

ГЛОБАЛЬНАЯ СИСТЕМА
НАБЛЮДЕНИЙ ЗА КЛИМАТОМ
НЕУСТАННО СЛЕДИМ ЗА КЛИМАТОМ

SYSTÈME MONDIAL
D'OBSERVATION DU CLIMAT
NOUS VEILLONS SUR LE CLIMAT

النظام العالمي
لرصد المناخ
لنضع المناخ نصب أعيننا

全球气候观测系统
密切监视气候

SISTEMA MUNDIAL
DE OBSERVACION DEL CLIMA
SIEMPRE VIGILANDO EL CLIMA

GLOBAL CLIMATE
OBSERVING SYSTEM
KEEPING WATCH OVER OUR CLIMATE

GCOS ECV Rationalization

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Chair GCOS Atmospheric Observations Panel for Climate

Chair, GCOS Task Team on ECV Rationalisation



**GLOBAL CLIMATE
OBSERVING SYSTEM**

KEEPING WATCH OVER OUR CLIMATE



Supported by the European Union



PART 1

INTRODUCTION

55 Essential Climate Variables



ECV Criteria

Observation is:

- Feasible
- Cost-effective
- Relevant

Atmosphere

Surface Ocean Physics



Ocean Biogeochemistry



Ocean Biology / Ecosystems



Subsurface Ocean Physics



Cryosphere



Anthroposphere



GCOS • WCRP

TOPC

Land

Biosphere



Hydrosphere



GCOS • GOOS • WCRP

GOOPC

Ocean



55 Essential Climate Variables... and 200 ECV products



Sea Ice



Sea ice variability is a key indicator of climate variability and change in the polar regions. The primary parameters that define the state of sea ice include: concentration, area and extent, ice type, motion, deformation, age, thickness, and volume. The presence of sea ice strongly modifies surface waves and air-sea exchanges of heat, momentum, moisture and gases. Sea ice has a significant impact on the Earth's albedo and hence changes in Sea Ice impact the global energy budget. The properties of many water masses of the global ocean and strongly influenced determined freezing and melting processes in sea ice regions.

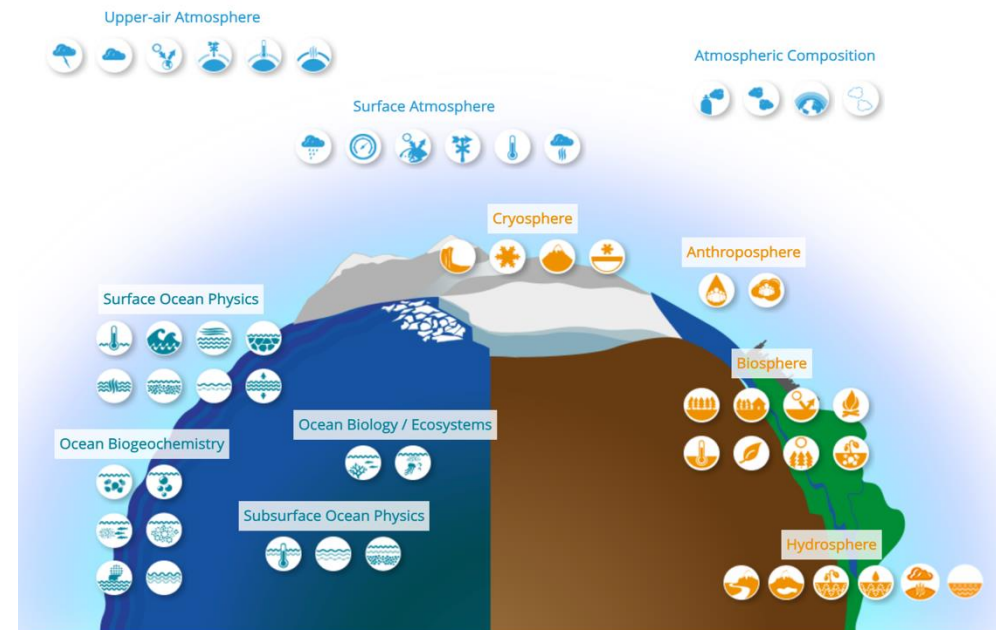
Domain:	Ocean
Subdomain:	Physical
Scientific Area:	Snow and Ice
ECV Steward:	Thomas Lavergne/Stefan Kern
Products:	Sea Ice Concentration; Sea Ice Thickness; Sea Ice Drift; Sea Ice Age; Sea Ice Temperature; Sea Ice Surface Albedo; Snow Depth on Sea Ice

Products are “measurable parameters needed to evaluate the ECV” (GCOS-245, 2022)

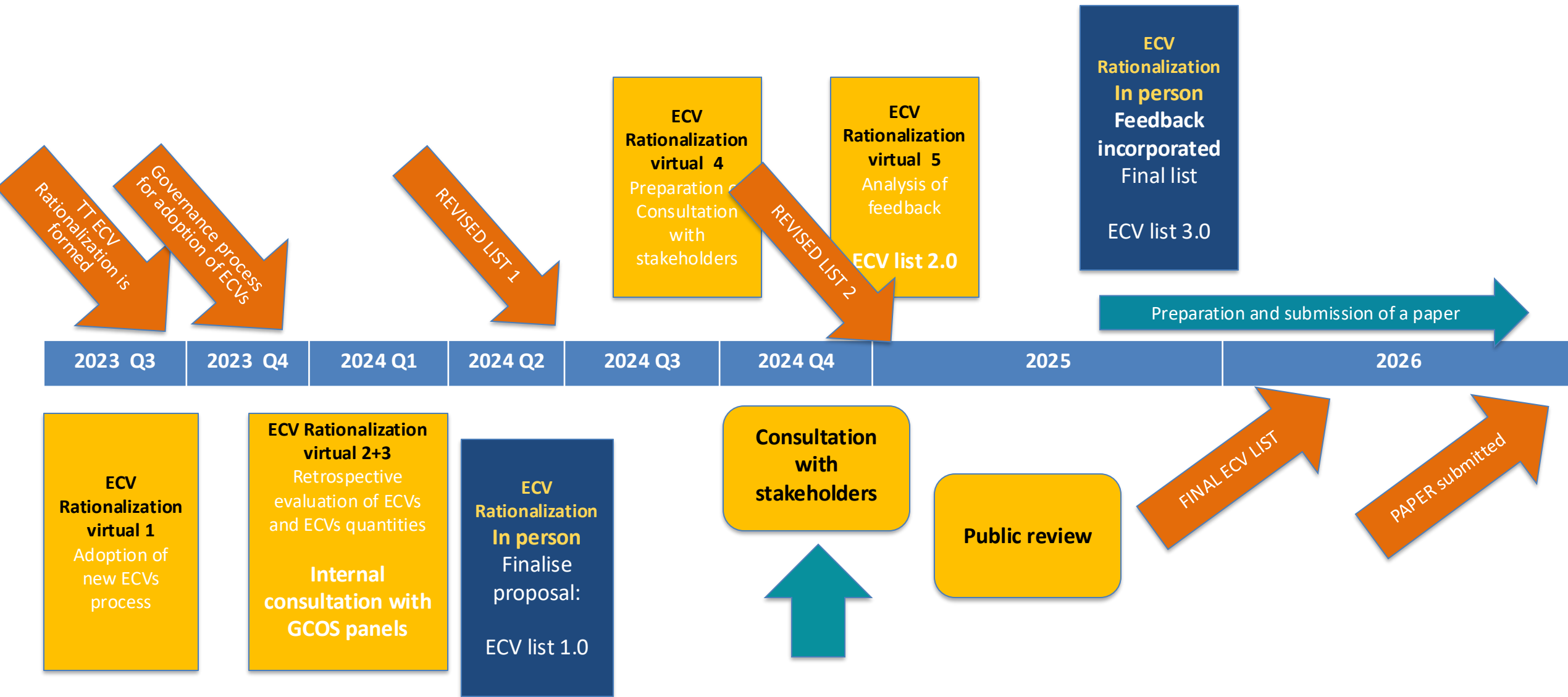
Why do we need an ECV Rationalization process

After 20 years of ECV framework:

- Are all the 55 Essential Climate Variables **still essential**? Are we **missing anything**?
- Is the **current grouping the best possible** one? Is it **balanced**? Is it **consistent** across domains and across earth cycles?
- Is there **enough transparency** and **coherence** in the process that leads to including a new ECV in the list?

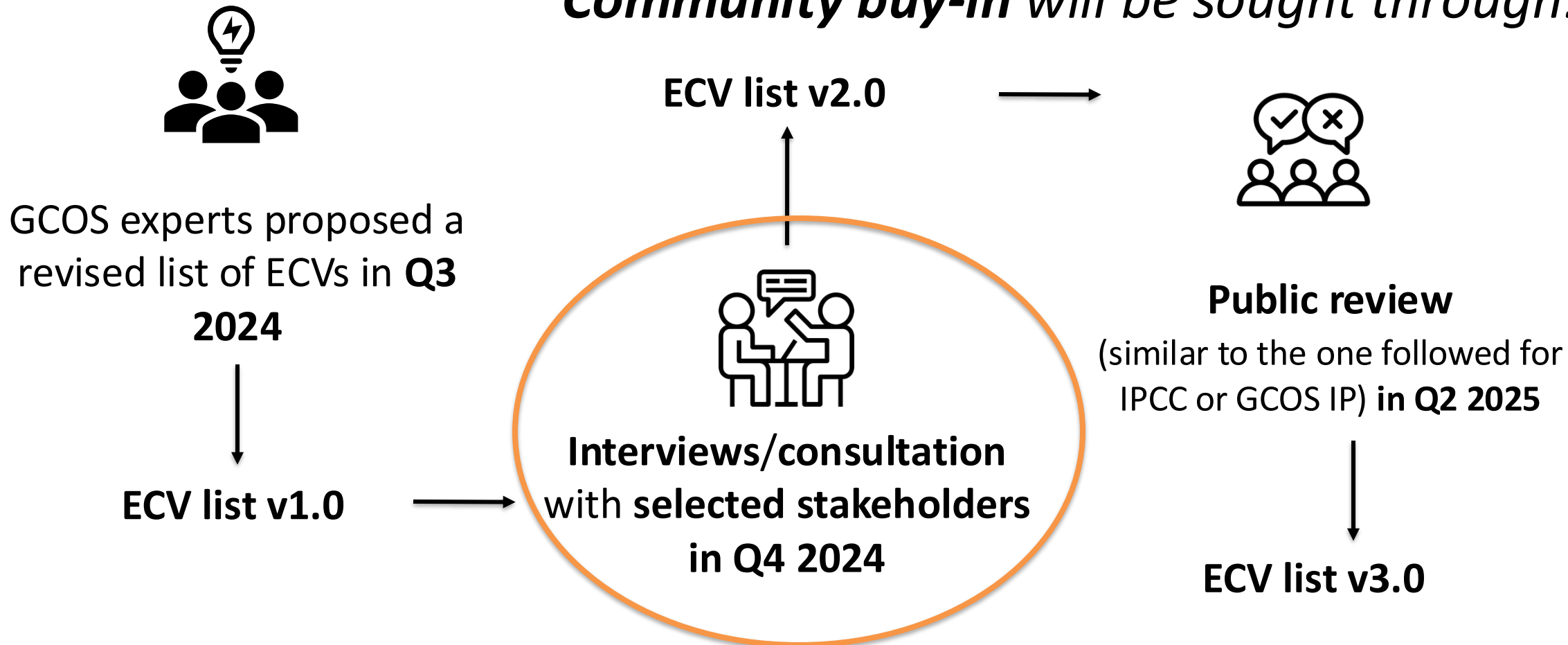


The ECV Rationalization process timeline



Understanding the consultation process

Community buy-in will be sought through:



The consultation with selected stakeholders allows them to **influence the process** before the public review

Understanding this interview



GCOS will take all feedback into account, but this is a multi-actor process with clear goals where **compromises will be needed**

- The ECV Rationalization process comprises:

- (1) the list of ECVs to be considered (ECVs are selected);
- (2) the quantities of the selected ECVs (ECV quantities);
- (3) the list of ECVs (ECV quantities) itself.

**NOTHING IS
FINAL UNTIL
EVERYTHING
IS FINAL**



IMPORTANT: focus on overall process before looking into the details (overall result of the ECV rationalization process, not specific ECVs/ECV quantities)

PART 2

MAIN OUTCOMES

GOVERNANCE: PROCESS TO ADOPT A NEW ECV

CURRENT

- Only **best practices**, not a formal process.
- Proposals to add ECVs are submitted by groups of experts (very often connected to the panels), and **panels evaluate them** according to the three main criteria: (1) feasibility; (2) cost-effectiveness; 3) relevance.
- **GCOS Steering Committee** takes the ultimate decision (to include or not the new ECV).
- The best practices **only concern the inclusion of new ECVs** to the list (not the ECV products).

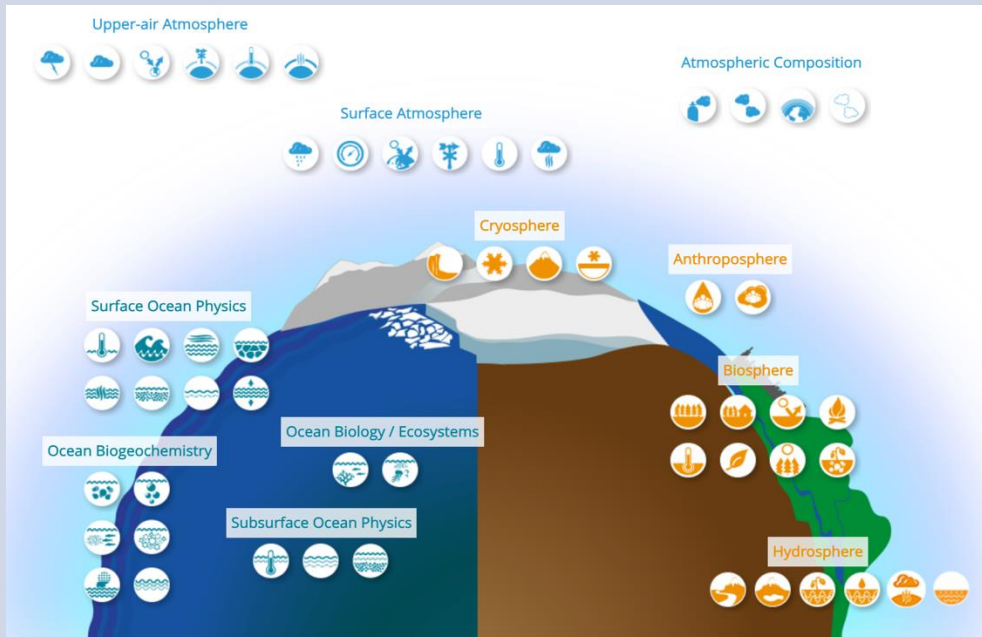
FUTURE

- **Formal process** designed including:
 - **Bodies involved** and **clear delineation of roles** between the panels, the GCOS Steering Committee, and a cross-panel ECV Board
 - **Instructions** on how to submit the proposal, and how to justify it, including a template
 - **Details** on the evaluation process and evaluation criteria including timeline
- The **process differentiates** between submission of new ECVs and submission of ECV products (now called quantities)

DEFINITIONS

CURRENT (GCOS-245, 2022)

- An **Essential Climate Variables (ECV)** is a physical, chemical or biological variable (or group of linked variables) that critically contributes to the characterization of Earth's climate.
- An **ECV product** is a measurable parameter needed to characterize the ECV.



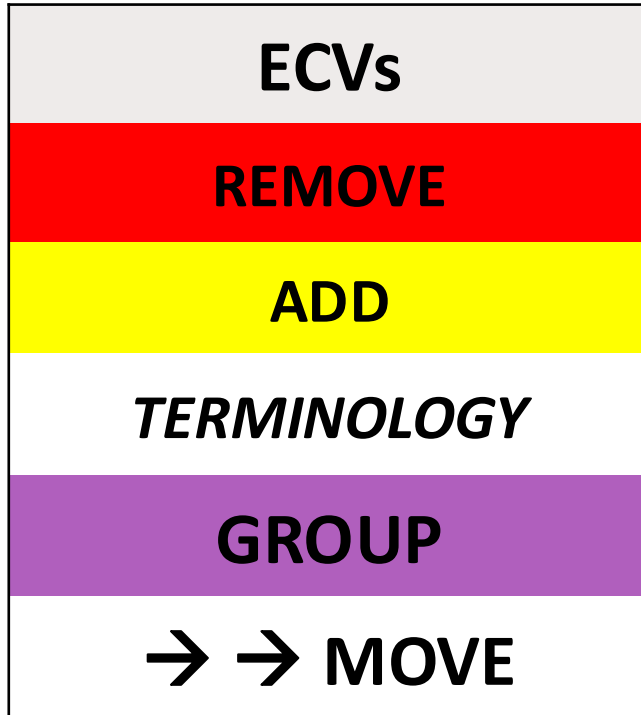
FUTURE

ECV products renamed as ECV quantities (to indicate more clearly that these are measurable aspects that can be quantified in some way) and the ECV definition has been modified to show that they can comprise multiple quantities.

- **ECV quantity:** property of phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference^[1]. An ECV may be described by one or more such quantities. ECV quantities can be physical, chemical or biological. Categorical quantities are possible (e.g. precipitation type, land cover class).
- An **Essential Climate Variable (ECV)** is a singular quantity or a collective set of well-defined quantities that critically contribute to the characterization of Earth's climate.

[1] [International vocabulary of metrology – Basic and general concepts and associated terms \(VIM\)](#)

CATEGORIES OF CHANGES



ECV quantities		
Remove	Remove	Remove
New	New	New
<i>→ Moved to another ECV</i>	<i>→ Moved to another ECV</i>	<i>→ Moved to another ECV</i>
<i>Terminology</i>	<i>Terminology</i>	<i>Terminology</i>

ECV



ECV quantities



Typology of changes



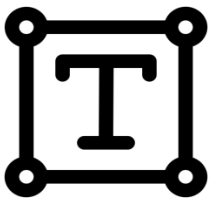
1. REMOVE : ■

- The Anthropogenic ECVs (GHG emissions and Water Use) have been removed.



2. ADD : ■

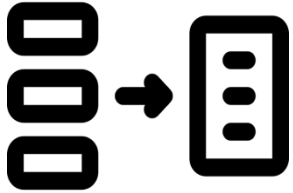
- There are 22 “new” ECVs which are the result of merging/regrouping.
- Some ECV quantities have been added for completeness and consistency. It remains to be double checked that there is sufficient observational capacity underpinning them.



3. CHANGE in terminology :

- For consistency, clarity of communication and policy relevance
Eg. Atmosphere, ocean, terrestrial preferred to air-sea-land; Ocean acidification instead of Inorganic carbon; no acronyms.

Typology of changes



4. GROUP :

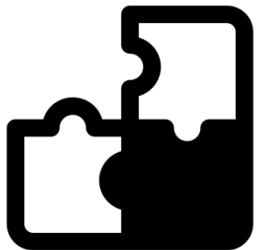


- Some ECVs were the same thing just at different heights or depths;
- Other ECVs or ECV quantities were repeated across panels (e.g. Albedo)



IMPORTANT: There are now **four cross-panel ECVs**

(CH₄ and Short-lived GHG, CO₂ and Long-lived GHG, Albedo, Turbulent Heat Fluxes)



5. MOVE :



- Some ECVs have become ECV quantities and are regrouped under new ECVs (e.g. Ocean tracers moved under Ocean circulation);
- ECV quantities have been re-located under a different ECV (Soil temperature moved under Soil Physics)

HALF OF THE ECVs REMAIN ESSENTIALLY UNCHANGED

Earth Radiation Budget

35

Solar spectral irradiance

36

Downward short-wave irradiance at top of the atmosphere

37

Upward long-wave irradiance at top of the atmosphere

38

Upward short-wave irradiance at top of the atmosphere

Ocean Nutrients

29

Silicate concentration

30

Phosphate concentration

31

Nitrate concentration

Glaciers

19

Glacier Area

20

Glacier Elevation Change

21

Glacier Mass Change

COMPARISON ORIGINAL – PROPOSED - AOPC OOPC TOPC

CURRENT

PROPOSAL

AOPC

OOPC

TOPC

AOPC

OOPC

TOPC

Air Pressure	1	Atmospheric pressure (near surface)
Surface Temperature	2	Air temperature (near surface)
Surface wind Speed and Direction	3	Wind speed (near surface)
	4	Wind direction (near surface)
	5	Wind vector (near surface)
Upper-air Temperature	6	Atmospheric temperature in the boundary layer
	7	Atmospheric temperature in the free troposphere
	8	Atmospheric temperature in the upper troposphere and lower stratosphere
	9	Atmospheric temperature in the middle and upper stratosphere
	10	Atmospheric temperature in the mesosphere
Upper-air Wind Speed and Direction	11	Wind (horizontal) in the boundary layer
	12	Wind (horizontal) in the free troposphere
	13	Wind (horizontal) in the upper troposphere and lower stratosphere
	14	Wind (horizontal) in the middle and upper stratosphere
	15	Wind (horizontal) in the mesosphere
	16	Wind (vertical) in the boundary layer
	17	Wind (vertical) in the free troposphere
	18	Wind (vertical) in the upper troposphere and lower stratosphere
	19	Wind (vertical) in the middle and upper stratosphere
	20	Wind (vertical) in the mesosphere
Surface Water Vapour	21	Relative Humidity (near surface)
	22	Air Specific Humidity (near surface)
Upper-air Water Vapour	23	Relative Humidity in the boundary layer
	24	Relative Humidity in the free troposphere
	25	Relative Humidity in the upper troposphere and lower stratosphere
	26	Relative Humidity in the middle and upper stratosphere
	27	Relative Humidity in the mesosphere
	28	Specific Humidity in the boundary layer
	29	Specific Humidity in the free troposphere
	30	Specific Humidity in the upper troposphere and lower stratosphere
	31	Specific Humidity in the middle and upper stratosphere
	32	Specific Humidity in the mesosphere
	33	Integrated Water Vapour
Precipitation	34	Accumulated precipitation
Surface Radiation Budget	35	Downward Short-Wave Irradiance at Earth Surface
	36	Downward Long-Wave Irradiance at Earth Surface
	37	Upward Long-Wave Irradiance at Earth Surface
Earth Radiation Budget	38	Solar Spectral Irradiance
	39	Downward Short-Wave Irradiance at Top of the Atmosphere
	40	Upward Long-Wave Irradiance at Top of the Atmosphere
	41	Upward Short-Wave Irradiance at Top of the Atmosphere
	42	Radiation Profile
Cloud Properties	43	Cloud Cover
	44	Cloud Liquid Water Path
	45	Cloud Ice Water Path
	46	Cloud Drop Effective Radius
	47	Cloud Optical Depth
	48	Cloud Top Temperature
	49	Cloud Top Height
Lightning	50	Total Lightning Stroke Density
	51	Schumann Resonances
Carbon Dioxide, Methane and Other Greenhouse Gases	52	CO2 Mole Fraction
	53	CO2 Column Average Dry Air Mixing Ratio
	54	CH4 Mole Fraction
	55	CH4 Column Average Dry Air Mixing Ratio
	56	N2O Mole Fraction
Ozone	57	Ozone Mole Fraction in the Troposphere
	58	Ozone Mole Fraction in the Upper Troposphere/ Lower Stratosphere
	59	Ozone Mole Fraction in the Middle and Upper Stratosphere
	60	Ozone Total Column
	61	Ozone Stratospheric Column
Precursors (Supporting the aerosol and ozone ECVs)	62	CO Tropospheric Column
	63	CO Mole Fraction
	64	HCHO Tropospheric Column
	65	SO2 Tropospheric Column
	66	SO2 Stratospheric Column
	67	NO2 Tropospheric Column
	68	NO2 Mole Fraction
Aerosols Properties	69	Aerosol Light Extinction Vertical Profile (Troposphere)
	70	Aerosol Light Extinction Vertical Profile (Stratosphere)
	71	Multi-wavelength Aerosol Optical Depth
	72	Aerosol Single Scattering Albedo
	73	Chemical Composition of Aerosol Particles
	74	Number of Cloud Condensation Nuclei
	75	Aerosol Number Size Distribution

Sea-Surface temperature	1	Sea-Surface temperature
Subsurface Temperature	2	Interior Temperature
Sea-Surface Salinity	3	Sea-Surface Salinity
Subsurface Salinity	4	Interior Salinity
Sea Ice	5	Sea Ice Concentration
	6	Sea Ice Thickness
	7	Sea Ice Drift
	8	Sea Ice Age
	9	Sea Ice Surface Temperature
	10	Sea Ice Surface Albedo
	11	Snow Depth on Sea Ice
Surface Currents	12	Surface Geostrophic Current
	13	Eulerian Currents
Subsurface Currents	14	Vertical Mixing
Sea Level	15	Regional Mean Sea Level
	16	Global Mean Sea Level
Sea State	17	Wave Height
Ocean Surface Heat Flux	18	Sensible Heat Flux
	19	Latent Heat Flux
Oxygen	20	Dissolved Oxygen Concentration
Nutrients	21	Silicate
	22	Phosphate
	23	Nitrate
Ocean Inorganic Carbon	24	Total Alkalinity
	25	Dissolved Inorganic Carbon
	26	pCO2
Transient Tracers	27	14C
	28	SF6
	29	CFC-11
	30	CFC-12
Ocean nitrous oxide N2O	31	nitrous oxide
	32	N2O Air-Sea Flux
Ocean Colour	33	Water-Leaving Radiance
	34	Chlorophyll-a concentration
Plankton	35	Zooplankton Diversity
	36	Zooplankton Biomass
	37	Phytoplankton Diversity
	38	Phytoplankton Biomass
Marine Habitat Properties	39	Mangrove Cover and Composition
	40	Seagrass Cover (areal extent)
	41	Macrhalgal Canopy Cover and Composition
	42	Hard coral cover and composition

Groundwater	1	Groundwater Storage Change
	2	Groundwater Level
Lakes	3	Lake Ice Extent
	4	Lake Ice Thickness
	5	Lake Ice Cover
	6	Lake Ice Cover Extent
	7	Lake Ice Thickness
	8	Lake Water-Leaving Radiance
Rivers	9	River discharge
	10	River Water Level
Soil Moisture	11	Surface Soil Moisture
	12	Froze/Thaw
	13	Surface Humidity
	14	Root-Zone Soil Moisture
Terrestrial Water Storage	15	Terrestrial Water Storage Anomaly
Snow	16	Snow Cover Extent
	17	Snow Depth
	18	Snow Water Equivalent
Glaciers	19	Glacier Area
	20	Glacier Elevation Change
	21	Glacier Mass Change
Ice Sheets and Ice Shelves	22	Ice Surface Elevation Change
	23	Ice Sheet and Ice Shelves Velocity
	24	Ice Volume Change
	25	Ice Grounding Line Location
Permafrost	26	Permafrost Temperature
	27	Permafrost Active Layer Thickness
	28	Rock Glacier Velocity
Fraction of FAPAR	29	Fraction of Absorbed Photosynthetically Active Radiation
Leaf Area Index	30	Leaf Area Index (LAI)
Albedo	31	Spectral and Broadband (Visible, Near Infrared and Shortwave) DHR & BHR with Associated Spectral Bidirectional Reflectance Distribution Function (BRDF) Parameters
Land-Surface Temperature	32	Land Surface Temperature
	33	Soil temperature
Above-Ground Biomass	34	Above-Ground Biomass (AGB)
Land Cover	35	Land Cover Type
	36	Maps of High-Resolution Land-Cover
	37	Maps of Key-URCC Land-Cover, Related Changes and Land-Management-Etaps
Soil carbon	38	Carbon in Soil
	39	Mineral-Goil Bulk-Density
	40	Peatlands
Fire	41	Burned Area
	42	Active Fires
	43	Fire Radiative Power
Anthropogenic Greenhouse-Gas Fluxes	44	Anthropogenic CO2-Emissions from Fossil-Fuel-Use, Industry, Agriculture, Waste and Product-Use
	45	Anthropogenic CH4-Emissions from Fossil-Fuel-Use, Industry, Intensive-Agriculture and Fuel-Use
	46	Anthropogenic N2O-Emissions from Fossil-Fuel-Use, Industry, Agriculture, Waste and Product-Use, Intense from N-Related-Emissions-Operations
	47	Anthropogenic F-Gas-Emissions from Industrial-Processes and Product-Use
	48	Total-Estimated-Fluxes by Coupled-Data-Assimilation-Models with Observed-Atmospheric-Composition-National
	49	Total-Estimated-Fluxes by Coupled-Data-Assimilation-Models with Observed-Atmospheric-Composition-Global
	50	High-Resolution-Footprint-Around-Point-Counters
Evaporation from Land	51	Sensible Heat Flux
	52	Latent Heat Flux
	53	Base-Soil-Evaporation
	54	Interception-Loss
	55	Transpiration
Anthropogenic Water Use	56	Anthropogenic-Water-Use

Atmospheric Surface Pressure	1	Atmospheric pressure (near surface)
Atmospheric Temperature	2	Atmospheric temperature (near surface)
	3	Atmospheric temperature in the boundary layer
	4	Atmospheric temperature in the free troposphere
	5	Atmospheric temperature in the upper troposphere and lower stratosphere
	6	Atmospheric temperature in the middle and upper stratosphere
	7	Atmospheric temperature in the mesosphere
Atmospheric Winds	8	Wind speed (near surface)
	9	Wind direction (near surface)
	10	Wind vector (near surface)
	11	Wind vector (horizontal) in the boundary layer
	12	Wind vector (horizontal) in the free troposphere
	13	Wind vector (horizontal) in the upper troposphere lower stratosphere
	14	Wind vector (horizontal) in the middle and upper stratosphere
	15	Wind (vertical) in the boundary layer
	16	Wind (vertical) in the free troposphere
	17	Wind (vertical) in the upper troposphere lower stratosphere
	18	Wind (vertical) in the middle and upper stratosphere
Atmospheric Water Vapour	19	Atmospheric relative humidity (near surface)
	20	Atmospheric specific humidity (near surface)
	21	Atmospheric relative humidity in the boundary layer
	22	Atmospheric relative humidity in the free troposphere
	23	Atmospheric relative humidity in the upper troposphere and lower stratosphere
	24	Atmospheric specific humidity in the boundary layer
	25	Atmospheric specific humidity in the free troposphere
	26	Atmospheric specific humidity in the upper troposphere and lower stratosphere
	27	Atmospheric integrated water vapour
Precipitation	28	Accumulated precipitation
	29	Convective-type
	30	Stratiform-type
Surface Radiation Budget	31	Downward short-wave irradiance at earth surface
	32	Downward long-wave irradiance at earth surface
	33	Upward long-wave irradiance at earth surface
Earth Radiation Budget	34	Solar spectral irradiance
	35	Downward short-wave irradiance at top of the atmosphere
	36	Upward long-wave irradiance at top of the atmosphere
	37	Upward short-wave irradiance at top of the atmosphere
Clouds	38	Cloud cover
	39	Cloud liquid water path
	40	Cloud ice water path
	41	Cloud drop effective radius
	42	Cloud optical depth
	43	Cloud top temperature
	44	Cloud top height
Lightning	45	Total lightning stroke density
	46	Schumann resonance
Ozone and its precursors	47	Ozone mole fraction in the free troposphere
	48	Ozone mole fraction in the upper troposphere/ lower stratosphere
	49	Ozone mole fraction in the middle and upper stratosphere
	50	Ozone total column
	51	Ozone tropospheric column
	52	Ozone stratospheric column
	53	CO tropospheric column
	54	CO mole fraction
	55	HCHO tropospheric column
	56	NO2 tropospheric column
	57	NO2 mole fraction
Aerosols and its precursors	58	Aerosol light extinction vertical profile in the troposphere
	59	Aerosol light extinction vertical profile in the stratosphere
	60	Multi-wavelength aerosol optical depth
	61	Aerosol single scattering albedo
	62	Chemical composition of aerosol particles
	63	Number of cloud condensation nuclei
	64	Aerosol number size distribution
	65	SO2 tropospheric column
	66	SO2 stratospheric column

Ocean Temperature	1	Surface ocean temperature
Ocean Salinity	2	Surface ocean salinity
	3	Subsurface ocean salinity
Sea Ice	4	Sea ice concentration
	5	Sea ice thickness
	6	Sea ice drift
	7	Sea ice age
	8	Sea ice surface temperature
	9	Snow depth on sea ice
Ocean Circulation	10	Ocean surface velocity
	11	Ocean surface velocity
	12	Transient tracer concentrations
Sea Level	13	Wave height
Sea State	14	Wave height
	15	Wave period
Ocean Surface Wind Stress	16	Ocean surface wind stress vector
Ocean Acidification	17	Total alkalinity
	18	Dissolved inorganic carbon
	19	pCO2
Ocean Dissolved Gases	20	Dissolved oxygen concentration
	21	nitrous oxide concentration
Ocean Nutrients	22	Silicate concentration
	23	Phosphate concentration
	24	Nitrate concentration
Ocean Organic Carbon Storage	25	Ocean biomass carbon storage (phytoplankton, zooplankton, ...)
	26	Blue carbon habitats (mangroves, seagrass, saltmarshes, macroalgae)
Ocean Colour and Productivity	27	Chlorophyll-a concentration
	28	Flow active productivity
	29	Flow passive productivity
	30	Flow total productivity
	31	Flow net productivity
	32	Flow gross primary production
	33	Flow net primary production
	34	Flow gross community production
	35	Flow net community production
	36	Flow total community production
	37	Flow net community production
	38	Flow gross community production
	39	Flow net community production
	40	Flow gross community production
	41	Flow net community production
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	97	Flow net community production
	98	Flow gross community production
	99	Flow net community production
	100	Flow gross community production

Groundwater	1	Groundwater storage change
	2	Groundwater level
Lakes	3	Lake Ice Extent
	4	Lake Ice Thickness
	5	Lake Ice Cover
	6	Lake Ice Cover Extent
	7	Lake Ice Thickness
	8	Lake Water-Leaving Radiance
Rivers	9	River discharge
	10	River water level
Soil physics	11	Surface Soil Moisture
	12	Froze/Thaw
	13	Surface Humidity
	14	Root-Zone Soil Moisture
Terrestrial Water Storage	15	Terrestrial water storage anomaly
Snow	16	Snow cover extent
	17	Snow depth
	18	Snow water equivalent
Glaciers	19	Glacier Area
	20	Glacier Elevation change
	21	Glacier Mass change
Ice Sheets and Ice Shelves	22	Ice Surface Elevation change
	23	Ice Sheet and ice shelves velocity
	24	Ice volume change
	25	Ice grounding line location
Permafrost	26	Permafrost temperature
	27	Permafrost active layer thickness
	28	Rock glacier velocity
Land Surface Temperature	29	Land surface temperature
Land Cover and Use	30	Land cover type
	31	Maps of High-Resolution Land-Cover
	32	Maps of Key-URCC Land-Cover, Related Changes and Land-Management-Etaps
Fire	33	Burned area
	34	Active fires
	35	Fire radiative power
Terrestrial carbon storage	36	Vegetation height
	37	Vegetation type and species
	38	Aboveground biomass carbon stocks
	39	Peatland
	40	Organic carbon stocks in soils
Vegetation productivity	41	Fraction of absorbed photosynthetically active radiation
	42	Flow active productivity
	43	Flow passive productivity
	44	Flow total productivity
	45	Flow net productivity
	46	Flow gross primary production
	47	Flow net primary production
	48	Flow gross community production
	49	Flow net community production
	50	Flow total community production
	51	Flow net community production
	52	Flow gross community production
	53	Flow net community production
	54	Flow gross community production
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	82	Flow gross community production
	83	Flow net community production
	84	Flow gross community production
	85	Flow net community production
	86	Flow gross community production
	87	Flow net community production

Categories of changes: REMOVE

ORIGINAL

PROPOSED

57	Anthropogenic Water Use	Anthropogenic Water Use
44	Anthropogenic Greenhouse-Gas Fluxes	Anthropogenic CO2 Emissions from Fossil Fuel Use, Industry, Agriculture, Waste and Products Use
45		Anthropogenic CH4 Emissions from Fossil Fuel, Waste, Agriculture, Industrial Processes and Fuel Use
46		Anthropogenic N2O Emissions from Fossil Fuel Use, Industry, Agriculture, Waste and Products Use, Indirect from N-Related Emissions/Depositions
47		Anthropogenic F-Gas Emissions from Industrial Processes and Product Use
48		Total Estimated Fluxes by Coupled Data Assimilation/Models with Observed Atmospheric Composition — National
49		Total Estimated Fluxes by Coupled Data Assimilation/Models with Observed Atmospheric Composition — Continental
50		Anthropogenic CO2 Emissions/Removals by Land Categories
51		High-Resolution Footprint Around Point Sources



Categories of changes: *TERMINOLOGY*

Consistency
Comprehension
Clarity

ECV

AOPC

OOPC

TOPC

ECV quantities

AOPC

OOPC

TOPC

Cloud *Properties*

Atmospheric *Surface Pressure*

Ocean Nutrients

Blue carbon habitats (mangroves, seagrass, saltmarshes, macroalgae)

Ocean surface *wind stress vector*

Lake Water Level (*LWL*)

Seasonal freeze/thaw

Peatland *volume*

Categories of changes: GROUP + ADD

ORIGINAL

PROPOSED

AOPC

Surface Temperature

2

Air *Atmospheric* temperature (near surface)

Upper-air Temperature

6

Atmospheric temperature in the boundary layer

7

Atmospheric temperature in the free troposphere

8

Atmospheric temperature in the upper troposphere and lower Stratosphere

9

Atmospheric Temperature in the Middle and Upper Stratosphere

10

Atmospheric Temperature in the Mesosphere

Atmospheric Temperature

2

Atmospheric temperature (near surface)

3

Atmospheric temperature in the boundary layer

4

Atmospheric temperature in the free troposphere

5

Atmospheric temperature in the upper troposphere and lower stratosphere

6

Atmospheric temperature in the middle and upper stratosphere

7

Atmospheric temperature in the mesosphere

Categories of changes: **GROUP** - ECV quantity moved

ORIGINAL

PROPOSED

OOPC

Ocean Surface Heat Flux

19
20
21

-Radiative Heat Flux
--> Sensible Heat Flux
--> Latent Heat Flux

TOPC

Evaporation from Land

52
53
54
55
56

--> Sensible Heat Flux
--> Latent Heat Flux
Bare Soil Evaporation
Interception Loss
Transpiration

CROSS-PANEL

Surface Turbulent Heat Fluxes

1
2
3
4

Sensible heat flux ocean-atmosphere
Latent heat (evaporation) flux ocean-atmosphere
Sensible heat flux terrestrial-atmosphere
Latent heat (evapotranspiration) flux terrestrial-atmosphere

Categories of changes: **GROUP** + → ECV moved

ORIGINAL

OOPC

Surface Currents

12
13

~~Surface Geostrophic Current~~
~~Ekman Currents~~

Subsurface Currents

14

~~Vertical Mixing~~

Transient Tracers

29
30
31
32

--> 14C
--> SF₆
--> CFC-11
--> CFC-12

PROPOSED

OOPC

Ocean Circulation

13
14
15
16

Ocean surface velocity
Ocean subsurface velocity
Transient tracer *concentrations*
Turbulent diapycnal fluxes

ECV+4 quantities converted into one single ECV quantity

OVERVIEW

ORIGINAL

Number of ECVs (Total = **55**)

AOPC = 16 *OOPC = 19* *TOPC = 20*

ECV products (Total = **177**)

AOPC = 76 *OOPC = 44* *TOPC = 57*

23 out of 55 ECVs remain essentially unchanged

PROPOSED

Number of ECVs (Total **42**)

AOPC = 11 *OOPC = 12* *TOPC = 15* *CP = 4*

ECV quantities (Total = **170**)

AOPC = 70 *OOPC = 39* *TOPC = 45* *CP = 16*

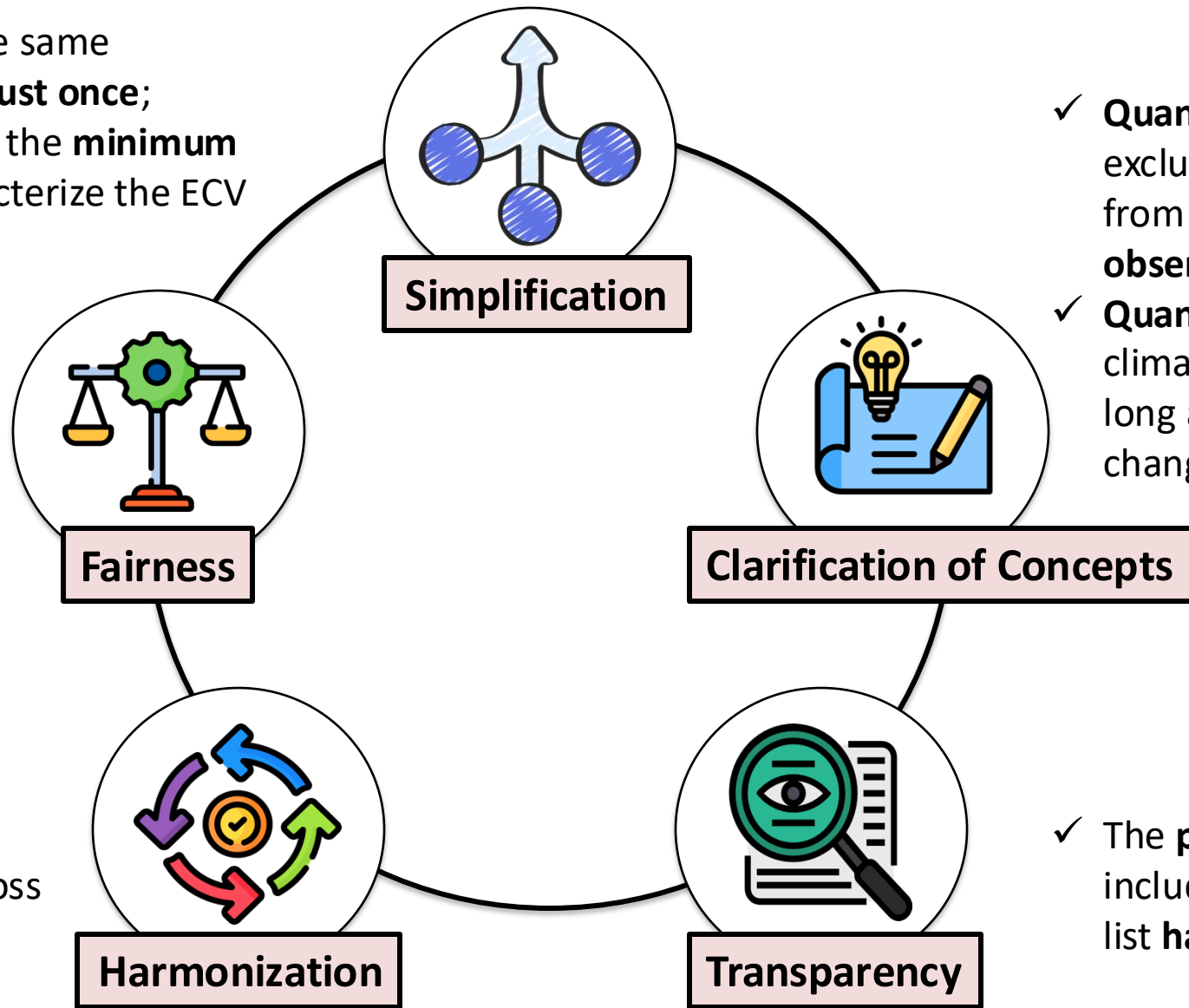
All new ECVs are the result of grouping/moving previous ECVs

What has been achieved

- ✓ **Variables** that refer to the same property **should appear just once**;
- ✓ **ECV quantities** should be the **minimum number** needed to characterize the ECV

- ✓ The **current grouping** is **more balanced** in terms of the weight given to the ECVs and ECV quantities

- ✓ The terminology is more **consistent** across panels



- ✓ **Quantities** cannot be based exclusively in statistics/derived from models, they **must be observed**;
- ✓ **Quantities** that **show impact** (of climate change) **can be ECVs**, as long as they inform on climate change

- ✓ The **process** that leads to including a new variable in the list **has been defined**

PART 3

NEXT STEPS AND DISCUSSION

Next steps post-interview


Word document with instructions and extra comments

GCOS consultation on Rationalising the Essential Climate Variables:

How to provide feedback after the one-to-one interviews

The **ECVs_Rationalization_Proposed-ECV list v1.0.xlsl** file compiles both the original list of ECV and ECV products (now called quantities) as they were published in 2022 GCOS Requirements document AND the proposed new list of ECV and ECV quantities.

The list of ECV and ECV products/quantities are presented by panel (AOPC, OOPC, TOPC). There are two tabs per panel, one for the original list and one for the proposed list.

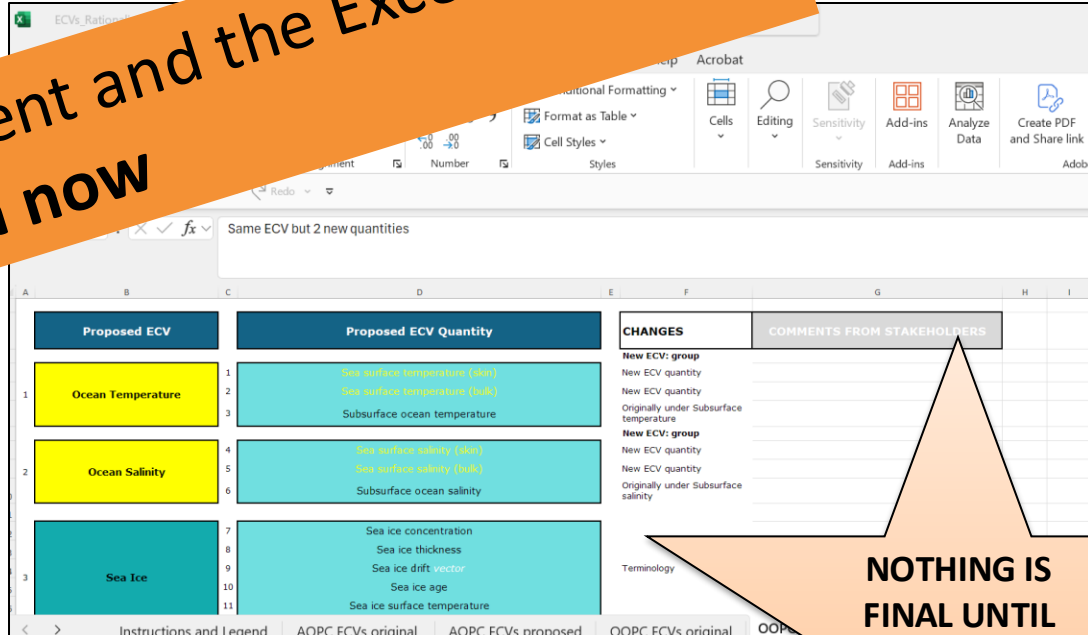


ECVs and ECV products have been renamed as ECV quantities (to indicate more quantifiable aspects that can be quantified in some way) and the ECV quantities have been modified to show that they can comprise multiple quantities.

- An **Essential Climate Variable (ECV)** is a singular quantity or a collective set of well-defined quantities that critically contribute to the characterization of Earth's climate. ECV quantities can be physical, chemical or biological.
- An **ECV Quantity** is a property of phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference ([International Vocabulary of Metrology – Basic and general concepts and associated terms \(VIM\)](#)). An ECV may be described by one or more such quantities. Categorical quantities are possible (e.g. precipitation type, land cover class).

You are invited to use **Column G** to provide specific feedback in the tabs proposing ECV and ECV quantities (one tab for AOPC, OOPC and TOPC, plus a cross-panel tab), as well as in the original lists for the three panels. A couple of examples of possible feedback are given below. You are not expected to fill in Column G for all the rows, only when you have something to comment/add/modify.

Annotated Excel sheet with the collated feedback of your organization



Same ECV but 2 new quantities

Please provide the Word document and the Excel file in 3 weeks from now

NOTHING IS FINAL UNTIL EVERYTHING IS FINAL

But before that: looking at the global picture...

1. Do you agree that **there is value** in ECV rationalization and strengthening the governance process?
2. What **challenges** and/or **opportunities** would these changes bring to you and your operations?
3. Is there anything that is **obviously missing** or **wrong**?
4. Do you have **any other comments**?

Thank you!



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