GCOS-Austria Online-Meeting

Contribution of the ZAMG Sonnblick Observatory to GCOS
Beitrag des ZAMG Sonnblick Observatoriums zu GCOS

von

Dr. Elke Ludewig

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SONNBLICK 3106 m est. 1886 OBSERVATORY

ZAMG Zentralanstalt für Meteorologie und Geodynamik

Contribution of the ZAMG Sonnblick Observatory to GCOS

Sonnblick Observatory (SBO)
climate and environmental research station at 3.106m

1886 — **135 years** — 2021 +

climate monitoring

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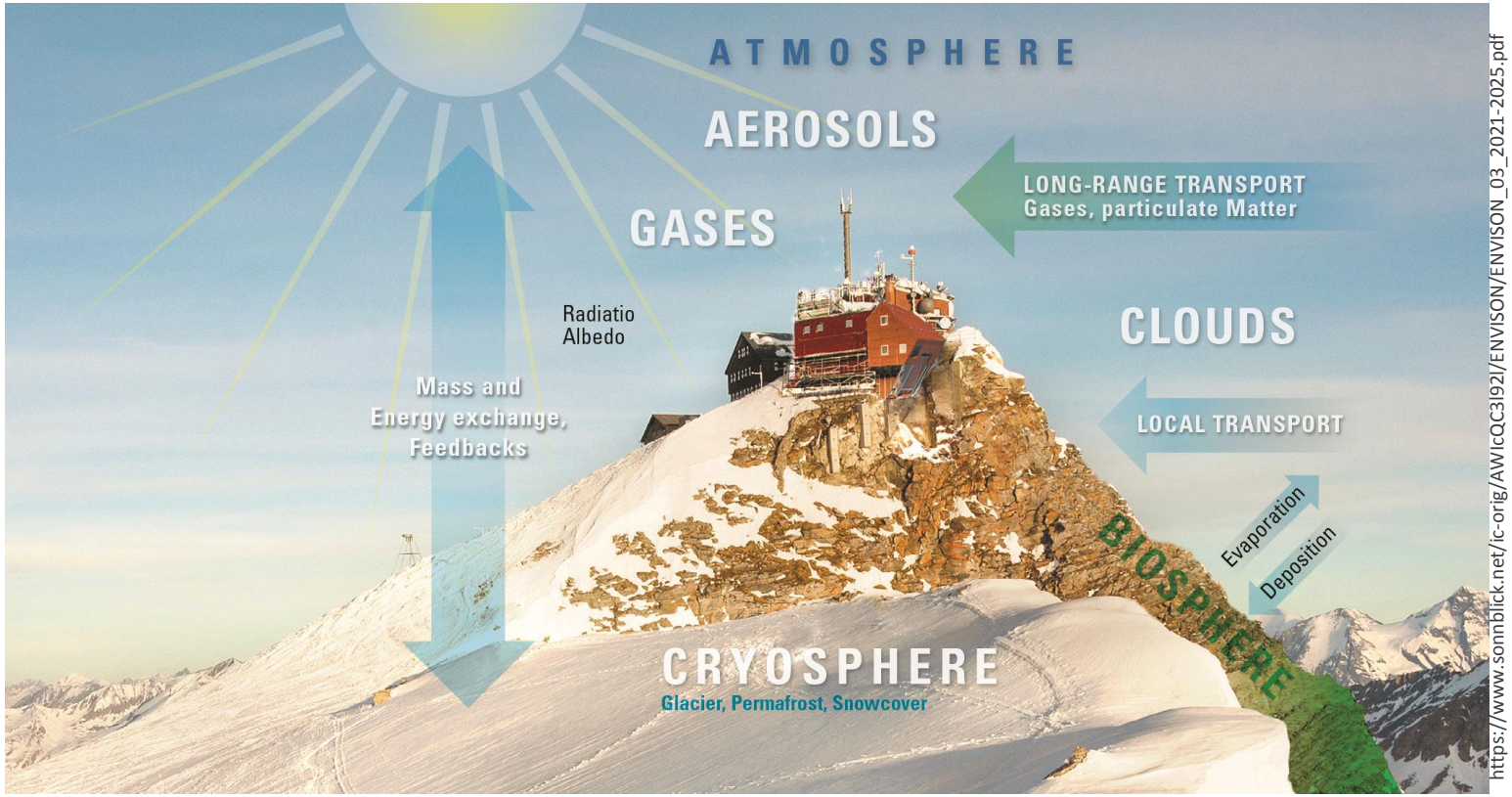
Forschungskonzept: “ENVISON”

ENVIronmental Research and Monitoring **SONN**BLICK
Programme 2021-2025

ENVISON-2025



https://www.sonnblick.net/ic-orig/AWIcQC3192I/ENVISON/ENVISON_03_2021-2025.pdf

NDACC

GLOBAL ATMOSPHERE WATCH

GCW Global Cryosphere Watch

WRMC-BSRN
World Radiation Monitoring Center-
Baseline Surface Radiation Network

ACTRiS

LTER Austria
Austrian Long-Term Ecosystem Research Network

[...]

→ considering GCOS indicators and variables

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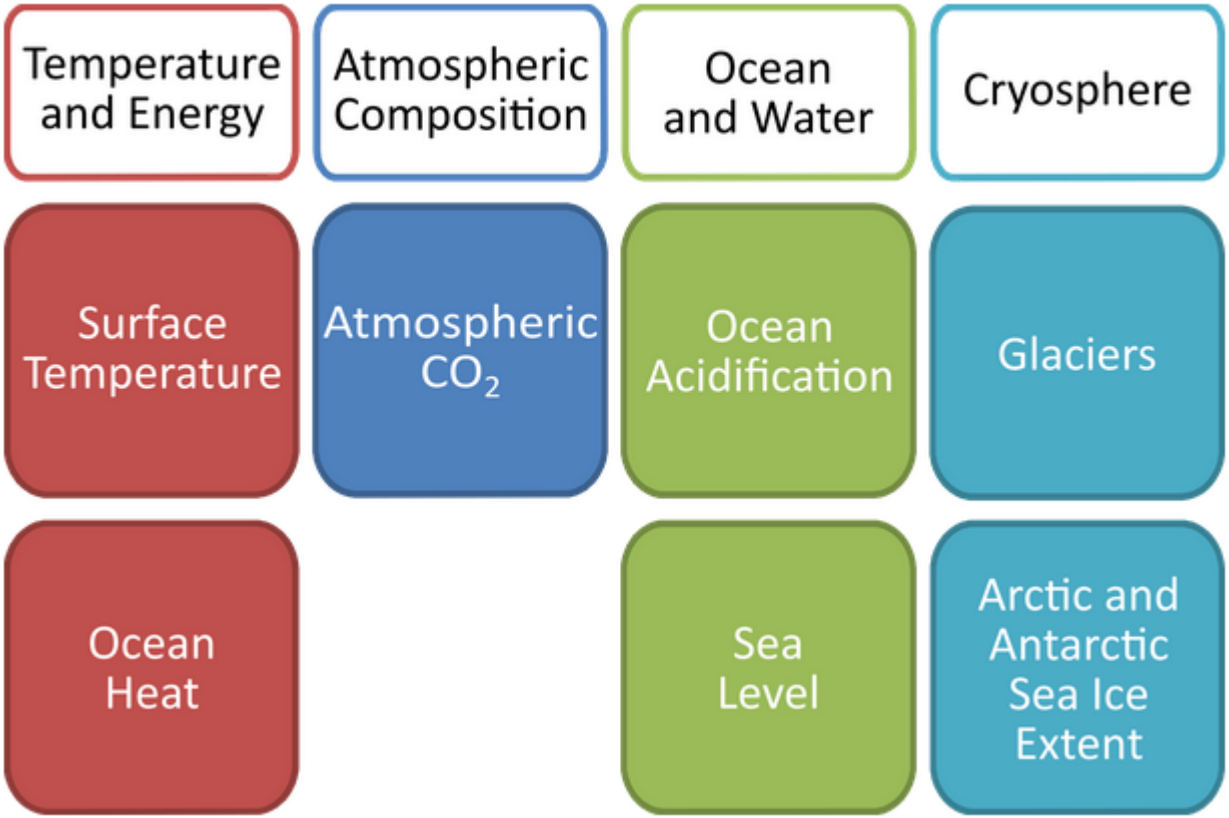
Global Climate Indicators

Internationale Bedeutung: internationale Messprogramme



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Global Climate Indicators

Use of GCOS at SBO

Temperature and Energy	Atmospheric Composition	Ocean and Water	Cryosphere
Surface Temperature	Atmospheric CO_2	Ocean Acidification	Glaciers
Ocean Heat		Sea Level	Arctic and Antarctic Sea Ice Extent

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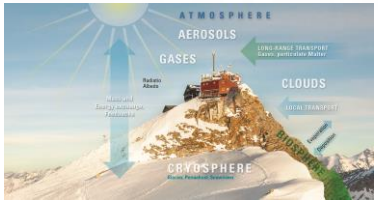
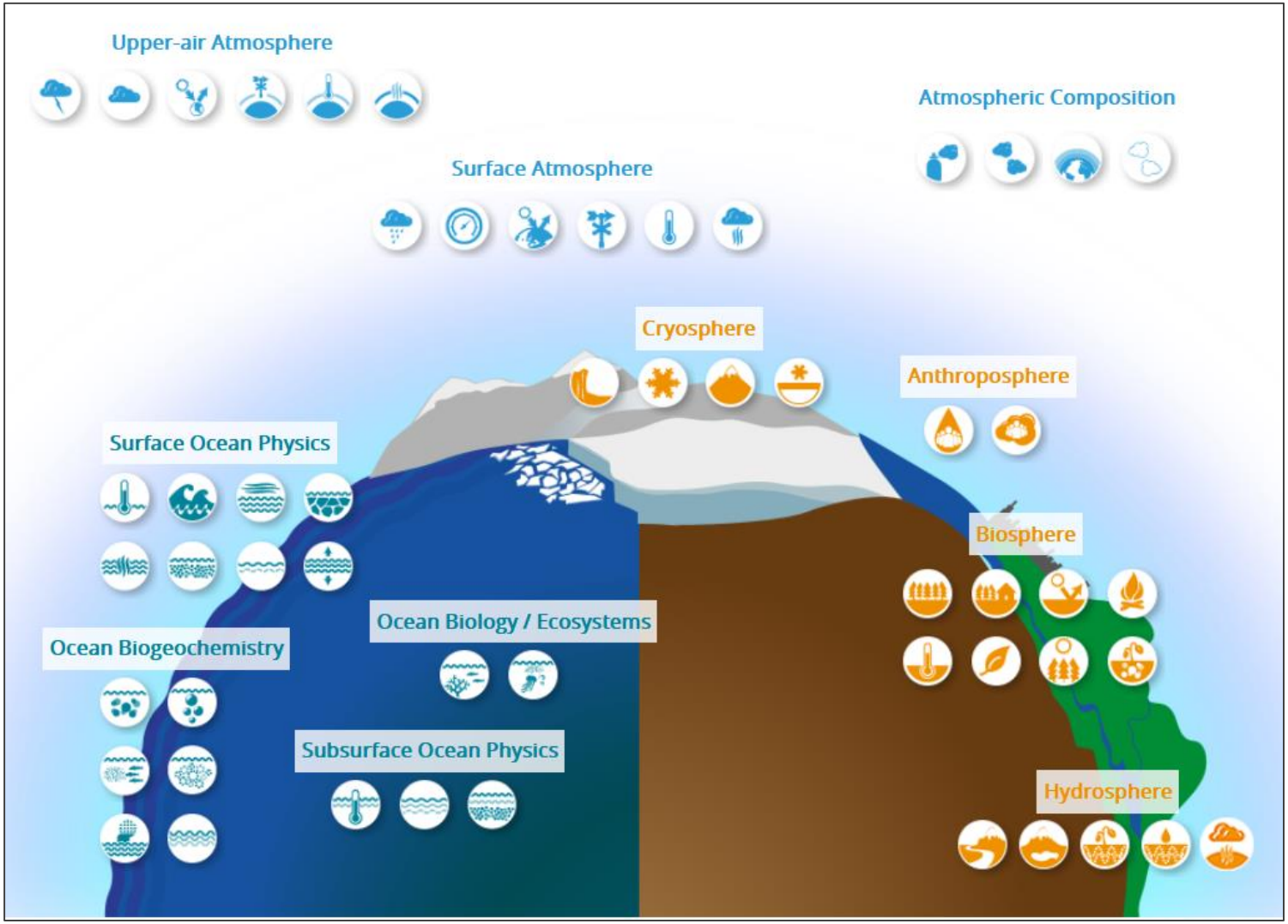
Essential Climate Variables





https://gcos.wmo.int/en/essential-climate-variables

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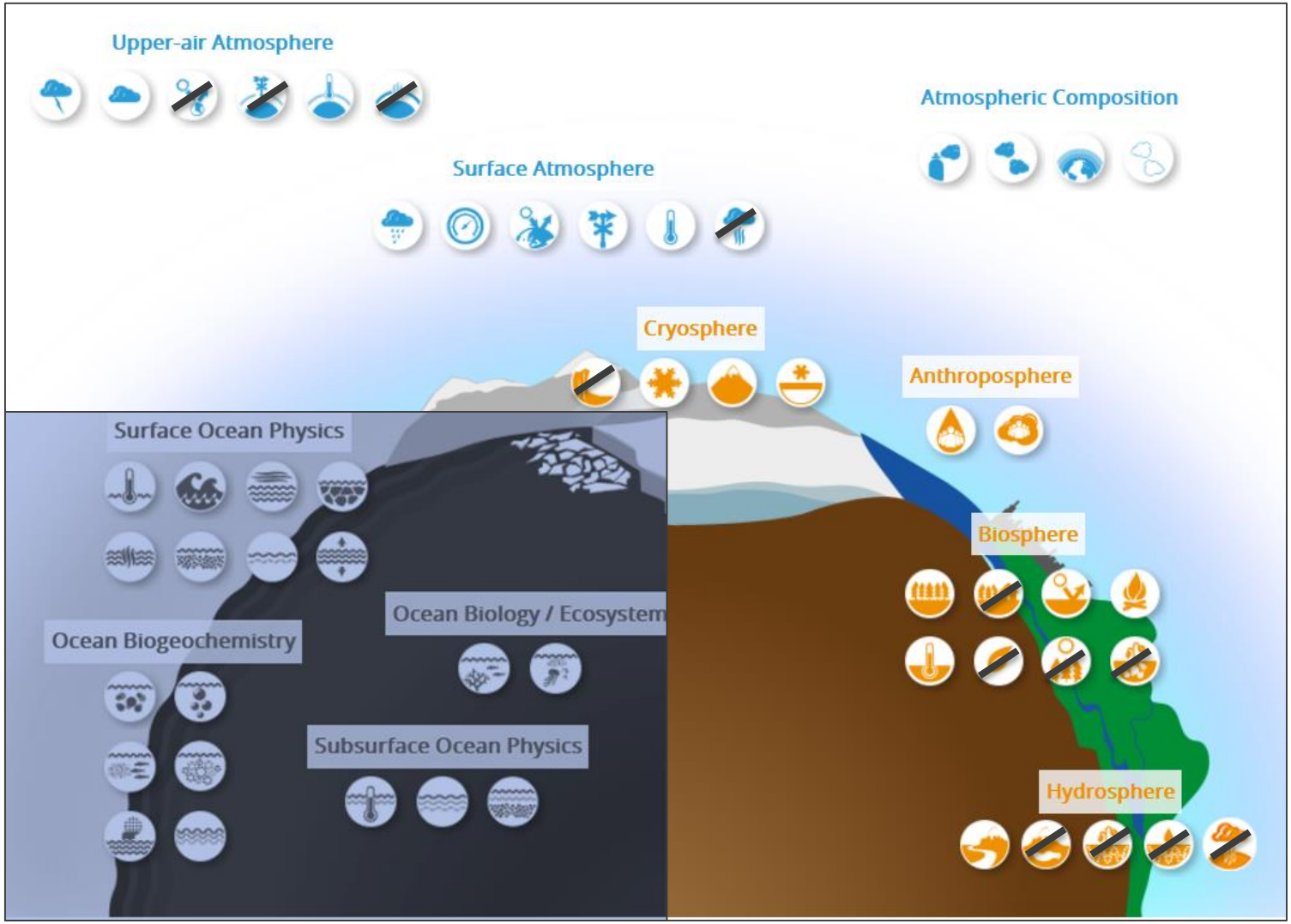
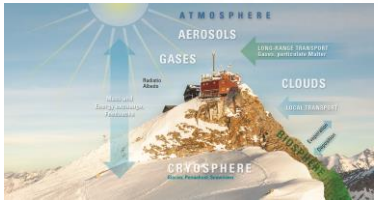
Essential Climate Variables @ SBO





considering ECVs ~22/35

https://gcos.wmo.int/en/essential-climate-variables

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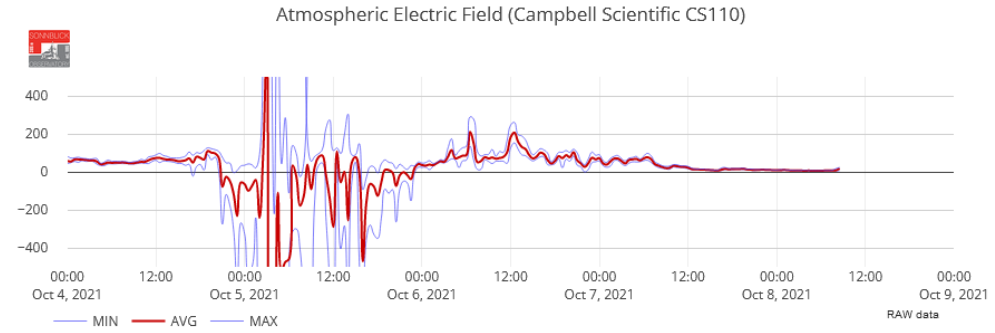
Essential Climate Variables @ SBO

Upper-air: LIGHTNING



https://www.sonnblick.net/en/data/data-viewer/meteorology/

Cooperation with ALDIS
(**A**ustrian
Lightning **D**etection & **I**nformation **S**ystem)

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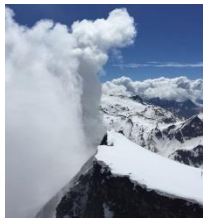
Essential Climate Variables @ SBO

Upper-air: CLOUDS



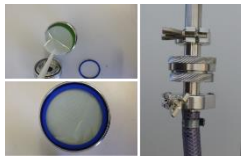
- surface synoptic observations (**FM-12**)
- **METAR** (METeorological Aerodrome Report)
- **cloud in situ** observations (ice nucleation, cloud water chemical analysis, cloud liquid water content, etc.)

European Center for Cloud Ambient Intercomparison (ECCINT)

ACTRiS

Center for Cloud in Situ Measurements (CIS)
Karlsruhe Institute of Technology (KIT)

Unit 1	Unit 2	Unit 3	Unit 4
Center for Cloud Ice Nucleation (CCIce)	Center for Cloud Particle Properties (CCPar)	Center for Cloud Water Chemistry (CCWaC)	European Center for Cloud Ambient Intercomparison (ECCINT)
Karlsruhe Institute of Technology (KIT)	The University of Manchester (U-Man)	Leibniz Institute for Tropospheric Research (TROPOS)	ZAMG Sonnblick Observatory (SBO)
Ice nucleating particle (INP) instruments ▸ INP number concentration ▸ INP temperature spectrum	**CDP/Mie scattering probe** ▸ particle nuber ▸ particle size distribution **OAP imaging probe** ▸ particle number concentration ▸ particle size distribution	**Bulk cloud water chemical analysis** ▸ Bulk cloud water chemical composition	**Integrating cloud probes** ▸ liquid water content (*) ▸ droplet effective diameter (*) ▸ cloud determination (*) mandatory variable



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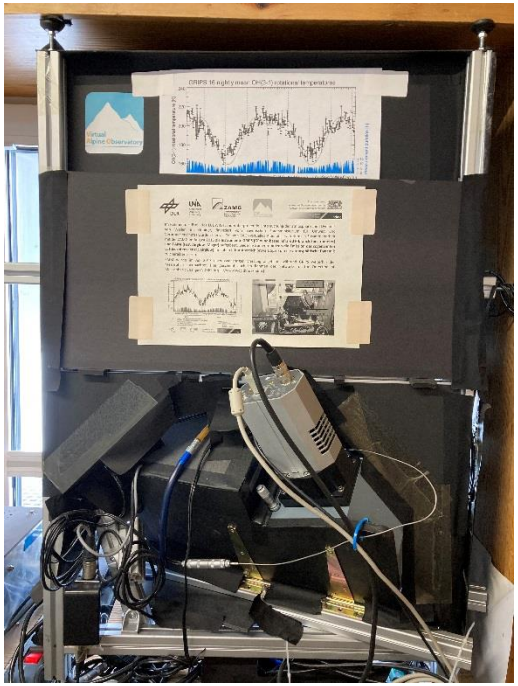
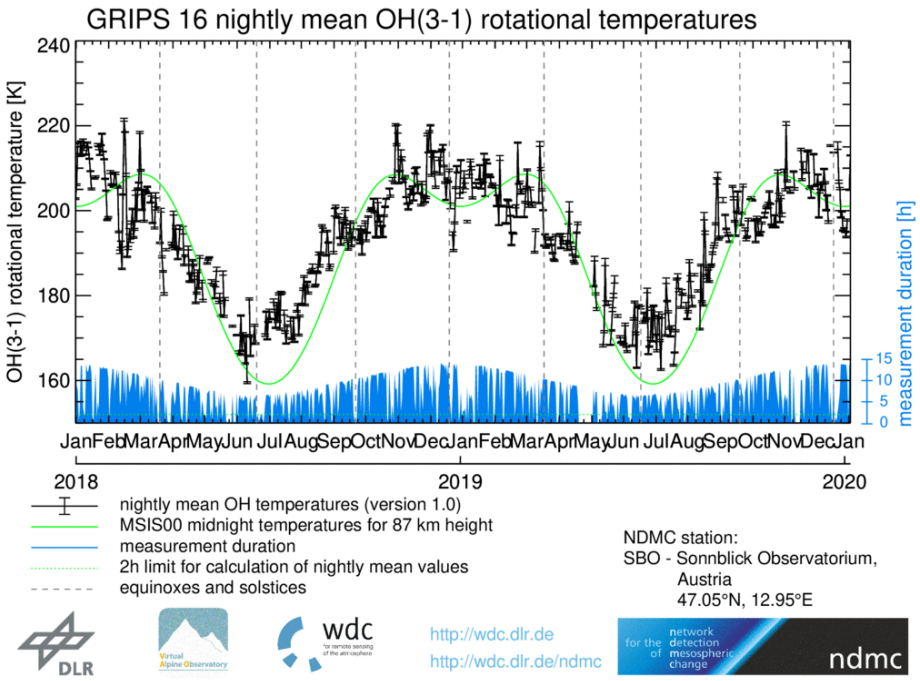
Essential Climate Variables @ SBO

Upper-air: Temperature

ambient temperature at 87 km altitude

Infrarot-Spektrometer **GRIPS** (DLR)
(Ground-based Infrared P-branch Spectrometer)





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Essential Climate Variables @ SBO

Surface: PRECIPITATION

- amount & content
- at the station
- in the fields at different altitudes
- since 1886

- automatically and by hand

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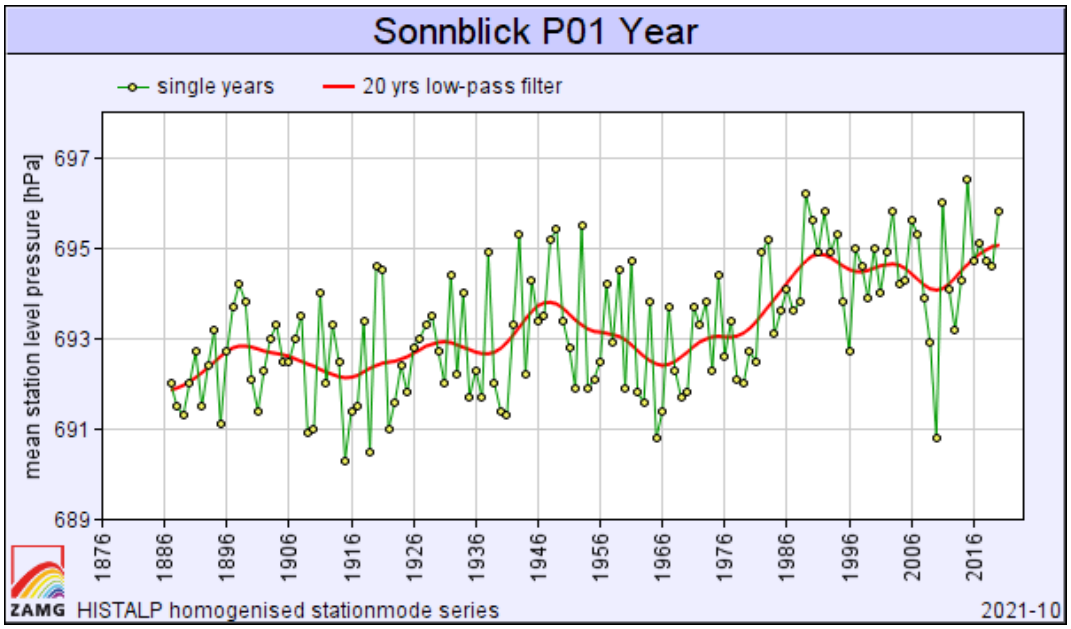
Essential Climate Variables @ SBO

Surface: PRESSURE

- since 1886



https://www.zamg.ac.at/histalp/dataset/station/csv.php

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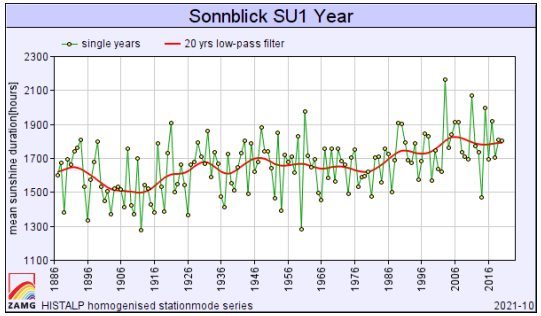
Essential Climate Variables @ SBO

Surface: RADIATION BUDGET

- since 1886
- ARAD (2011), BSRN (2013)
- Albedo (2019)



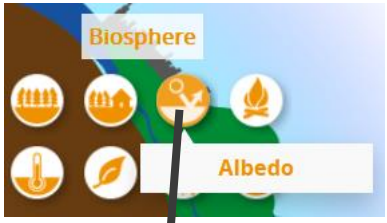


Abbildung 2: Typische ARAD Station: Sonnenfolger mit den verschiedenen Strahlungsmessgeräten.

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Essential Climate Variables @ SBO

Surface: WIND SPEED & DIRECTION

- since 1886

anemometer cup wreath

↓

ultrasonic anemometer

→ Task: homogenization of the time series

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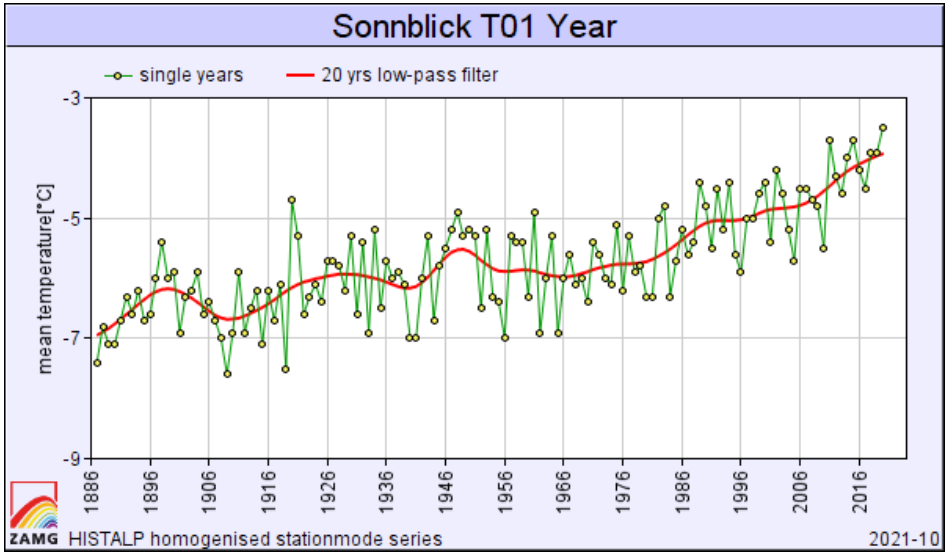
Essential Climate Variables @ SBO

Surface: SURFACE TEMPERATURE

- since 1886



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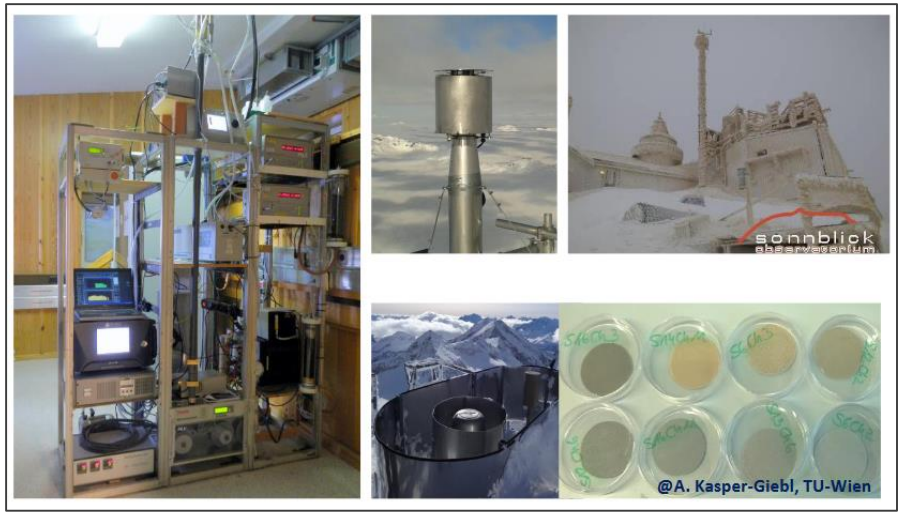
Essential Climate Variables @ SBO

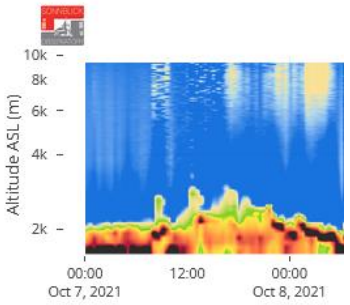
Atmospheric Composition: AEROSOLS

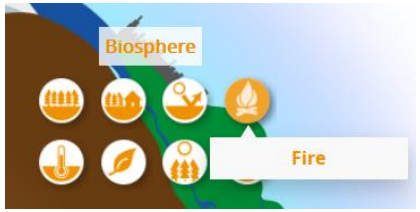
- since 2004
- since 2016: GAW global station
- → ACTRIS NF AIS

Aerosol

Time HH:MI	TSP µg/m³	CP 1/cm³	> 0,3 µm 1/cm³	> 1,0 µm 1/cm³	> 2,5 µm 1/cm³	BC ng/m³
11:00	-0.9	1122	0.31	0.010	0.0011	9.1
10:30	-0.9	1606	0.32	0.012	0.0007	6.3







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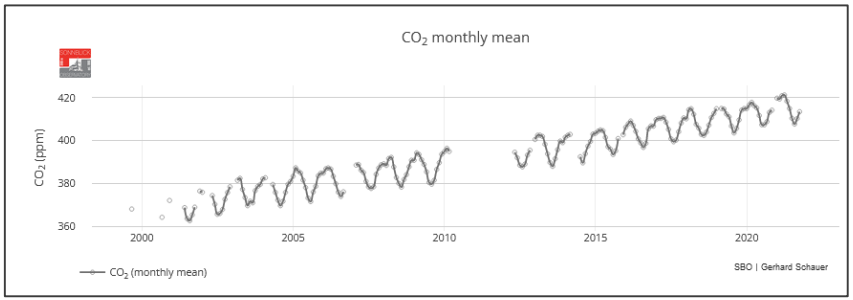
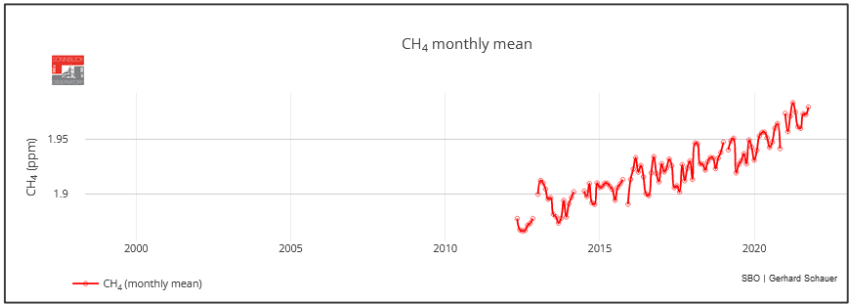
Essential Climate Variables @ SBO

Atmospheric Composition: CO2, CH4, other GHGs

- start 1988
- since 2000: CO2
- since 2012: CH4
- Since 2016: GAW, global



max April 2021:
421,28 ppm CO2
1,98 ppm CH4



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Essential Climate Variables @ SBO

Atmospheric Composition: OZONE

- start 1988/91

https://imp.boku.ac.at/strahlung/messwert.htm

Aktuelle Messungen des Stratosphärischen Ozons über Österreich

Auf dem Hohen Sonnblick in 3106 m Höhe wird der Gehalt des Ozons in der Atmosphäre vom Institut für Meteorologie und Klimatologie der Universität für Bodenkultur im Auftrag des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft gemessen.

	DU	%M	%V
Mi., 29.Sep.21	264	89	101
Do., 30.Sep.21	290	98	111
Fr., 01.Okt.21	284	99	109
Sa., 02.Okt.21	292	102	112
So., 03.Okt.21	278	97	106
Mo., 04.Okt.21	269	94	103
Di., 05.Okt.21	289	101	111

DU... Dicke der stratosphärischen Ozonschicht in mm x 100 bei Normaldruck und 0° (auf Meeresniveau)

%M... Vergleich in % zum langjährigen Monatsmittel vor Beginn der Ozonabnahme in der Stratosphäre

%V... Vergleich in % zum Monatsmittelwert des Vorjahres (zeigt die kurzzeitige Änderung)

https://www.umweltbundesamt.at/ozon-aktuell

umweltbundesamt

Messstelle	letzter aktueller 1h-MW [µg/m³]	Zeit letzter 1h-MW	aktueller 8h-MW [µg/m³]	1h-MW Maximum [µg/m³]	1h-MW Maximum Zeit	Dauer [h]
Sonnblick	84	13:00	86	95	11:00	0

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Essential Climate Variables @ SBO

Atmospheric Composition:

- **start 1988**

nitrogen dioxide (NO2)
sulphur dioxide (SO2)
carbon monoxide (CO)

formaldehyde (HCHO)

Trace Gas

https://www.sonnblick.net/en/data/data-viewer/

Time HH:MI	CO2 ppm	CH4 ppm	O3 ppb	NO ppb	NO2 ppb	NOy ppb	SO2 ppb	CO ppb
11:30	415.64	2.0027	43.2	0.035	0.054	0.501	0.104	131
11:00	415.85	1.9925	45.3	0.036	0.050	0.496	0.113	131
10:30	416.46	2.0066	42.8	0.039	0.054	0.546	0.121	139
10:00	416.84	2.0166	41.6	0.037	0.047	0.567	0.126	148
09:30	416.84	2.0189	40.9	0.033	0.057	0.551	0.134	146
09:00	417.01	2.0083	43.9	0.044	0.051	0.527	0.126	147

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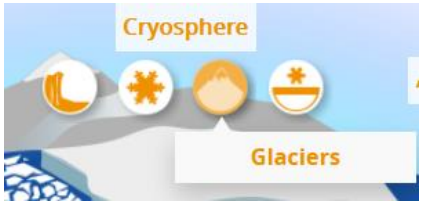
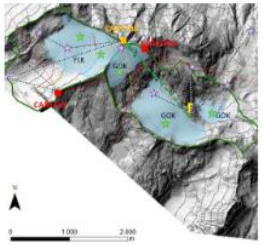
Essential Climate Variables @ SBO

Crysophere: GLACIERS & SNOW



- since 1896: glacier
- since 1927: snow level
- since 2015: GCW
- → eLTER



Bundesministerium
Nachhaltigkeit und
Tourismus

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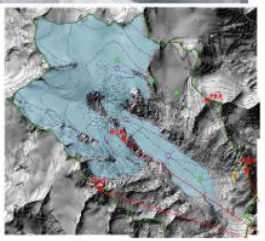

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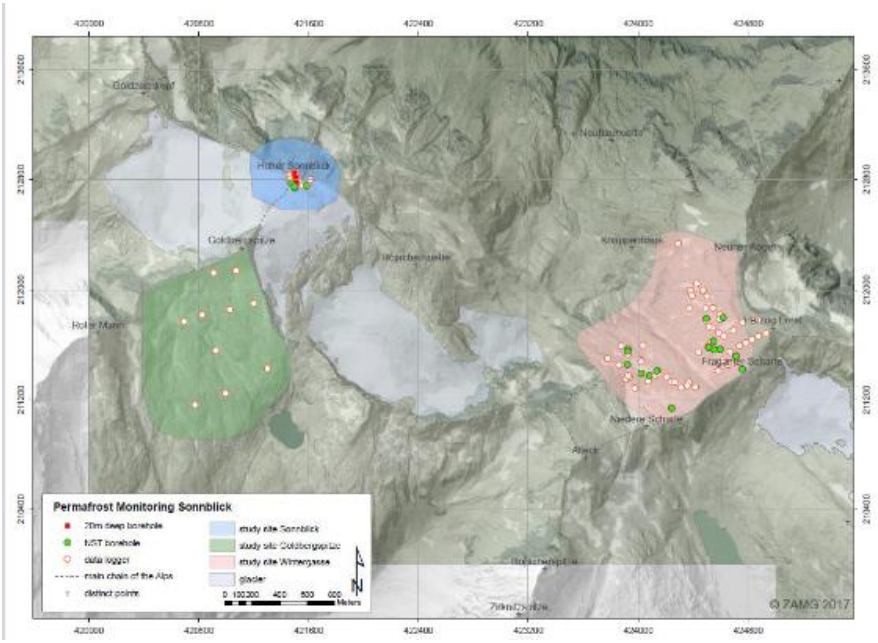
Essential Climate Variables @ SBO

Crysophere: PERMAFROST (& ROCK FALL)

- since 2007:
- since 2015: GCW
- → eLTER



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Essential Climate Variables @ SBO

Anthroposphere: Outlook: open discussions, activities, research projects

- discussions regarding water management, monitoring?!
- water cycle

modelling approaches (in cooperation with universities)

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135 years Sonnblick Observatory

ZAMG, SBO-Team and a lot of partners!

Rauris

- monitoring
- trend analysis
- harmonization
- Research
- Dissemination
- evaluation

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