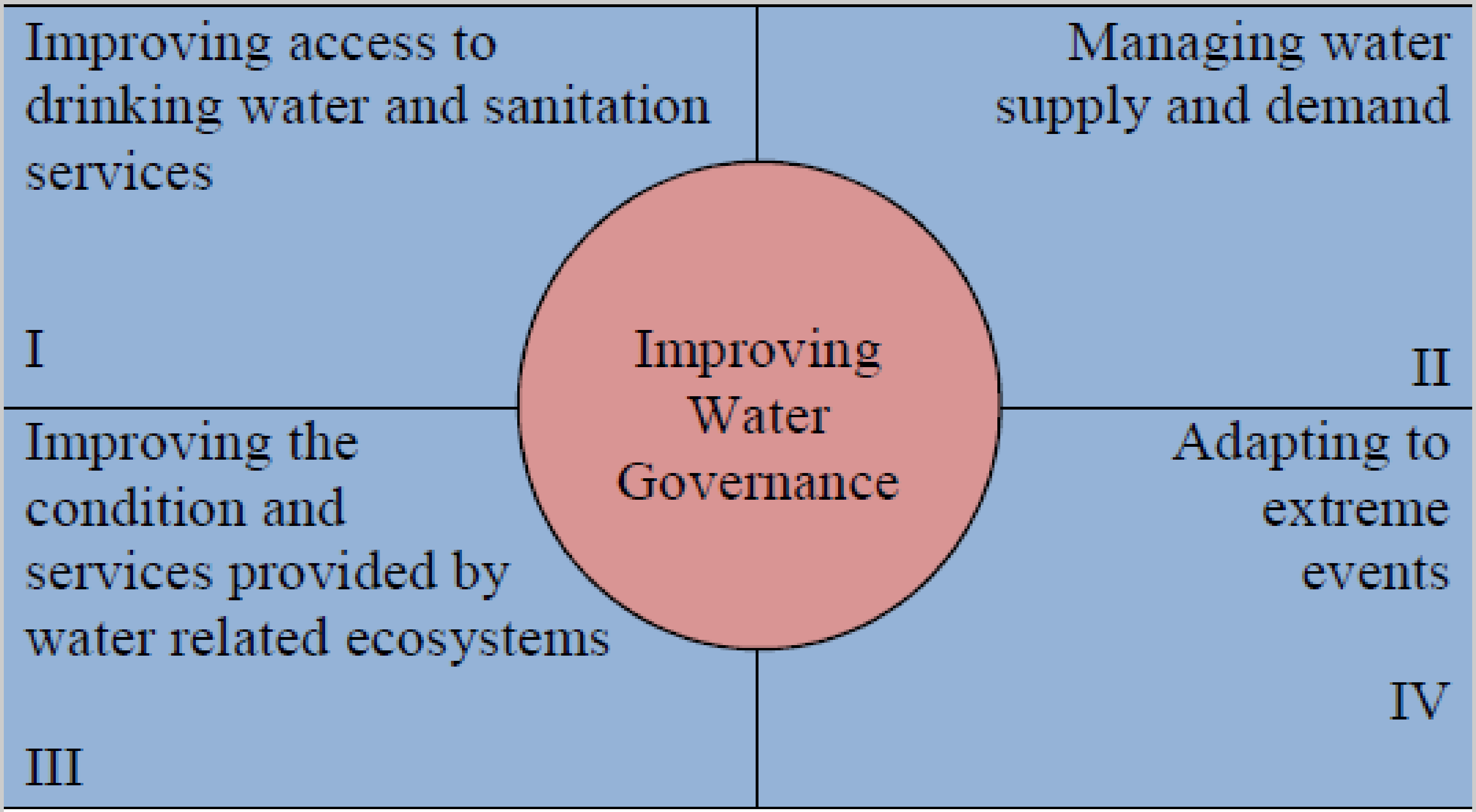
"Lack of *integrated* water data is a systematic impediment to informed decision making related to the sustainable use of water resources. Data are needed to provide information not just about water quantity, both on the surface and underground, but also about its ***quality, social and economic relations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

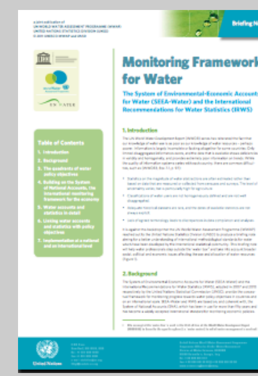
Conclusion from Session 6.4 "Data for All" of the 5th World Water Forum

- 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.

Level 1: Account 3: Water

Water policy issues and ecosystems



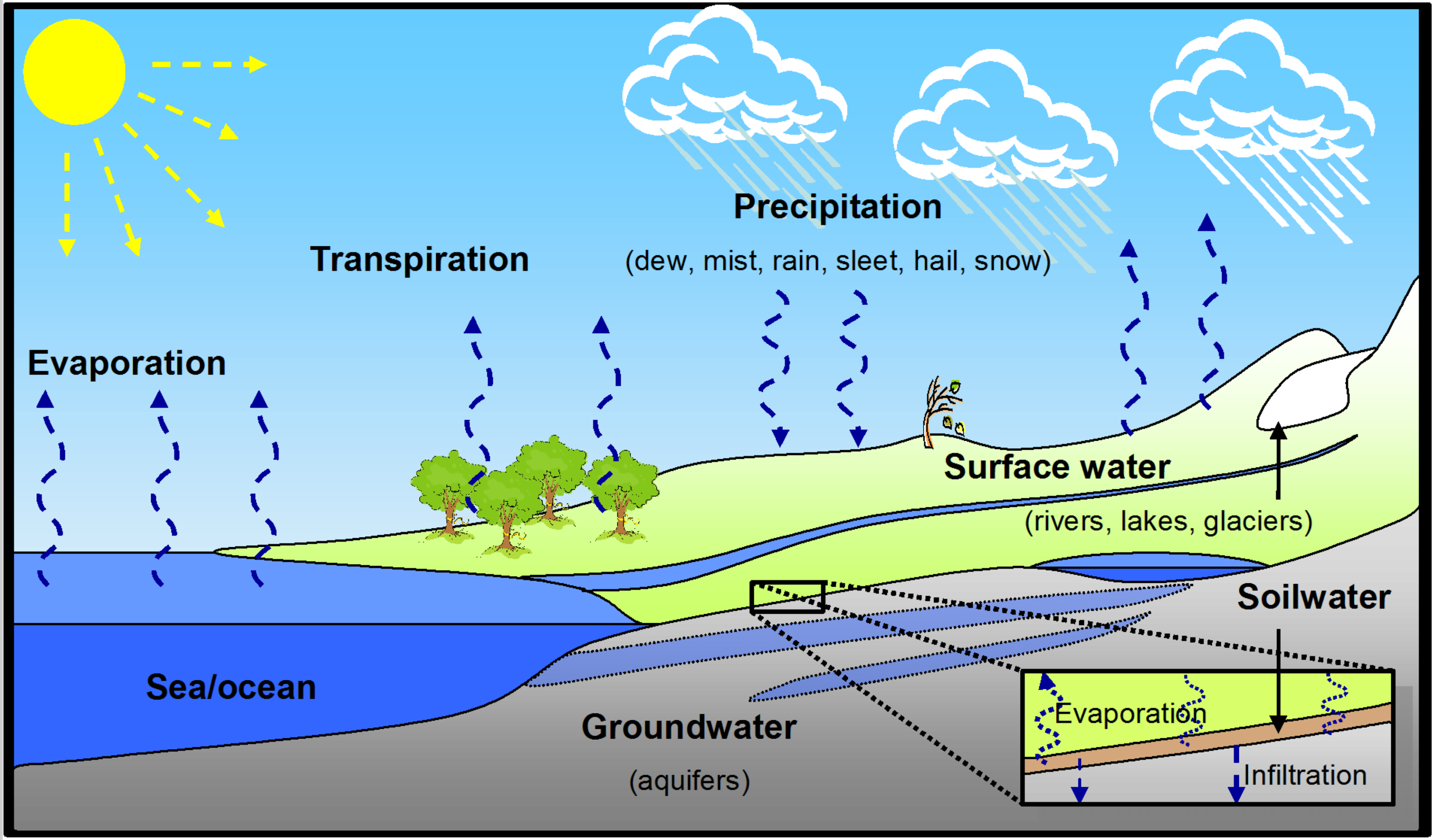


http://unstats.un.org/unsd/envaccounting/WWAP_UNSD_WaterMF.pdf

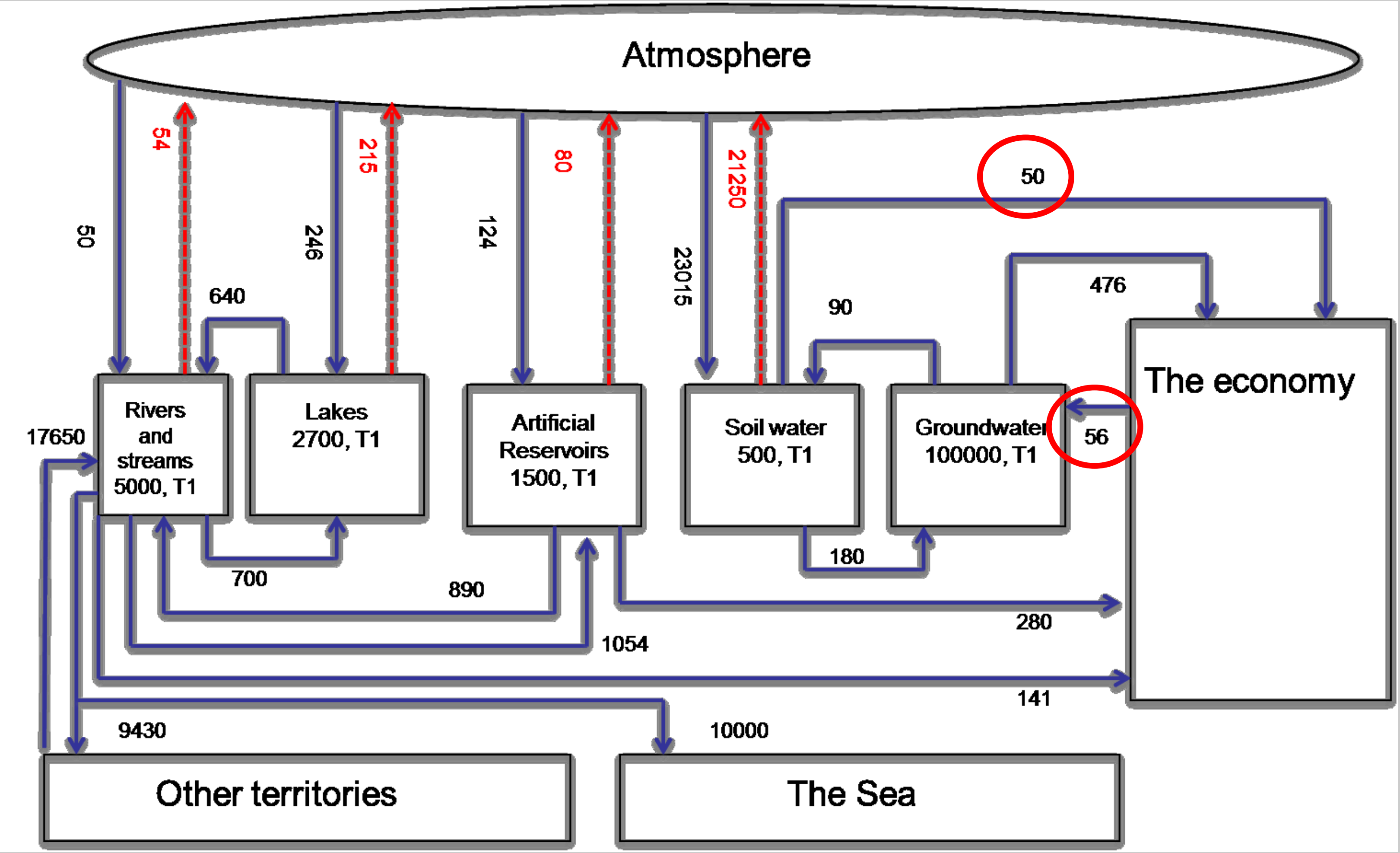
Level 1: Account 3: Water

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

The Hydrological Cycle



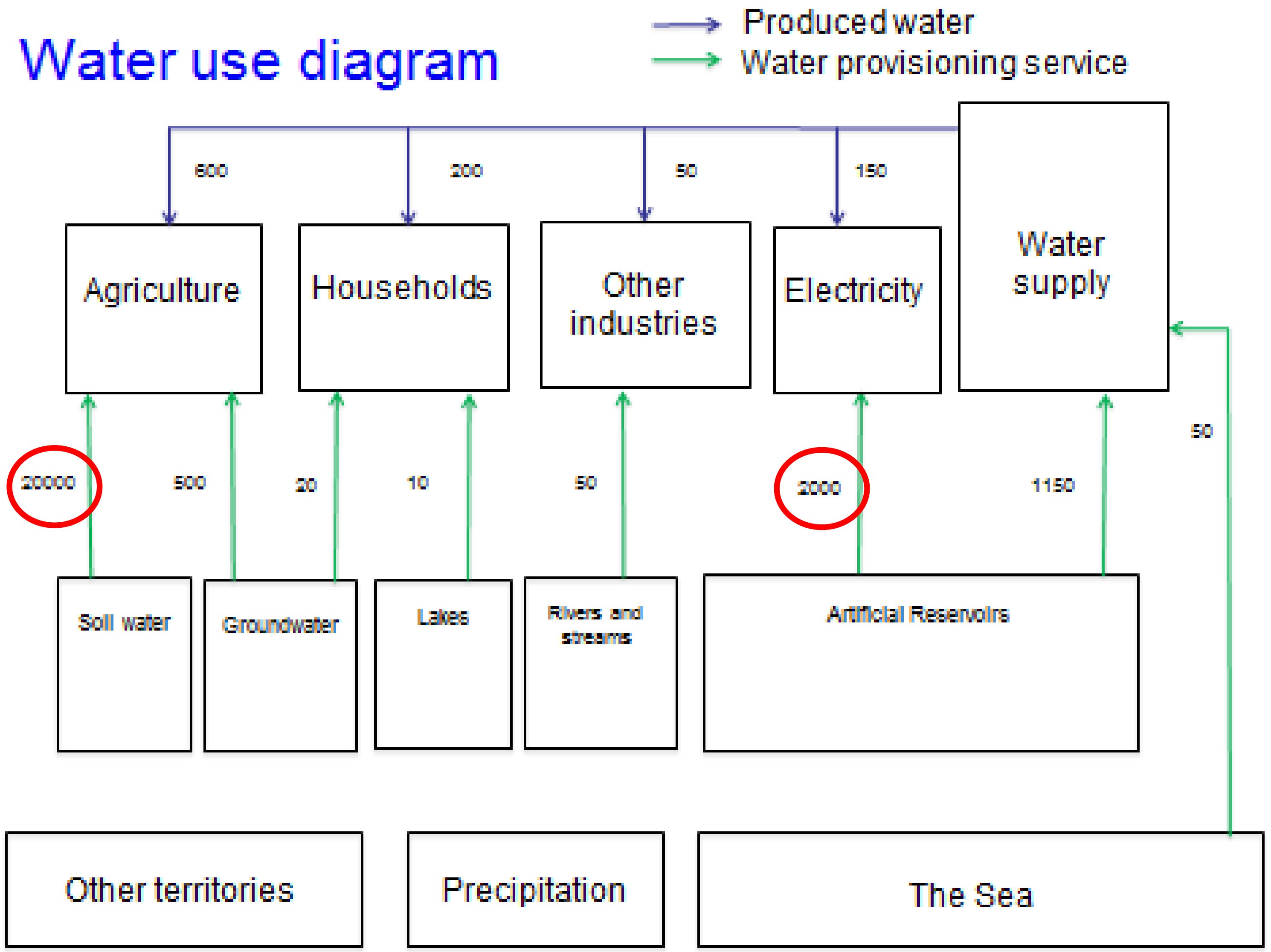
Water stocks and flows diagram



Water asset account (from diagram)

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

Water use diagram



Physical Water Use Table (from Diagram)

	Use of water					
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning	Water collection, treatment and supply	Other industries	Households	Total use
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 econmic units)	-	-	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**

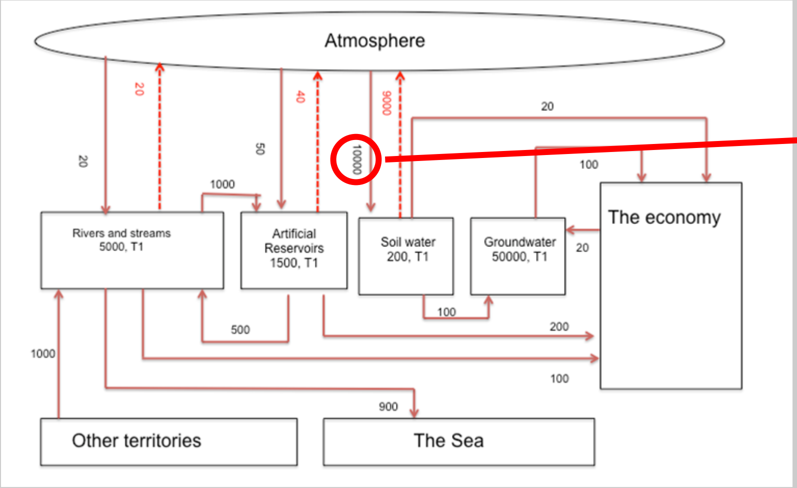
Level 1: Account 3: Water

- 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

Level 1: Account 3: Water

Group Exercise: Exercise 1 – Water Asset Account

Stock and Flow Diagram (m^3)



Water Asset Account (m^3)

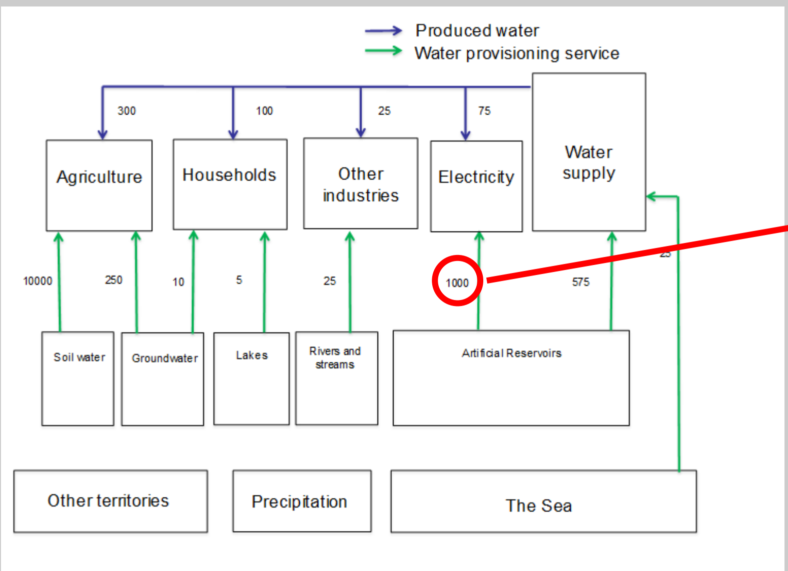
	Type of water resourcs					
	Surface water					
	Artificial reservoirs	Rivers and streams	Goundwater	Soil water	Total	
(A) Opening stock						
Additions to stock						
(B) Returns (from Economy)						
(C) Precipitation						
(D) Inflows from other territories						
(E) Inflows from other inland water						
(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

Level 1: Account 3: Water

Group Exercise: Exercise 2 – Water Use Table

Water Use Diagram (m^3)



Water Use Table (m^3)

	Use of water						
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Other industries	Households	**Total use**	
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 ecomomic units)							
(H) Use of water (from other economic units)							
(I) Own use							
Total use of water (abstracted and distributed water)							=H+I

→Calculate Totals, Opening Stock, Closing Stock

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

Level 1: Account 3: Water

- 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 resourcs					
	Surface water					
	Artificial reservoirs	Rivers and streams	Goundwater	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

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

Level 2:
Water Account

Level 2: Account 3: Water

- **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

Level 2: Account 3: Water

- **Data Options:**
  - Types of water data
    - Stock, supply, use,
    - Water quality
  - Sources of national and global water data

Level 2: Account 3: Water

- **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)
  - Land cover data
  - Water quality data

Level 2: Account 3: Water

- **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.)

Level 2: Account 3: Water

- **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/

Level 2: Account 3: Water

- Types of water quality indicators (examples)

Indicator	Notes	Water quality	Ecosystem condition
Nutrient levels and pollution loads	E.g. N,P,K levels, heavy metals and pesticides	Higher levels mean lower water quality and limits the possible uses of the water	Can lead to a change in the composition of aquatic species (e.g. fish kills)
Sediment load	e.g. small particles in the water resulting from soil erosion	Higher loads mean lower water quality and limits possible uses of water	Can lead to a change nature of downstream ecosystems (e.g. siltation of rivers and impact on marine ecosystems)
Species richness and abundance	This is a measure of the number, type (e.g. vascular plants, invertebrates, fish) of species occurring in the water.	Particular species or groups of species are sensitive to changes in the levels of nutrients or sediments loads and hence species richness and abundance is a proxy for water quality	Biodiversity is an indication of ecosystem condition.

Level 2: Account 3: Water

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)

Level 2: Account 3: Water

- **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)

Level 2: Account 3: Water

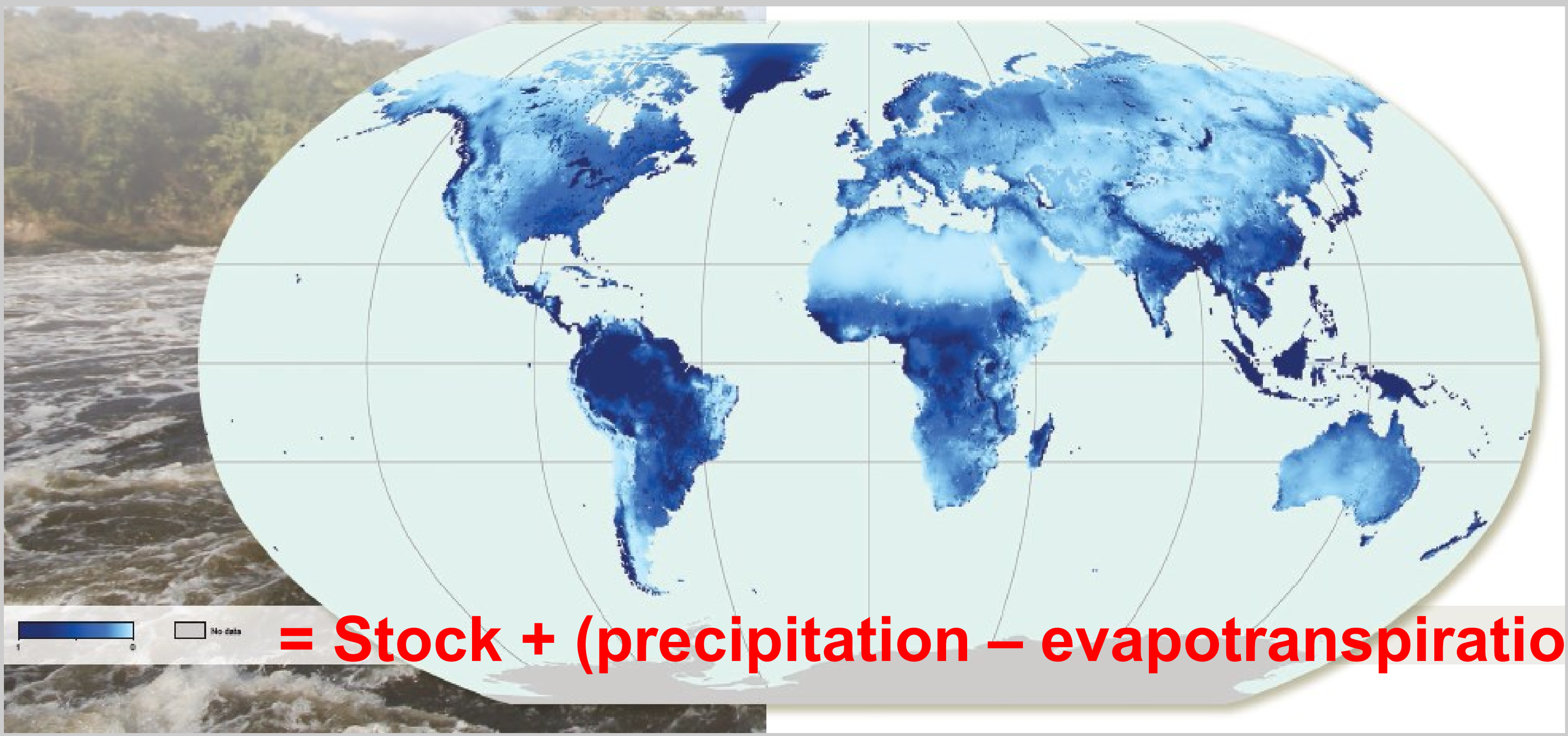
- **Other conceptual issues:**
  - Inter-ecosystem flows:
    - Ecosystems are suppliers and users of water
  - Treatment of rivers, coasts, marine Spatial Units
    - Need a coherent spatial database to analyse flows
  - Treatment of snow, permafrost
    - Is it included in the “stock”?
  - Large stocks
    - May be difficult to measure (e.g., Canada has over 1 million lakes)

Level 2: Account 3: Water

- Some Global and country examples:
  - **UNEP-WCMC:** Composite map of global ecosystem assets (Freshwater component)
  - **Australia:** Water Accounts
  - **Canada:** Freshwater Supply and Demand

Level 2: Account 3: Water

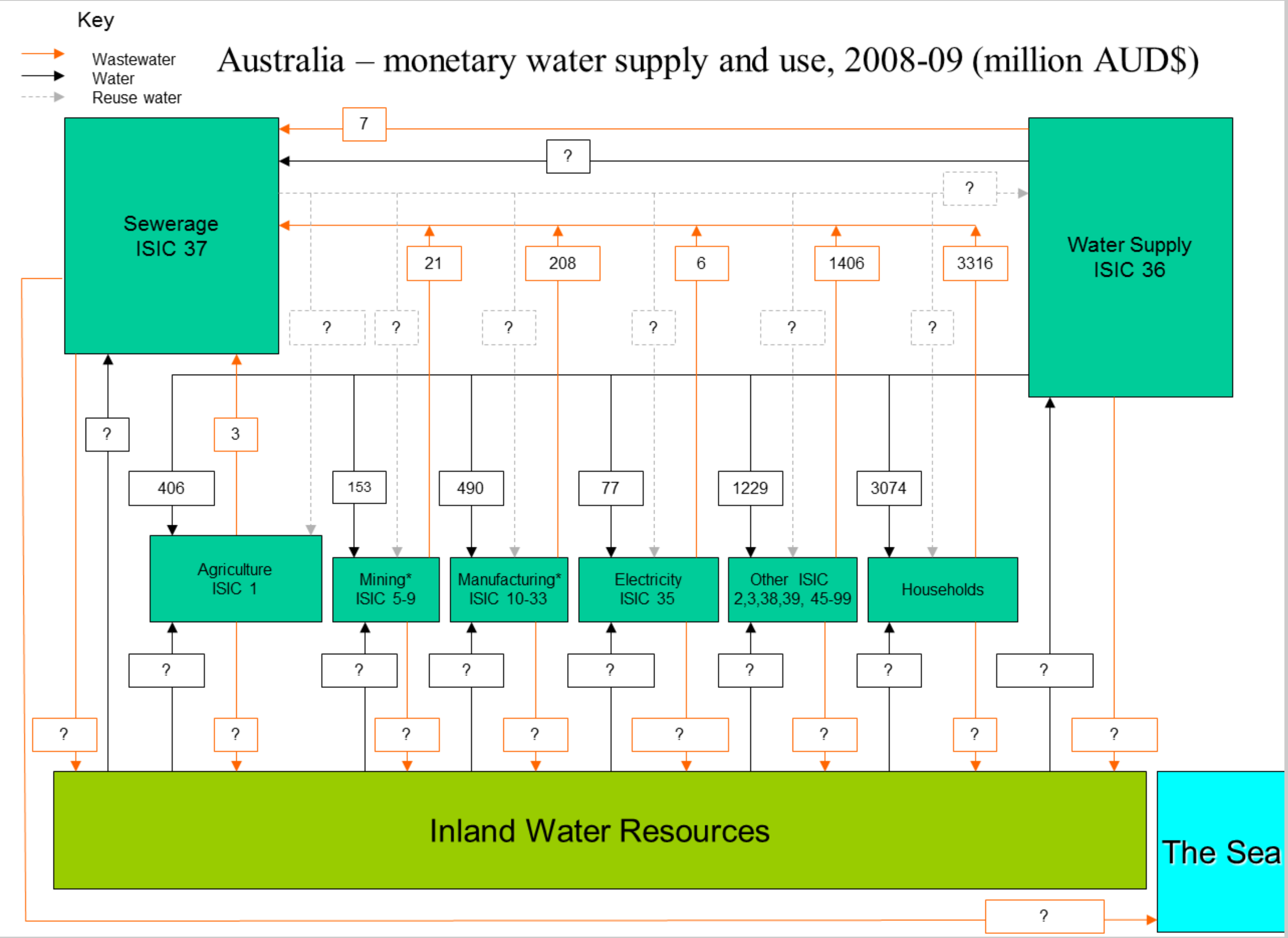
- **UNEP-WCMC:** Composite map of global freshwater resources



= Stock + (precipitation – evapotranspiration)

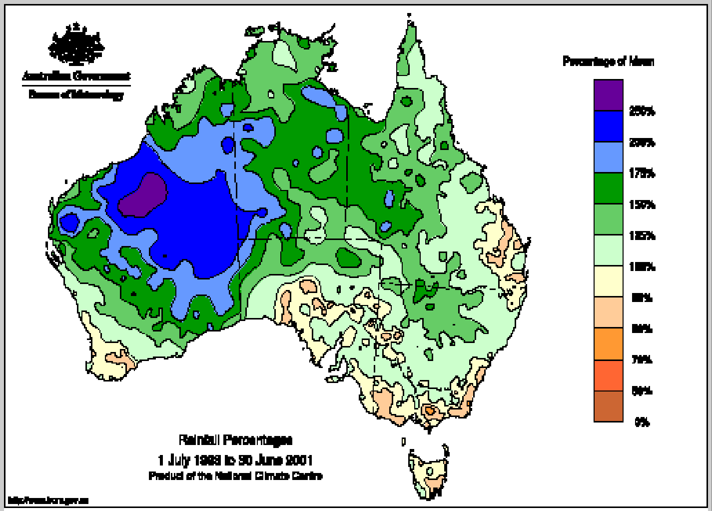
Source: Dickson, Blaney et al. (2014)

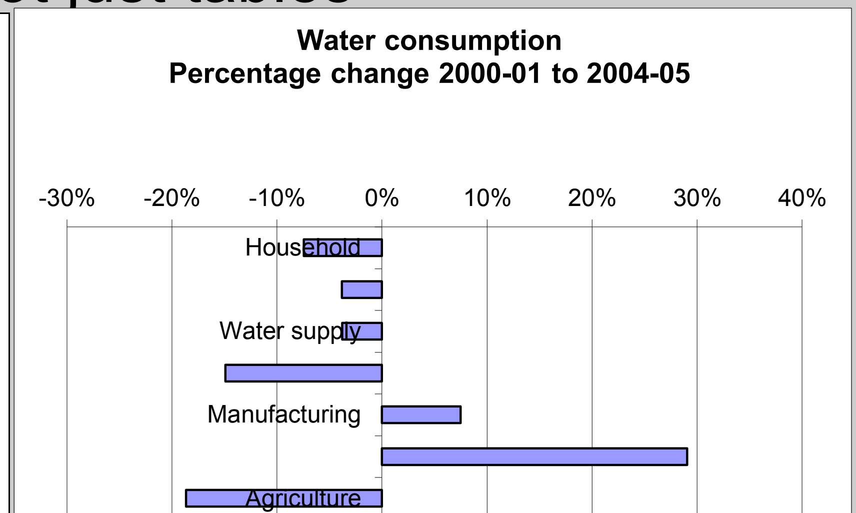
Level 2: Account 3: Water

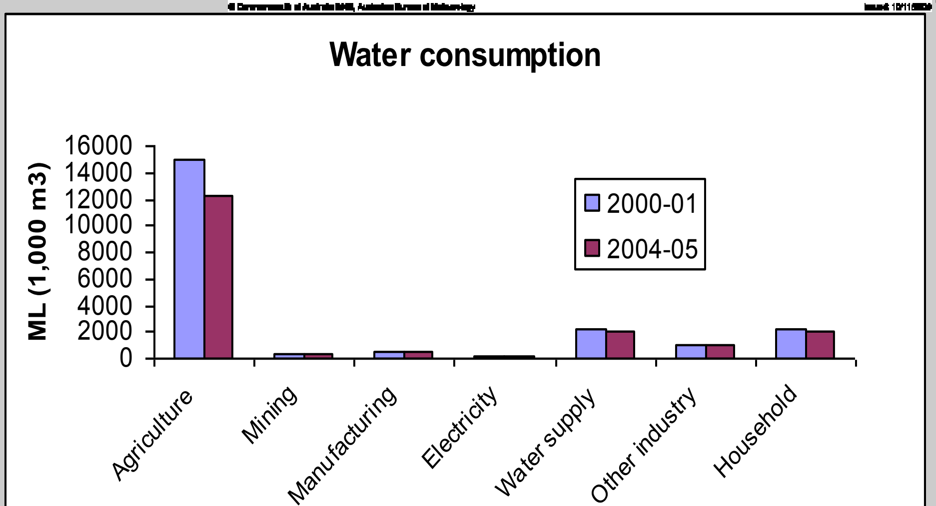


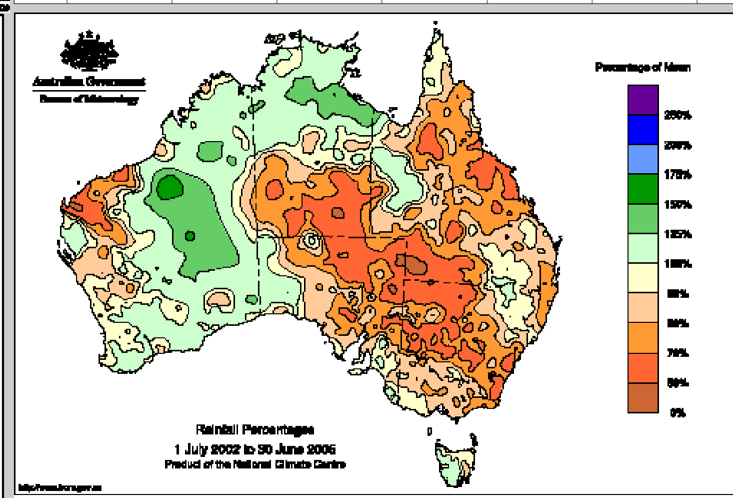
Level 2: Account 3: Water

Australia`s water accounts are not just tables



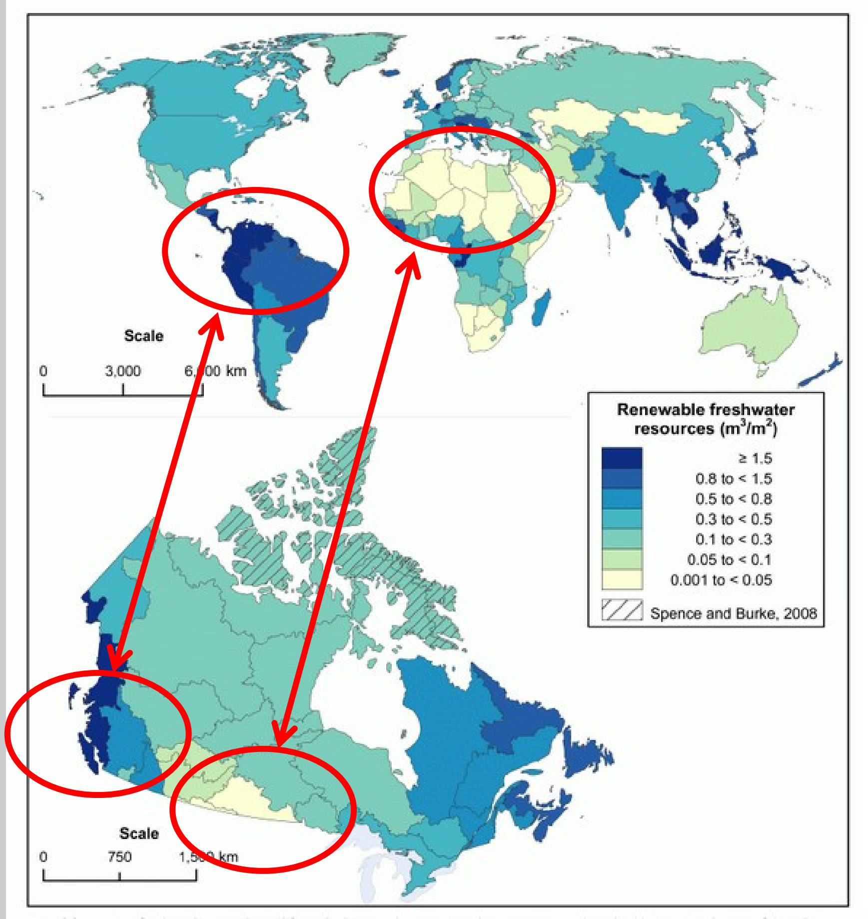


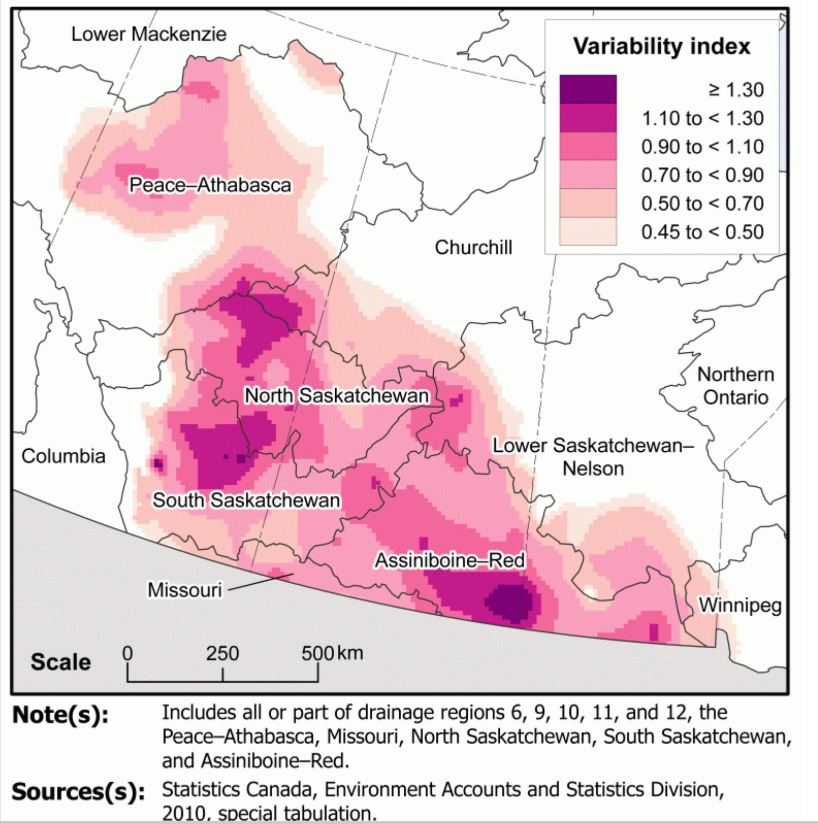




Level 2: Account 3: Water

- Canada’s Freshwater Supply and Demand





Source: Statistics Canada, 2010

Level 2: Account 3: Water

- 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?

Level 2: Account 3: Water

- Concepts Group exercise (15m)

- Group reports
  - Water issue you selected
  - The three measures you selected
  - Are national data available in your country for these measures?
- Discussion
  - What other measures could you suggest?
  - What other data sources could you suggest?

Level 2: Account 3: Water

- Discussion and questions
- Take home points
  - Water accounting can address a range of policies related to:
    - Improving access to drinking water and sanitation services
    - Managing water supply and demand
    - Improving the condition and services provided by water-related ecosystems
    - Adaptation to extreme events (flooding and drought)
  - 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

Level 2: Account 3: Water

- References

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- UNSD (2009) 5th World Water Forum Istanbul: Topic 6.4 Data for All, Turkey, http://unstats.un.org/unsd/envaccounting/workshops/wwf2009/topicOutline.pdf
- Vardon, M., Lenzen, M., Peevor, S., & Creaser, M. (2007). Water accounting in Australia. Ecological Economics, 61(4), 650-659.

- Further Information
  - SEEA Experimental Ecosystem Accounting (2012)
  - SEEA-EEA Technical Guidance (forthcoming)
    - Detailed supporting document on "Water and ecosystem accounting" by Michael Vardon

Evaluation of the training module

- Please complete the online evaluation form for this module: http://www.tinyurl.com/pbopmy2
- For this module
  - What did you learn that you could apply in your work?
  - Was the presentation clear and informative?
  - Was it too simple? Too complex?
  - Was there anything you did not understand?
  - What additions or deletions would you suggest (recognizing that the unit is intended for a general audience)?
  - Do you have any suggestions as to how the SEEA-EEA may be improved (concepts, principles) in this area?

Acknowledgements

- This project is a collaboration of The United Nations Statistics Division, United Nations Environment Programme and the Secretariat of the Convention on Biological Diversity and is supported by the Government of Norway.

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