Toward an
Antarctic Radiation Regional Network (ARRN)
workshop report

Surface radiation is crucial to determine the surface energy balance, which is fundamental for atmospheric and oceanic circulation processes and modulates a wide range of processes involving, for one, the cryosphere. For several reasons, Antarctica has a unique geographic position in radiation climatology: the net radiation is expected to rise rapidly, the continent shows a large range of surface temperature and is a remote location far from anthropogenic and terrestrial aerosol sources. If we want to get a full picture of the long-term rate change of incoming longwave radiation vs temperature change rate (Figure 1) it is important to improve/increase the observations in the continent, Antarctic stations place themselves in the bottom part.

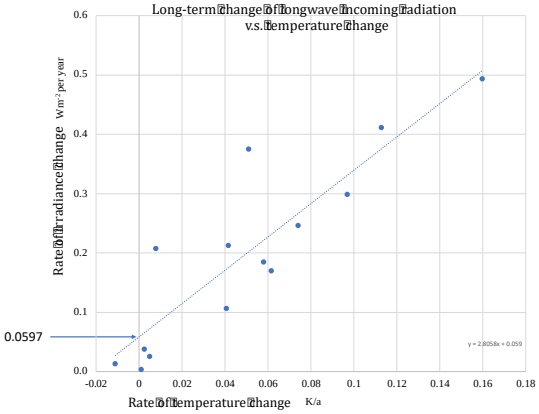

Figure 1: rates of change T vs LWD for BSRN stations (Ohmura Atsumu)

With the aim to obtain a clear picture of the ongoing activities regarding surface radiation observations and elaborate strategies to better assess radiative regimes and related processes in the different areas of the continent, a workshop and a side-meeting at the IUGG 2023 in Berlin were organised. The final and ambitious goal is the creation of an Antarctic Radiation Regional Network (ARRN).

The workshop was entirely held online from 5 July to 7 July 2023, with daily sessions, each dedicated to a particular topic, comprising presentations and discussions.

5 July 2023, Climate models and climate indicators
This session is aimed at assessing necessary inputs related to radiation budget for climate models (including ancillary information on cloudiness and surface characteristics), discussing in which way observations can be used in connection with models and help improving our application capability, knowledge, system representation, and identifying possible climate indicator(s) relevant to AntClimNow objectives. The results of the discussion in this session will allow the development of a possible common data management plan (DMP).

6 July 2023, Assessment of the state of observations in Antarctica
All participants can present what is routinely performed, instruments, analysis and methodology, data management, historical data sets at disposal, challenges faced (of both instruments and methodology) and future plans.

7 July 2023, Moving toward an Antarctic Radiation Regional Network (ARRN)
Starting from the information collected on the first day, the session is aimed at discussing a possible strategy to lay the groundwork for a regional network, trying to transfer and optimally use BSRN best practices, identify one or more common methodologies and better define the DMP.

About 20 people attended each day, from Northern and Southern America, Europe and Asia. A picture of participants of day 1 is attached in Figure 2 (see end of report).
Sites whose activities were presented on day 2 are summed in Figure 3 and Table 1 (see end of report).
At the end of the workshop a summary document was shared with participants.

The workshop held a side-meeting 18 July 2023 in Berlin, at the IUGG 2023 conference, to reach a broader audience and deepen the discussion on the points emerged from the online meeting. The presentations allowed to delve into the reasons and challenges of observations in Antarctica, and to discuss the possibility of integrating the initiative in the SCAR context with a possible Action Group.

The workshop and side-event highlighted the interest of the international community in ARRN initiative. Suggestions were made on which parameters, in addition to basic radiation components, the network should focus on; cloud observations and measurements over sea ice or ice shelves were deemed important, as well as aerosol and vertical profiles information.

The next, immediate steps toward the continuation of this initiative and creation of the network will be to:

- create a webpage collecting useful information on data at disposal, relevant material and references and a forum where to discuss common challenges;
- keep the momentum and trying to paint a full picture of the on-going activities concerning radiation in the continent;
- work on a platform to make (historical and present-day) data more easily available, also in connection with climate indicators;
- work on an Action Group proposal for the next SCAR conference in 2024.

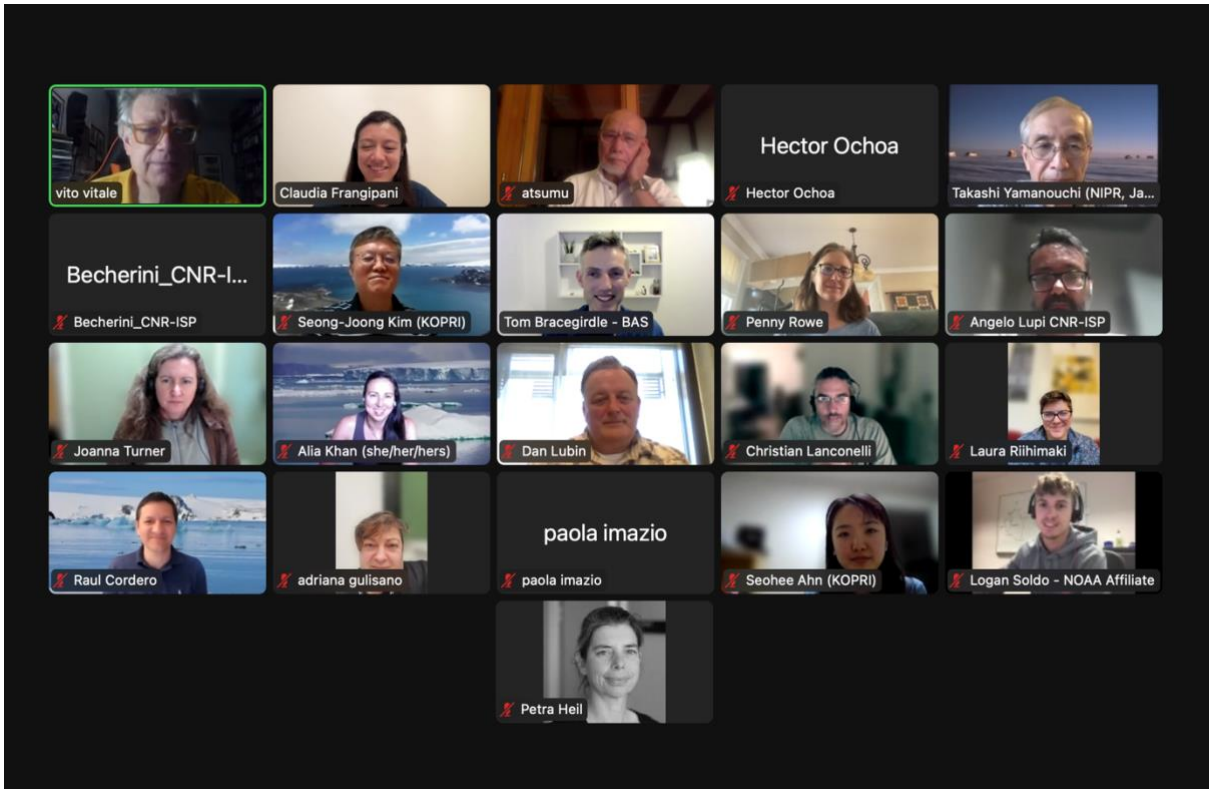

Figure 2: Session 1 (5 July 2023) picture of participants

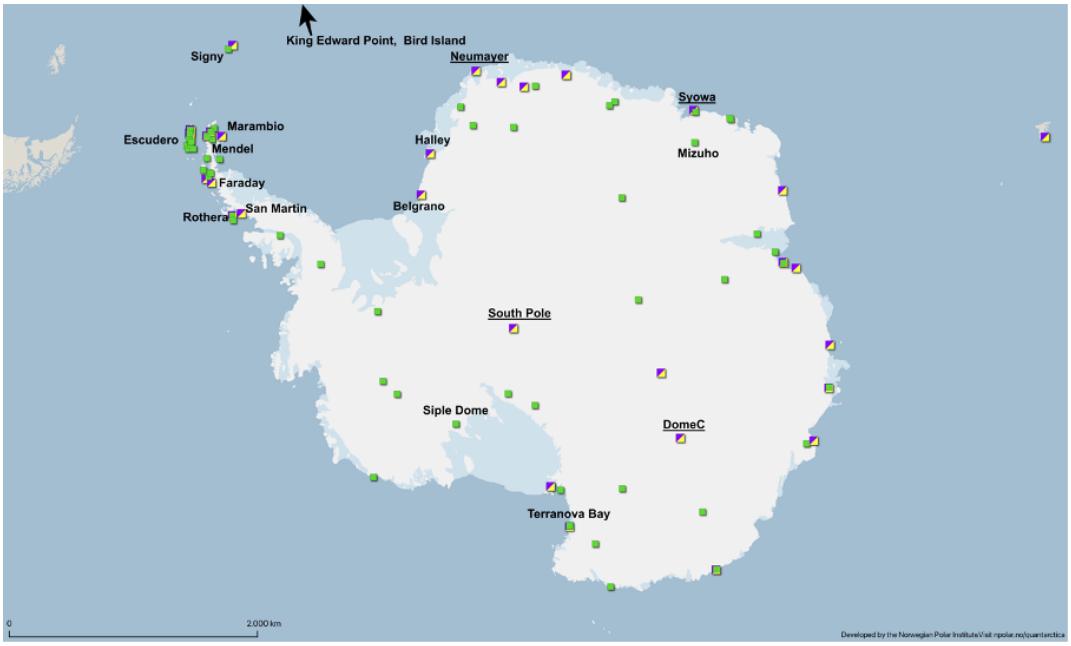

Figure 3: sites presented at the workshop, day 2

Station	coordinates	Instruments	Additional instruments	Notes
Mizuho	70°41’57”S - 44°16’45”E	Pyranometer (Eko) pyrheliometer (Eko) net radiometer (Eko) PIR (Eppley)		
Halley	75°34’25’’S - 25°28’01’’W	CNR4 (Kipp&Zonen) Future SPN1 (Delta-T)	Ceilometer Synoptic obs Columnar ozone	Past hourly / monthly SW and UV averages
Rothera	67°34’00’’S - 68°07’59’’W	CNR1 (Kipp&Zonen) Future SPN1 (Delta-T)	Ceilometer Synoptic obs Columnar ozone	Past hourly / monthly SW and UV averages
Signy	60°42’30’’S - 45°35’43’’W	SPN1 (Delta-T)		Past hourly / monthly SW and UV averages
King Edward Point **Bird Island**	54° ÷ 55° S - 36°÷ 38°W	SPN1 (Delta-T)		
Faraday	65°14’44’’S - 64°15’27’’W		Columnar ozone	Past hourly / monthly SW and UV averages
Siple Dome	81°39’15”S - 149°00’18”W	CMP22 (Kipp&Zonen) CMP10 (Kipp&Zonen) CGR4 (Kipp&Zonen) CNR4 (Kipp&Zonen)	IRT sensor (Campbell Sci) Spectrometer (Stellarnet) All-sky camera (ALCOR) IRGASON (Campbell Sci)	
South Pole	90°S - 0° E	PSP (Eppley) NIP (Eppley) 8-48 B&W (Eppley) PIR (Eppley) Future CMP22 (Kipp&Zonen) and SPN1 (Delta-T)		
Mendel	63°48’02”S - 57°52’56”W	CMP11 (Kipp&Zonen) CNR4 (Kipp&Zonen)	cloud obs aerosol: LOAC USA-1 (Metek) CUV3, UVSABT (Kipp&Zonen) UV-Biometer (Solar Light) EMS11 (EMS Brno)	
Terranova Bay	74°37’38’’S - 164°14’16’’E	CHP1 (Kipp&Zonen) DR01 (Hukseflux) SPP (Eppley) SR20 (Hukseflux) CMP21 (Kipp&Zonen) PIR (Eppley) CGR4 (Kipp&Zonen) IR20 (Hukseflux) SPN1 (Delta-T)	UVA, UVB (Solar Light) TUVT (Eppley)	
DomeC	75°05’59’’S - 123°19’57’’E	CMP22 (Kipp&Zonen) CG4R (Kipp&Zonen) CHP1 (Kipp&Zonen) SPN1 (Delta-T)	Future astronomical camera	
Marambio	64°14’50”S - 56°37’39”W	SPN1 (Delta-T) NR01 (Hukseflux)	all sky camera (ALCOR) Brewer MKIII (Kipp&Zonen)	
Belgrano **San Martin**	77°52’26”S - 34°37’40”W 68°07’47”S - 67°06’10”W		Brewer MKIII, MKIV (Kipp&Zonen)	