2020 IRC Business Meeting

(on-line)

11:00-13:00 UTC 10 August 2020

Welcome & Agenda Approved

List of Attendants

Alkiviadis Bais
Lei Bi
Christine Chiu
Alexandre Correia
Roger Davies
Amelie Driemel
Iouli Gordon
Vincent Guidard
Robin Hogan
Yasuko Kasai
Seiji Kato
Jhoon Kim
Tristan L'Ecuyer
Jacqueline Lenoble
Zhengquiang Li
Norman Loeb
Andreas Macke
Alexander Marshak
Bernhard Mayer
Allison McComiskey
Teruyuki Nakajima
HajimeOkamoto
Lazaros Oraiopoulos
Peter Pilewskie
Manuel López Puertas
Jerome Riedi
Byung-Ju Sohn
Piet StammesAlexander
Trishchenko
Andrei Vigasin
Ann Webb
Manfred Wendisch
Martin Wild
Marcia Yamasoe
Ping Yang
Feng Zhang
Christian Lanconelli

IRC Business Meeting Agenda

I. **Welcome**
II. **Approval of Agenda**
III. **President's Report**
- (a) Remembrances
- (b) IRC Financial Status
- (c) Recent IRC Activities
- (d) BACO-21 On-line Meeting

IV. **Postponed IRS 2020**
V. **Election of IRC Officers for next term (2021-2024)**
VI. **Working Group Chair/Rapporteur Presentations**
- ASA
- BSRN
- CIRC
- CR
- GDAP
- GEB
- ICLAS
- IPRT
- ITWG
- UV
- 3DRT

VII. **Working Group Reconstruction Report**
VIII. **Upcoming Election of IRC Commissioners for Next Term ('21-'24)**
IX. **2021 Next BM @ IRS2021**
X. **Other Businesses**

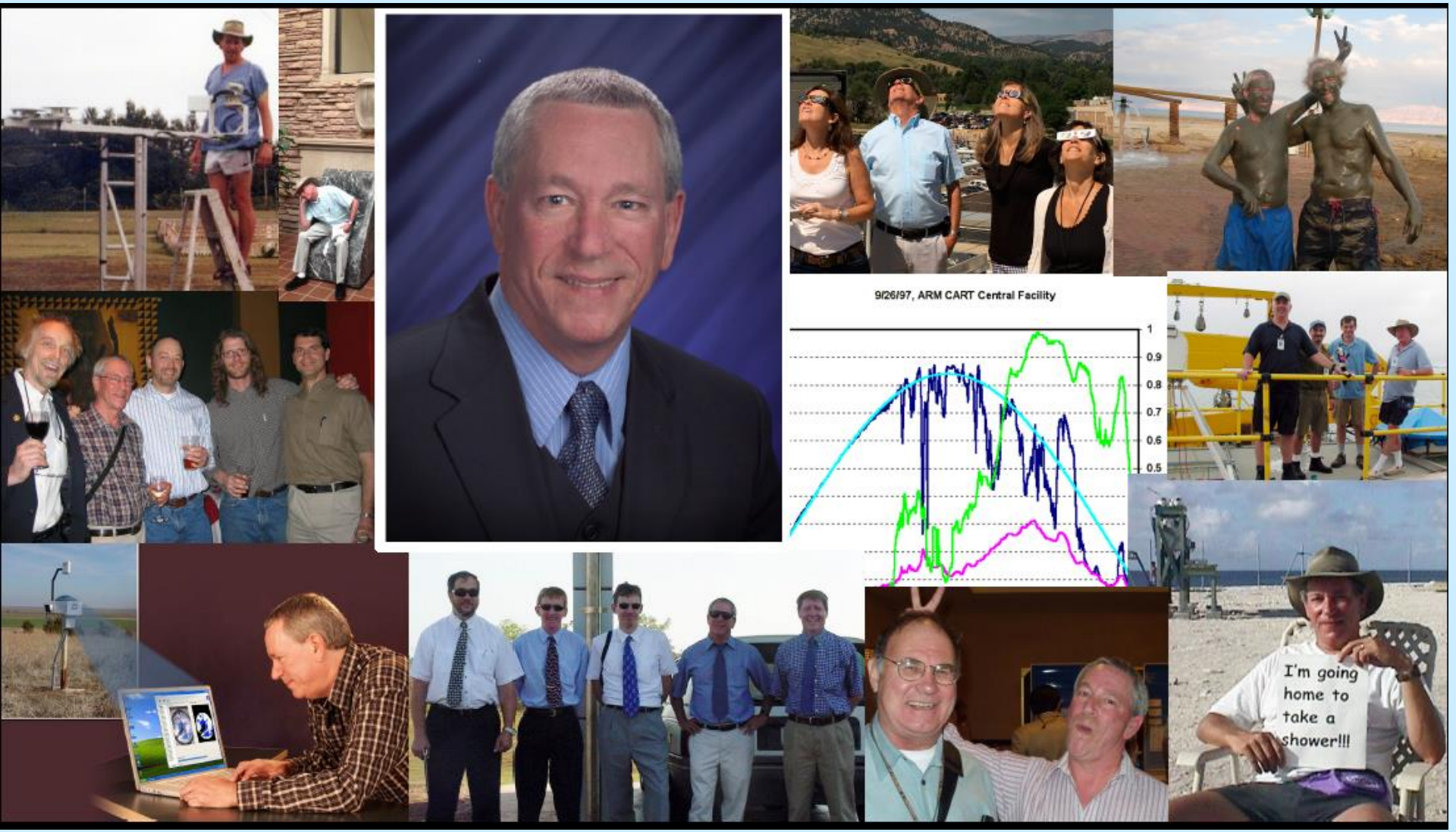
President's Report

In Remembrance

Tribute to Chuck Long (delivered by Allison McComiskey)

Tribute to Michael Mischchenko (delivered by Ping Yang)

In remembrance of
Dr. Charles Nelson Chuck Long (1953-2019)



In Remembrance of Dr. Michael Mishchenko (1959-2020)

Major Contributions
(310+ papers, 7 books, 31697 citations, H-index=85)

- Light Scattering Theory (in particular, the T-matrix method, light scattering in an absorbing medium)
- Radiative Transfer Theory (in particular, the establishment of the physical-optics content of the radiative transfer theory by deriving it directly from the Maxwell equations)
- Polarimetric Remote Sensing Theory and Applications
- Significant services to the research community (e.g., Topical Editor of Applied Optics, JQSRT Editor-In-Chief, a primary organizer of 10 major conferences, the Project Scientist of the NASA Glory Space Mission …)

Financial Report

2017-2020 Budget Summary

(USD)

Date	Transaction	Amount	Fees	Balance
25/4/2017	Transfer from Peter Pilewskie	15634.93	-8.9	15626.03
11/8/2017	Cumulative Interest (11 Aug 2017)	6.38		15632.41
29/8/2017	IRC website domain use (yearly till Oct '18)		-30.00	15602.41
29/8/2017	IRC BM dinner (@Cape Town BM)		-738.99	14863.42
10/7/2018	@IRC BM in Vancouver Food 857.59 (CAD) -- 648 USD A/V 1,102.08(CAD) -- 831 USD		-1479.00	13384.42
29/1/2019	Loan to IRS2020 LOC for convention hall deposit		-3490.14	9894.28
2018-2019	Domain fee for the IRC Homepage (31.57+31.57CHF) = (32.18+32 = 64.18 USD)		-64.18	9830.10

Recent IRC Activities/Postponed IRS 2020

March 2020:
The organization of IRS 2020 was progressing as scheduled:
Completed tasks:
- Selection of accepted Abstracts
- Allocation of Abstracts to sessions
- Preliminary program plan of all sessions
- Registration was progressing
- Maquette of the gold medal
- Signed contract with AIP Publishing fro the Proceedings
- Symposium Dinner venue booked
- Lunch menus booked

26 March 2020:
The decision of postponement of IRS 2020 was communicated to all participants

4 April 2020:
New dates for IRS 2020 were fixed and announced **14 – 18 June 2021**

Postponed IRS 2020: Accepted Abstracts

No	Session Title	Oral	Poster	Sum	% Oral in session	% Oral in Total
1	Topical Union Session	3		3		
2	Radiative Transfer Theory and Modeling	40	26	66	61	12
3	Particle Radiative Properties	17	14	31	55	5
4	General Remote Sensing	72	38	110	65	21
5	Ground-based Measurements and Field Observations	49	35	84	58	14
6	Radiation Budget and Forcing	63	28	91	69	18
7	Weather, Climate and Environment Applications	55	27	82	67	16
8	Solar UV Radiation	24	29	53	45	7
9	Ocean Optics	15	5	20	75	4
10	Climate Change in the Mediterranean and Radiative Impacts of a Changing Environment	6	6	12	50	2
	TOTAL	**341**	**208**	**552**		

Many Thanks to all session Conveners

Postponed IRS 2020: Program Layout

Time-slots	5 July SUNDAY	6 July MONDAY	7 July TUESDAY	8 July WEDNESDAY	9 July THURSDAY	10 July FRIDAY
8:30		Registration	Registration	Registration	Registration	Registration
09:00-09:30		Opening ceremony	Keynote	Keynote	30' Late start	Oral Session
09:30-10:00			Keynote	Keynote	Young award	6 talks
10:00-10:30		Keynote	Keynote	Keynote	Gold medal	90 min
10:30-11:00		Coffee-Break	Coffee-Break	Coffee-Break	Coffee-Break	Coffee-Break
11:00						
11:15						
11:30		Oral Session	Oral Session	Oral Session	Oral Session	Oral Session
11:45		7 talks	7 talks	7 talks	7 talks	7 talks
12:00		105 min	105 min	105 min	105 min	105 min
12:15						
12:30						
12:45-14:15		Lunch	Lunch	Lunch	Lunch	
14:15						
14:30						
14:45		Oral Session	Oral Session	Oral Session	Oral Session	
15:00		7 talks	7 talks	7 talks	7 talks	
15:15		105 min	105 min	105 min	105 min	
15:30						
15:45						
16:00-16:30		Coffee-Break	Coffee-Break	Coffee-Break	Coffee-Break	
16:30						
16:45				Oral Session		
17:00		Oral Session	Poster Session	5 talks	Poster Session	
17:15		7 talks	105 min	75 min	105 min	
17:30	Registration	105 min				
17:45				Group Photo		
18:00				Preparation time for dinner **75 min**		
18:15		Reception	**IRC bussiness meeting**			
19:00				Dinner		

Postponed IRS 2020: Detailed Program

IRS 2020: Preliminary program and session layout

6 JUL MONDAY				
Time	Rialdis	Room 1	Room 2	Room 3
8:30	Registration			
8:45				
9:00				
9:15	Opening			
9:30	Ceremony			
9:45	Keynote 1			
10:00				
10:15	Awards			
10:30		Coffee break		
10:45				
11:00	4	5	6	7
11:15	4	5	6	7
11:30	4	5	6	7
11:45	4	5	6	7
12:00	4	5	6	7
12:15	4	5	6	7
12:30	4	5	6	7
12:45				
13:00				
13:15		Lunch		
13:30				
13:45				
14:00				
14:15	4	5	6	7
14:30	4	5	6	7
14:45	4	5	6	7
15:00	4	5	6	7
15:15	4	5	6	7
15:30	4	5	6	7
15:45	4	5	6	7
16:00		Coffee Break		
16:15				
16:30	4	5	6	7
16:45	4	5	6	7
17:00	4	5	6	7
17:15	4	5	6	7
17:30	4	5	6	7
17:45	4	5	6	7
18:00	4	5	6	7
18:15				
18:30				
18:45		Welcome Reception		
19:00		18:15-20:45		
19:15				
19:30				
19:45				

7 JUL TUESDAY					
Time	Rialdis	Room 1	Room 2	Room 3	
9:00	Keynote 2				
9:15					
9:30	Keynote 3				
9:45					
10:00	Keynote 4				
10:15					
10:30		Coffee Break			
10:45					
11:00	4	5	7	6	
11:15	4	5	7	6	
11:30	4	5	7	6	
11:45	4	5	7	6	
12:00	4	5	7	6	
12:15	4	5	7	6	
12:30	4	5	7	6	
12:45					
13:00					
13:15		Lunch			
13:30					
13:45					
14:00					
14:15	4	5	7	6	
14:30	4	5	7	6	
14:45	4	5	7	6	
15:00	4	5	7	6	
15:15	4	5	7	6	
15:30	4	5	7	6	
15:45	4	5	7	6	
16:00		Coffee Break			
16:15					
16:30					
16:45					
17:00		POSTER	SESSION		
17:15		16:30-18:15			
17:30					
17:45					
18:00					
18:15					
18:30					
18:45		IRC Business Meeting			
19:00		Starts 18:15			
19:15					
19:30					
19:45					

8 JUL WEDNESDAY						
Time	Rialdis	Room 1	Room 2	Room 3	Room 4	
9:00	Keynote 5					
9:15						
9:30	Keynote 6					
9:45						
10:00	Keynote 7					
10:15						
10:30			Coffee Break			
10:45						
11:00	4	5	7	6	2	
11:15	4	5	7	6	2	
11:30	4	5	7	6	2	
11:45	4	5	7	6	2	
12:00	4	5	7	6	2	
12:15	4	5	7	6	2	
12:30	4	5	7	6	2	
12:45						
13:00						
13:15			Lunch			
13:30						
13:45						
14:00						
14:15	4	5	7	6	2	
14:30	4	5	7	6	2	
14:45	4	5	7	6	2	
15:00	4	5	7	6	2	
15:15	4	5	7	6	2	
15:30	4	5	7	6	2	
15:45	4	5	7	6	2	
16:00			Coffee Break			
16:15						
16:30	4	8	7	9	2	
16:45	4	8	7	9	2	
17:00	4	8	7	9	2	
17:15	4	8	7	9	2	
17:30	4	8	7	9	2	
17:45			Group Photo			
18:00						
18:15						
18:30						
18:45						
19:00						
19:15						
19:30		Departure for Symposium Dinner				
19:45						

9 JUL THURSDAY					
Time	Rialdis	Room 1	Room 2	Room 3	
9:00					
9:15					
9:30	Gold metal				
9:45	award				
10:00	Young Sci				
10:15	award				
10:30		Coffee Break			
10:45					
11:00	4	8	6	2	
11:15	4	8	6	2	
11:30	4	8	6	2	
11:45	4	8	6	2	
12:00	4	8	6	2	
12:15	4	8	6	2	
12:30	4	8	6	2	
12:45					
13:00					
13:15		Lunch			
13:30					
13:45					
14:00					
14:15	4	3	6	2	
14:30	4	3	6	2	
14:45	4	3	6	2	
15:00	4	3	6	2	
15:15	4	3	6	2	
15:30	4	3	6	2	
15:45	4	3	6	2	
16:00		Coffee Break			
16:15					
16:30					
16:45					
17:00		POSTER	SESSION		
17:15		16:30-18:15			
17:30					
17:45					
18:00					
18:15					
18:30					
18:45					
19:00					
19:15					
19:30					
19:45					

10 JUL FRIDAY				
Time	Rialdis	Room 1	Room 2	Room 3
9:00	9	8	3	10
9:15	9	8	3	10
9:30	9	8	3	10
9:45	9	8	3	10
10:00	9	8	3	10
10:15	9	8	3	10
10:30		Coffee Break		
10:45				
11:00	9	8	3	2
11:15	9	8	3	2
11:30	9	8	3	2
11:45	9	8	3	2
12:00		8	4	2
12:15		8	4	2
12:30			4	2
12:45			4	
13:00				
13:15				
13:30				
13:45				
14:00				
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19:30				
19:45				

2	Radiative Transfer Theory and
3	Particle Radiative Properties
4	General Remote Sensing
5	Ground-based Measurements ar
6	Radiation Budget and Forcing
7	Weather, Climate and Environme
8	Solar UV Radiation
9	Ocean Optics
10	Climate Change in the Mediterra

Postponed IRS 2020: Planning for 2021

Autumn 2020

- Evaluation of COVID-19 situation (in Greece and globally)
- Decision for holding IRS 2020 in June 2021
- Investigation of alternatives (e.g., web conference)
- Announcement to scientific community

January – February 2021

- Confirmation/Withdrawal of submitted abstracts
- Call for additional abstracts
- Re-open registration

BACO-21 On-line Meeting

Busan IAMAS-IACS-IAPSO Joint Assembly 2021
18-23 July, 2021, BEXCO, Busan, Republic of Korea

- Pandemic situation was not clear by the time when we have to make a contract with Convention Organizer.
- Many associated meetings planned to be in 2020 are now deferred to 2021, making the travel to BACO-21 even more difficult.
- LOC expressed the difficulty of holding the BACO-21 as planned, and proposed to have the meeting postponed to 2022.

EC of 3 Associations decided that there will be no face-to-face meeting in Busan in 2021.

And they proposed to have daily short invited presentations; 2 or 3 of them each a day by only invited speakers during the same July 18-23, 2021 period.

Election of IRC Officers for next term (2021-2024)

- Review the election rule
- Present a nominee for President
- Present nominees for Vice-President and Secretary

(Nominees out)

- Discuss voting procedures
  (5 min break)
- Collect the vote (Marcia, BJ)

(Nominees in)

- Announcement of election result

IRC election rules

http://www.irc-iamas.org/resources/index.php?id=4

- **Nomination of a candidate for President**
  The sitting IRC President forms a Nominating Committee of two or more additional individuals consisting of Honorary members who are past Presidents of the IRC.
  The sitting IRC President and the Nominating Committee select one new candidate for President.

- **Presentation of the nominee for President and vote**
  The nominee for President nominee is presented to members at the BM.
  The Nominee for President in turn presents his or her "slate" of nominees for Vice-President and Secretary.
  Elect only president
  If the Nominee for President is elected, then his or her nominees for Vice-President and Secretary are automatically elected

- **Voting rule**
  A vote of all members present at the business meeting for or against electing the Nominee as the new President for the following term.
  Each member has one vote.
  The new President is elected by a simple majority of affirmative votes.
  In the case of a tie, the vote of the sitting IRC president decides the outcome of the election.

Nominee for President (2021-24)

Prof. Peter Pilewskie

Prof. Pilewskie teaches courses in radiative transfer, remote sensing, atmospheric physics and instrumentation. His research interests include quantifying Earth's radiative energy budget, satellite, airborne and surface remote sensing of clouds and aerosols, and atmospheric radiative transfer.

- IRC Commissioner since 2009
  - IRC Secretary 2013-2016; IRC Vice President 2017-2020
- Deputy Secretary General, IAMAS, 2015-2018
- Professor, University of Colorado, Laboratory for Atmospheric and Space Physics (LASP), Department of Atmospheric and Oceanic Sciences
- CU LASP Assistant Director for Science
- Research Scientist at NASA Ames Research Center, 1989-2004
- Principal Investigator, *Libera*, 2020 – present
- LASP Science Principal Investigator, *CLARREO Pathfinder*, 2016 – present
- Principal Investigator, *Total and Spectral Irradiance Sensor*, 2005-2020
- American Meteorological Society Fellow
- Humboldt Research Award, Alexander von Humboldt Foundation
- NASA Exceptional Scientific Achievement Medal

Nominees for Vice-President and Secretary (2021-24)

Vice President:

- Prof. Dr. Manfred Wendisch, Director, Leipzig Institute for Meteorology, University of Leipzig
  - IRC Commissioner since 2013

Secretary:

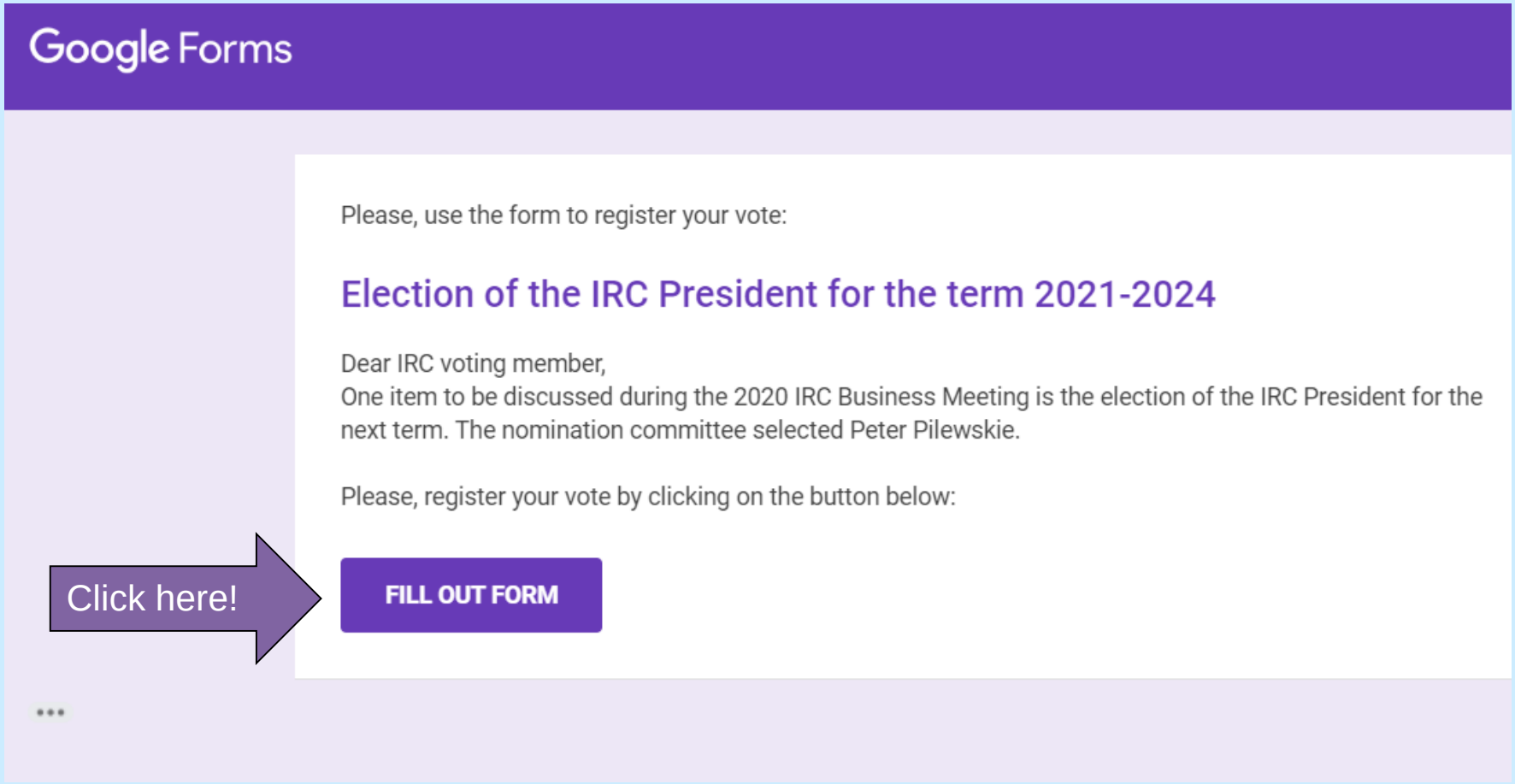
- Prof. Hajime Okamoto, Distinguished Professor, Kyushu University, Vice Director, Research Institute for Applied Mechanics
  - IRC Commissioner since 2013

Voting procedures

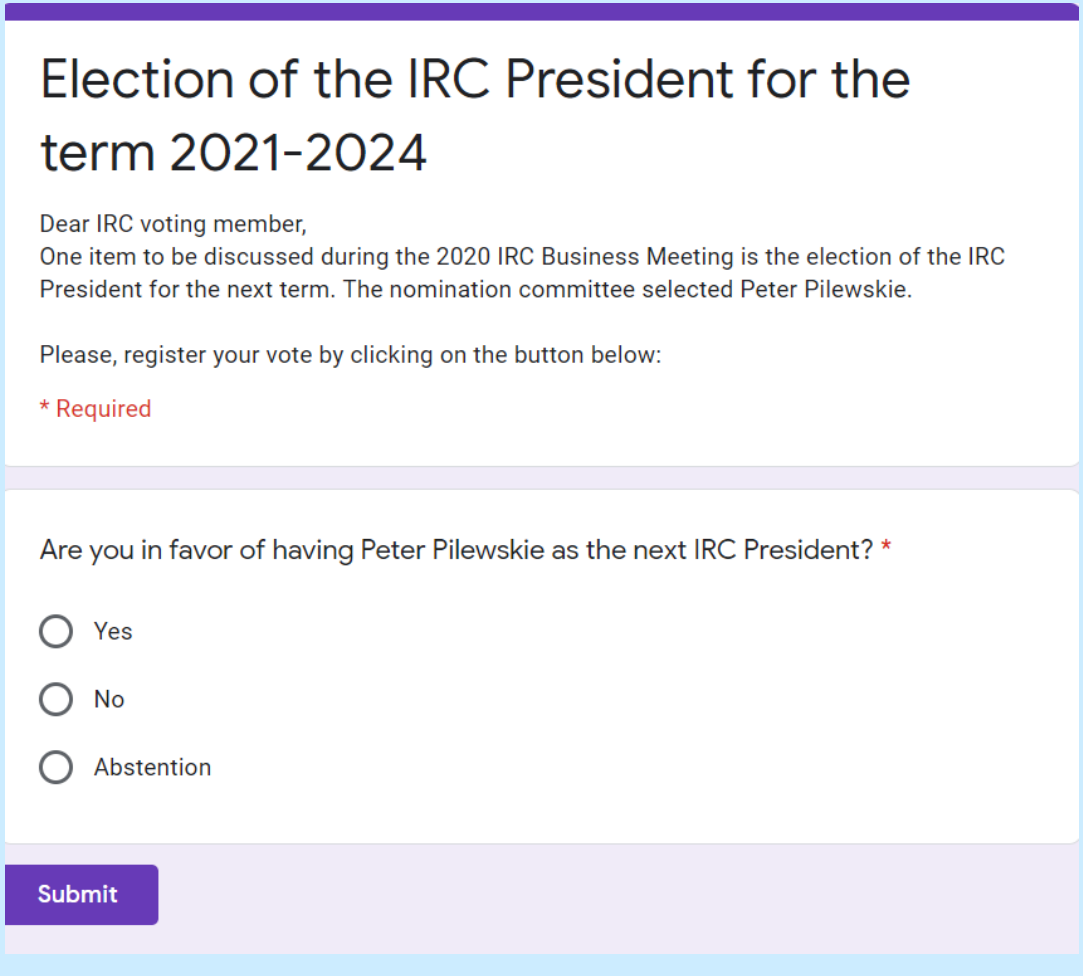
Voting members will receive a form by e-mail with instructions on how to vote.

Click on the “FILL OUT FORM” button.

In doing so, the form will open in another tab.



Please, read the instructions, click on your option and click on the “SUBMIT” button.



Click here!

Please, do this procedure only once.

Result of Election

Prof. Peter Pilewskie, LASP, Boulder CO, USA (current IRC Vice-President) was elected for next IRC President. (27 Yes, 1 abstention out of 28 votes)

Prof. Dr. Manfred Wendisch, Director, Leipzig Institute for Meteorology, University of Leipzig was elected for next Vice-President of IRC.

Prof. Hajime Okamoto, Distinguished Professor, Kyushu University, Vice Director, Research Institute for Applied Mechanics was elected for next Secretary of IRC.

Working Group Chair/Rapporteur Presentations

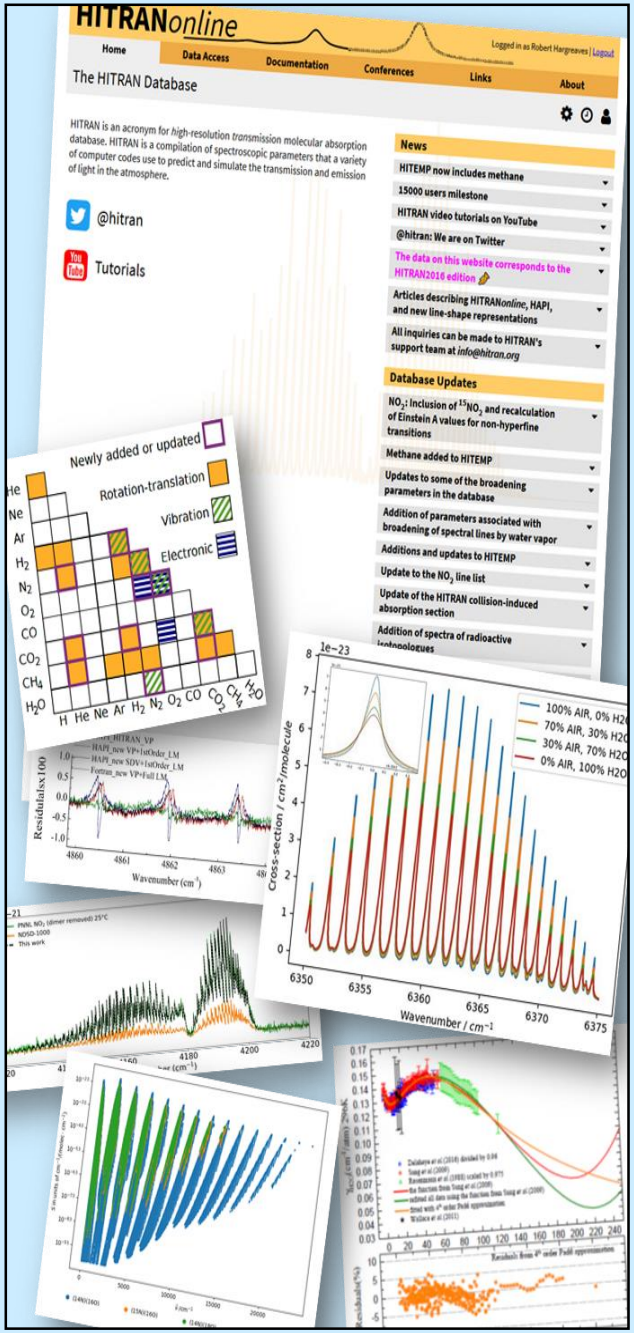
- ASA - Iouli Gordon
- BSRN - Amelie Driemel
- CIRC
- CR - Andreas Macke
- GDAP
- GEB – Martin Wild
- ICLAS - Alex Papayannis
- IPRT - Bernard Mayer and Claudia Emde
- ITWG - Vincent Guidard
- UV - Ann Webb
- 3DRT – Alexander Marshak
- Hyperspectral radiation: measurements and modelling

Atmospheric Spectroscopy: HITRAN2020

Iouli Gordon[1], Laurence Rothman[1], **Robert Hargreaves[1]**, Robab Hashemi[1], Ekaterina Karlovets[1], Frances Skinner[1], Eamon Conway[1,2], Yan Tan[3], Christian Hill[4], Roman Kochanov[1,5]

[1] Center for Astrophysics | Harvard & Smthsonian, Atomic and Molecular Physics Division, Cambridge, USA
[2] University College London, London, UK
[3] USTC, Hefei, China
[4] International Atomic Energy Agency, Division of Physical and Chemical Sciences, Vienna, Austria
[5]Tomsk State University, Laboratory of Quantum Mechanics of Molecules and Radiative Processes, Tomsk, Russia

***igordon@cfa.harvard.edu**



***igordon@cfa.harvard.edu**

Overview plan for **HITRAN**2020 (due: end of 2020)

Line-by-line (LBL):

- Almost all 49 molecules from **HITRAN**2016 [1] will be updated. The scale of each update depends on the molecule: ranging from the addition of new isotopologues/bands (e.g., $^{15}NO_2$), to the correction of a few lines.
- Examples of very extensive updates include H_2O, CO_2, O_3, CH_4 & selected trace gases
- New molecular species will be added (e.g., CH_3I, NF_3, CS_2)
- Foreign broadening parameters have been expanded with the inclusion of H_2O broadening [2]. Fig. 1 shows an example for CO_2
- Non-Voigt line shapes have been added for some molecules. Notably for CO_2 where line-mixing package is updated/integrated into HAPI

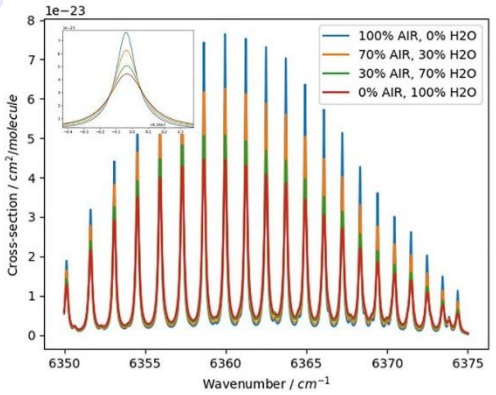


Figure 1

Collisional Induced Absorption (CIA):

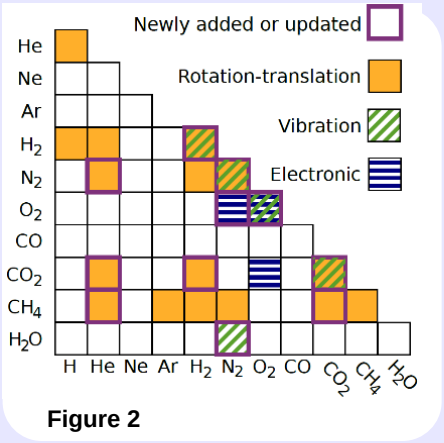


Figure 2

The CIA section has been expanded (Fig. 2). This includes updates to the **HITRAN**2020 CIA, new collisional complexes and new spectral regions [3]. In addition to [3], CIA data for **XXX** will be included.

Absorption cross sections (XSC):

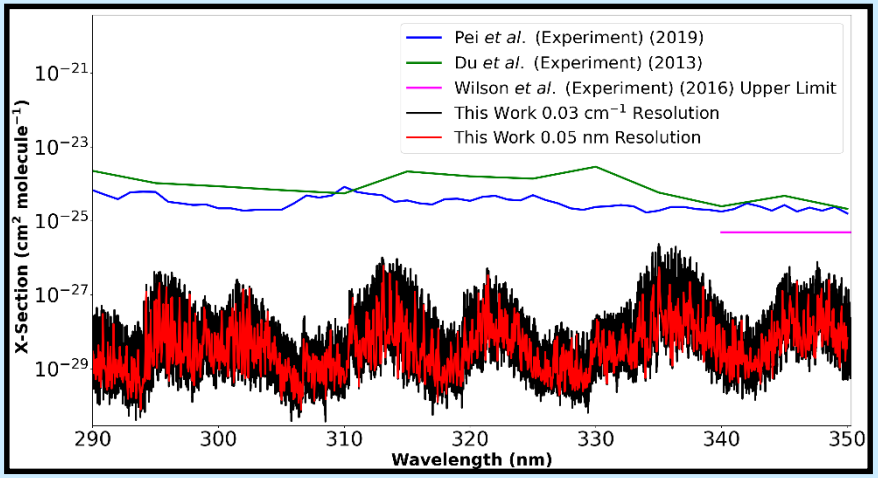
Many updated XSCs [4] were made available for **HITRAN**2016. It is expected than more will be added relating to H_2 and He broadened XSCs, as well as an increase in the number of XSCs that cover the UV spectral region

HITRAN2020

[1] Gordon et al. 2016 [doi:10.1016/j.jqsrt.2017.06.038]
[2] Tan et al. 2020 [doi:10.1029/2019JD030929]
[3] Karman et al. 2019 [10.1016/j.icarus.2019.02.034]
[4] Kochanov et al. 2019 [10.1016/j.jqsrt.2019.04.001]

Examples

New theoretical line list for **water vapor (H_2O)** Conway et al. 2020 [doi:10.5194/acp-2020-286]. The HITRAN2020 line list will be extended to 42 000 cm^{-1}. Validations show its superiority to other data

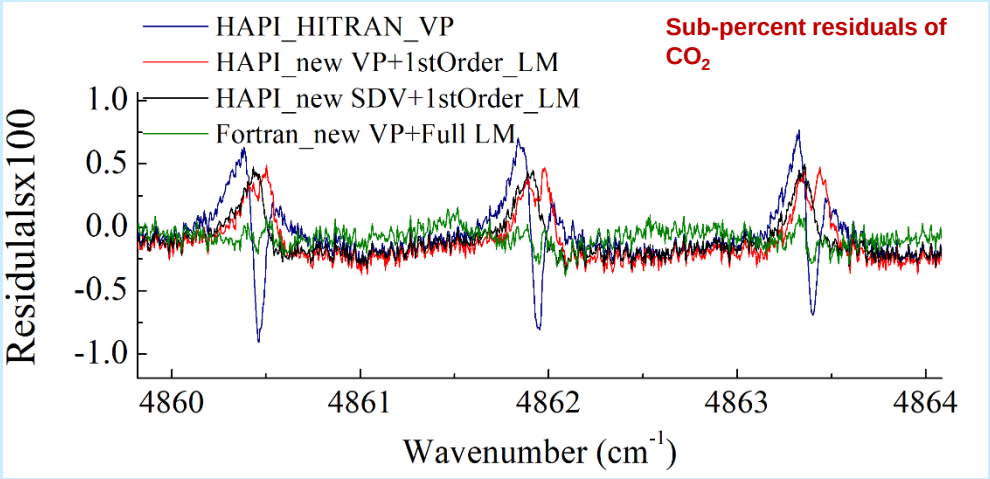


Pei et al. (https://doi.org/10.1029/2019JD030724) and Du et al. (https://doi.org/10.1002/grl.50935) measured cross sections in the NUV that appear significantly stronger than what they should be.

Extensive laboratory measurements and ab initio calculations in many different groups suggest that the intensities in MW and IR bands of **ozone (O_3)** in HITRAN2016 need to be reevaluated with average intensities increasing by **approximately**

Band	MW	10 μm	5 μm	14 μm
Increase	3.8 %	3 %	3.3 %	1.8 %

UV ozone cross-sections from DLR
https://zenodo.org/record/1485588#.XaYITWYpDIU



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

Archive status:

- 71 official stations with data
- 13 of those closed
- 3 more still in candidate status (Azores (ENA), Mexico (SEL), Reunion (RUN)
- Almost **12,000** months of radiation data in the archive.
- Since April 2016, **599** new access requests from **53** different countries

Web of Science:

- Cited over **3600** times without self-citations
- In over **2600** articles
- Producing an h-index of **31**

GEWEX GCOS GLOBAL CLIMATE OBSERVING SYSTEM NDACC AWI ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG European Commission

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

BSRN WG, selection of activities and plans

- Further investigate the possibility to review archive based on Worl infrared standard Group (WISG) infrared offset (while confirmed by CIMO radiation TT)
- Reinforce the Data Quality check (Data Quality WG)
- Interim BSRN 2020 virtual meeting late September / GDAP meeting mid October.
- GCOS (AOPC & OOPC) harmonization of best practices across land and ocean communities (Web platform to exchange information established by GCOS/on "Trello")
- Promoting coverage of geographical gaps of the network: possibly 5 to 8 upcoming candidate stations covering: Antactica, Mediterraneum, Indonesia, Thailand.
- Establish Level 2 BSRN official products: such as monthly avgs, clear sky Id, cloud effect, early-release data, …
- **Capacity4Dev (EU) user group**

Infrared J. Gröbner (PMOD/WRC) ~CIMO TT	**Spectral** Kathy Lantz (NOAA) ~NDAAC	**Broadband** A. Mc Comiskey (BNL)	**Uncertainties** (TBD) ~ CIMO TT	**NEW? Interaction with Ocean community** (TBD) ~ GDAP, GCOS
Cold Climate Issues Chris Cox (NOAA)	**Use of BSRN in Solar RE** E. Pereira (INPE)	**Manual review committee** G. Hodges (NOAA)	**Data Quality** W. Knap (KNMI)	**NEW? L2 products, VAP** (TBD) ~ GDAP, WCRP

GEWEX GCOS GLOBAL CLIMATE OBSERVING SYSTEM NDACC AWI ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG European Commission

Some recent (2019 + 2020) work on clouds & radiation, report for IRC 2020 BM, Andreas Macke and Stefan Kinne

Boers, R., F. Bosveld, H. K. Baltink, W. Knap, E. van Meijgaard, and W. Wauben, 2019: Observing and Modelling the Surface Radiative Budget and Cloud Radiative Forcing at the Cabauw Experimental Site for Atmospheric Research (CESAR), the Netherlands.
" The RCM has a cold bias with respect to the observations, but the model CRF-LW corresponds well to the observed CRF-LW as a result of compensating errors in the difference function that makes up the CRF-LW"

Wild, M., Hakuba, M.Z., Folini, D. *et al.* The cloud-free global energy balance and inferred cloud radiative effects: an assessment based on direct observations and climate models.
-> new CRE estimates (Wm^{-2}): TOA SW: − 47, TOA LW: 28, Surface SW: − 54, Surface LW: 28, Atm: 7 ,
"Global mean cloud radiative effects of individual models, however, vary substantially, with largest spreads and standard deviations occurring in the simulated surface estimates"

L'Ecuyer, T. S., Y. Hang, A. V. Matus, and Z. Wang, 2019: Reassessing the Effect of Cloud Type on Earth's Energy Balance in the Age of Active Spaceborne Observations. Part I: Top of Atmosphere and Surface.
"Multilayered clouds are found to exert the strongest influence on the top-of-atmosphere energy balance. However, a strong asymmetry in net cloud radiative cooling between the hemispheres (8.6 W m^{-2}) is dominated by enhanced cooling from stratocumulus over the southern oceans."

Yin, J., Porporato, A. Radiative effects of daily cycle of cloud frequency in past and future climates.
"Daily cloud cycle radiative effect (DCCRE): difference between the total radiative fluxes with the full cloud cycle and its uniformly distributed cloud counterpart. ... "Climate model outputs show large inter-model spreads of DCCRE, accounting for approximately 20% inter-model spread of the cloud radiative effects."

Loeb, N. G., Wang, H., Allan, R., Andrews, T., Armour, K., Cole, J. N. S., et al. (2020). New generation of climate models track recent unprecedented changes in earth's radiation budget observed by CERES.
"A model's ability to represent changes in the relationship between global mean net TOA flux and surface temperature depends upon how well it represents shortwave flux changes in low-cloud regions

Wall, C. J., Hartmann, D. L., & Norris, J. R. (2019). Is the net cloud radiative effect constrained to be uniform over the tropical warm pools?.
"Modelling studies support the hypothesis that feedbacks between sea surface temperature and convection are critical to obtaining similar net CRE in convective and nonconvective regions over the tropical warm pools."

Hogan, R. J., M. D. Fielding, H. W. Barker, N. Villefranque, and S. A. K. Schäfer, 2019: Entrapment: An Important Mechanism to Explain the Shortwave 3D Radiative Effect of Clouds.
"When the sun is high, 3D radiative transfer tends to make clouds less reflective, which we argue is explained by the mechanism of "entrapment" whereby horizontal transport of radiation beneath a cloud layer increases the chances, relative to the ICA, of light being absorbed by cloud or the surface."

Izeboud, M., Lhermitte, S., Van Tricht, K., Lenaerts, J. T. M., Van Lipzig, N. P. M., & Wever, N. (2020). The spatiotemporal variability of cloud radiative effects on the Greenland ice sheet surface mass balance.
"...conflicting views on the role of cloud effects on the LW and SW radiation, and the impact on the GrIS surface mass balance, ... spatial/seasonal contrast between the ablation and accumulation area. ... The choice of spatiotemporal coverage and resolution influences what type of cloud effects will be found. ... We can bring multiple studies together and diminish the conflicting views that previously existed."

Thomas, M. A., A Devasthale, T Koenigk, K Wyser, M Roberts, C Roberts, and K Lohmann
A statistical and process-oriented evaluation of cloud radiative effects in high-resolution global models, Geosci. Model Dev., 12, 1679–1702, 2019, https://doi.org/10.5194/gmd-12-1679-2019
"impact of atmospheric horizontal resolution on the representation of CRE: ... apparent insensitivity to increased atmospheric horizontal resolution indicates that physical parameterizations play a dominant role in determining the behaviour of cloud–radiation feedbacks."

Report of the IRC working group Global Energy Balance

Co Chairs:
Martin Wild and Norman Loeb

Objectives:

The main goals of this working group are the assessment of the magnitude and uncertainties of the components of the global energy balance, their decadal changes and underlying causes as well as their significance for other climate system components and climate change.

Activities: Meeting organization

- **European Geophysical Union (EGU) General Assembly 2020 (virtual meeting with online chat and uploaded contributions)**, April 2020. Organization of the session “Earth radiation budget, radiative forcing and climate change”, closely linked to the aims of this working group (Convenors Martin Wild, Paul Stackhouse, Jörg Trentmann). (consecutive since 2006)
- **American Geophysical Union (AGU) General Assembly 2020 (San Francisco / virtual meeting).** Dec 2020. Organization of the session “GC034: Earth’s Energy Balance and Energy Flows through the Climate System”, closely linked to the aims of this working group (Convenors Maria Hakuba, Seiji Kato, Lijing Cheng, Martin Wild).
- **IRS postponed to June 14-16 2021**. Organization of the session “Radiation Budget and Forcing”, closely linked to the aims of this working group (Convenors Seiji Kato, Norman Loeb, Martin Wild).

Activities: IPCC AR6

IPCC AR6 Chapter 7 "The Earth's energy budget, climate feedbacks, and climate sensitivity "

Martin Wild (Lead Author), responsible for Radiation / Energy Budget Section, Norman Loeb and Seiji Kato (contributing authors).

Status: Second Order Draft (SOD) completed, public review of SOD completed.

Final Draft (*FGD*) in preparation

Recommendations

Recommendations TOA aspects

Government agencies responsible for building the next generation of Earth Radiation Budget instruments should be urged to

- include onboard calibration equipment that can detect and correct for on-orbit contamination of optics.
- dedicate sufficient time for ground calibration activities.
- periodically re-verify the traceability of calibration targets on the ground.
- establish collaborations with other international agencies specializing in calibration standards (e.g., NIST, NRL).

The international community should provide guidance on the creation of Earth Radiation Budget climate data records. Earth Radiation Budget Climate Data Records capable of accurately characterizing climate at decadal time-scales are inherently more research data products than they are operational data products. While an operational approach works fine for processing weather data, far more rigor and quality assurance is necessary for climate data products, where reprocessing is an integral part of the effort.

Recommendations

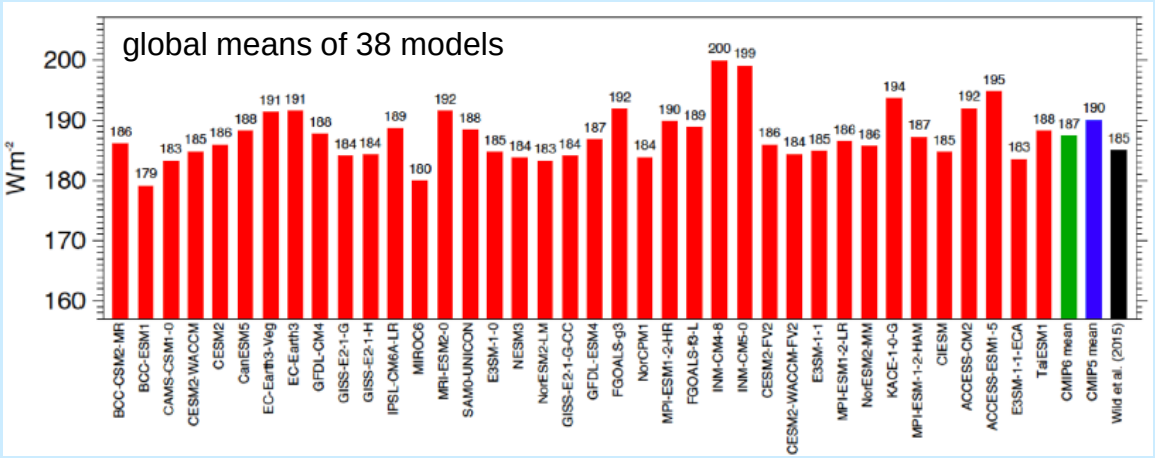
Recommendations surface aspects

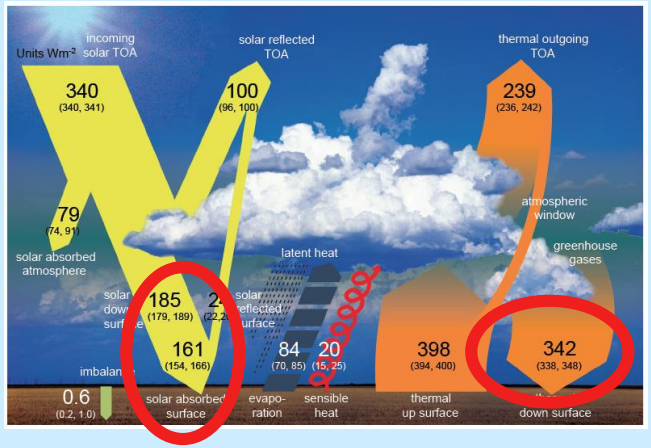
- Ensure a continued operation and maintenance of a well calibrated network of long term surface radiation stations to provide direct observations for satellite-derived products and model validation, and for the detection of changes in the radiation fields.
- High accuracy observation sites should be expanded to under-represented regions of the globe (low latitudes/ oceans). The use of shortwave radiometers (e.g. SPN-1) suited for use in remote locations (buoys /ships) is recommended.
- Anchor sites should include direct and diffuse shortwave measurements in addition to total incoming shortwave along with standard surface meteorological measurements essential for radiation quality assessment.
- To improve surface albedo estimates over various surface types and for the assessment of satellite derived albedo products, high accuracy spectral and broadband measurements from towers are desirable at the anchor sites
- Atmospheric spectral optical depths should be observed to infer atmospheric column abundance of aerosol, ozone, water vapor and other atmospheric constituents.
- The spatial representativeness of surface anchor sites needs to be further assessed (Hakuba et al. 2013, 2014, Schwarz et al. 2017, 2018). Possible urbanization effects (impact of local air pollution) in surface solar radiation records needs quantification.
- Letters of support from the International Radiation Commission to National agencies funding BSRN stations may help to raise the recognition of the importance of such anchor sites. A letter of support from the IRC for the continuation of the radiation measurements at sites operationally struggling and/or at risk of being shut down may therefore be helpful.

Example research: radiation budgets in CMIP6 GCMs

Model mean: 187 Wm^{-2}
Model range: 21 Wm^{-2}
Standard dev.: 4.5 Wm^{-2}

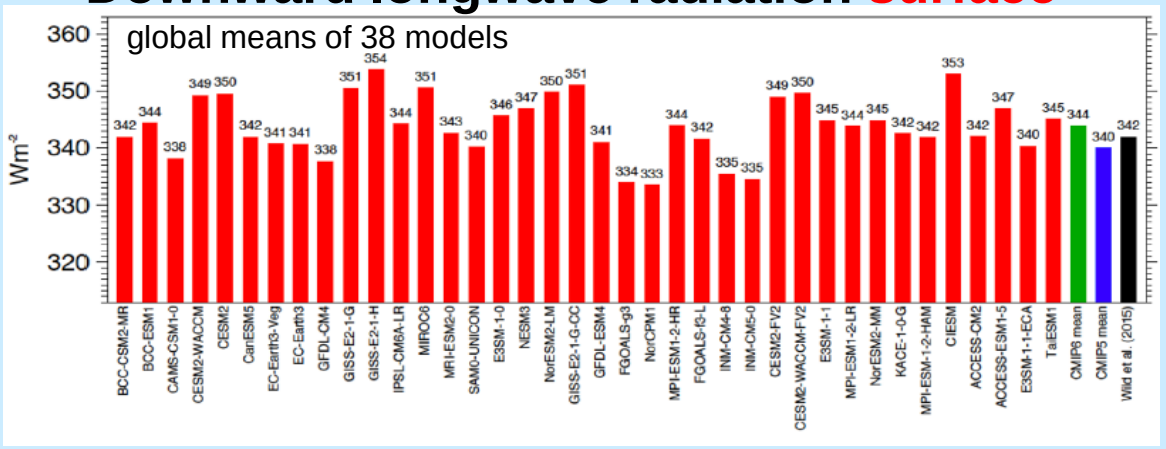
Downward shortwave radiation surface





Model mean 344 Wm^{-2}
Model range: 20 Wm^{-2}
Standard dev.: 5.2 Wm^{-2}

Downward longwave radiation surface



- *CMIP6 improved radiation budgets in global multimodel mean*
- *Still substantial global mean biases in individual models*
- *More consistent representation in SW clear sky budgets*

Wild M. The global energy balance as represented in CMIP6 models. *Clim Dyn* 55, 553–577 (2020)

IPRT - International working group on polarized radiative transfer

Claudia Emde and Bernhard Mayer

Meteorological Institute
Ludwig-Maximilians-University Munich
Germany

IRC business meeting, 10 August 2020

International Working Group on Polarized Radiative Transfer

Aims of working group IPRT:

- bring the community together (workshops)
- **compare and improve models, 3D model intercomparison**
- **provide benchmark results**
- provide information about free codes
- develop new and faster, publically available codes
- provide input data (scattering matrices, BPDFs – bidirectional polarization distribution functions, ...)

Project website:
www.meteo.physik.uni-muenchen.de/~iprt

Radiative transfer in fully spherical geometry

- Important for satellite-based limb sounding observations and ground based observations during twilight
- New benchmark results have been published:

  S. Korkin, E.-S. Yang, R. Spurr, C. Emde, N. Krotkov, A. Vasilkov, D. Haffner, J. Mok, and A. Lyapustin. **Revised and extended benchmark results for Rayleigh scattering of sunlight in spherical atmospheres.** *J. Quant. Spectrosc. Radiat. Transfer*, 2020, in press.

- Similar model intercomparison study including polarization ongoing

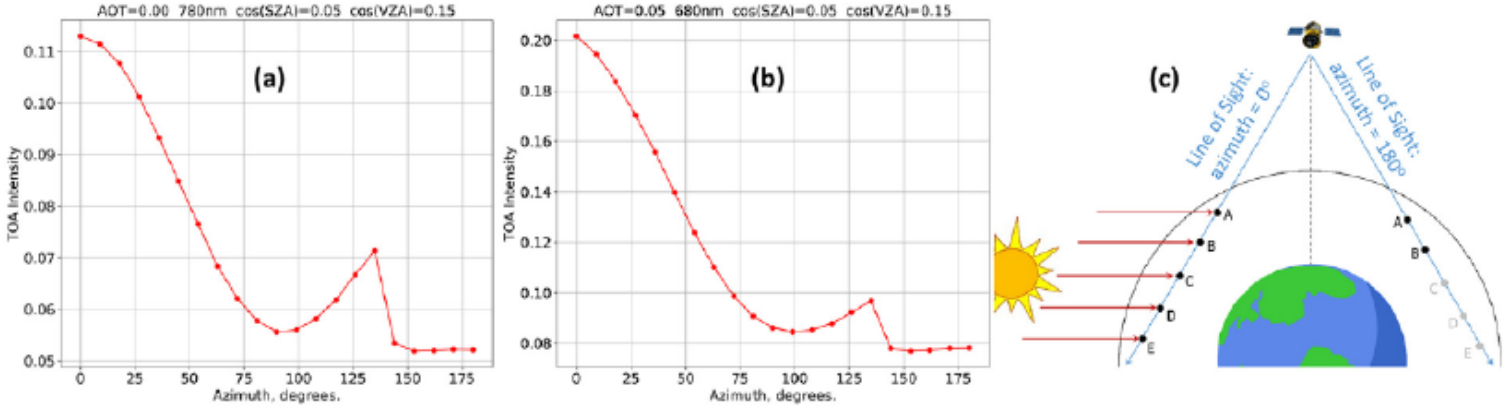


Fig. 6. Reflected intensity (y-axis) as a function of the TOA azimuth (x-axis) and AOT (image (a) vs (b)). The Earth shadow causes drops near 135° azimuth: points A & B are visible for any azimuth, while C, D, and E "disappear" into the Earth shadow in the backscattering directions as shown in image (c).

Figure from Korkin et al. 2020

Plans for extensive model intercomparison for polarized radiative transfer in fully spherical geometry

- Observational setups
  - Ground-based sensor (Polarization in twilight)
  - Satellite-based sensor (Limb geometry)
- Atmospheric setups
  - Clear-sky
  - Aerosol
  - Thin 1D cirrus cloud
  - Finite 3D cumulus clouds
- Model setups
  - pseudo-spherical approximation
  - spherically symmetric atmosphere (refraction neglected)
  - spherically symmetric atmosphere (refraction enabled)
  - 3D spherical atmosphere
- Detailed defintion of test cases in preparation, will be provided on IPRT website
- Groups which can handle VRTE in spherical geometry will be invited to participate

IRC Business Meeting, 10 Aug 2020

ITWG report to IRC

Vincent Guidard (Météo-France)
Liam Gumley (SSEC, UWisconsin)

Conference ITSC-22 in fall 2019

- ITSC-22, was hosted by ECCC at the Manoir Saint-Sauveur in Saint-Sauveur, Québec, Canada, between 31 October and 6 November 2019
- 152 participants from 45 organizations, 17 countries and 3 international bodies
- 80 longer format oral presentations and 125 poster papers
- Working Groups were formed to consider six key areas of interest to the ITWG:
  Radiative Transfer, Climate, Data Assimilation and Numerical Weather Prediction,
  Advanced Sounders,International Issues and
  Future Systems, and Products and Software
- 23 recommendations issued
- website http://cimss.ssec.wisc.edu/itwg/itsc/itsc22/index.html

Conference ITSC-22 in fall 2019

Radiative transfer, optimizing return on investments:

(21) To IRC and agencies involved in radiative transfer developments: ITWG strongly recommends continuous efforts in radiative transfer modelling developments, especially regarding:

Line-by-line model development as a fundamental basis for accurate radiative transfer calculations in fast RT models.

Development of reference-quality ocean-surface emissivity modeling, specifically Infrared, Microwave, for both active and passive simulations.

Extension of the frequency range of scattering models to cover the ranges of current and upcoming sensors, from visible to microwave (i.e., ICI channels).

(22) To IRC and agencies involved in spectroscopy research and radiative transfer development: ITWG strongly recommends continuous support of theoretical and laboratory spectroscopic studies to improve the accuracy of fundamental parameters required for radiative transfer calculations (e.g., research into spectroscopy of higher frequency microwave channels up to 1000 GHz), as well as efforts to map uncertainties in spectroscopy into radiance uncertainties.

- ITSC-23 was planned for spring 2021,
  but due to the COVID situation,
  tentatively in fall 2021
- To keep the momentum in between 2 ITSCs,
  sub-working groups meetings planned for
  november 2020 (remotely)
- The Surface sub-working group will become
  International Suface Working Group
  as a sub-group of CMGS

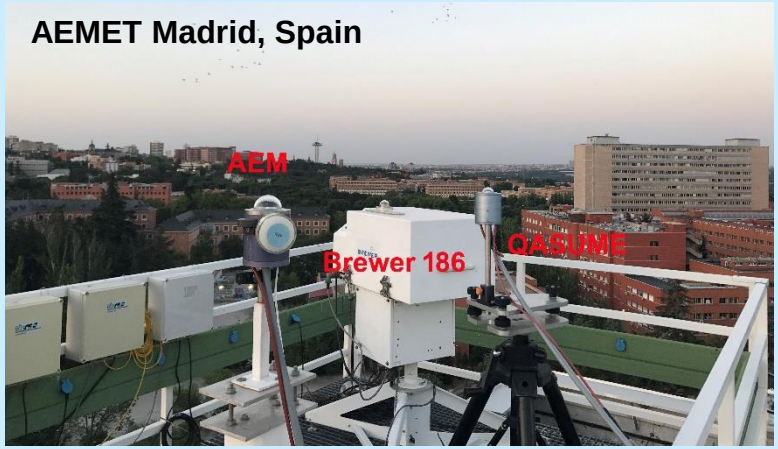
UV Working Group Overview

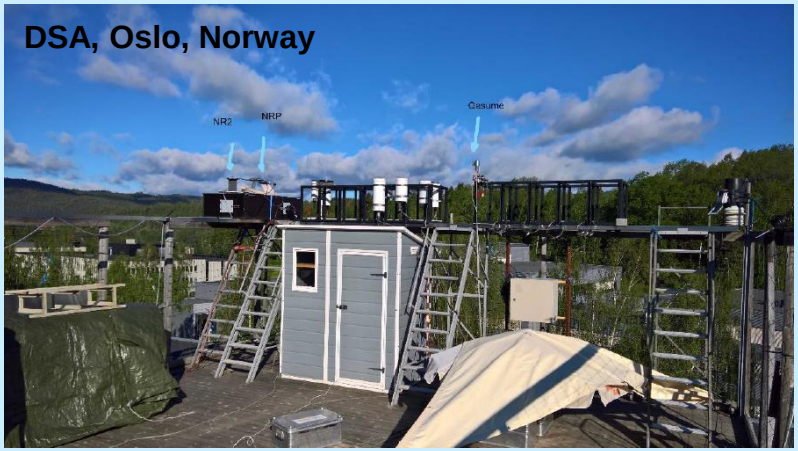
Ann Webb, Julian Grobner, Alkis Bais, Mario Blumthaler, Luca Egli

- International Union of Photobiologists, Barcelona, August 2019: Sessions on UV measurements; UV effects
- Good response to IRS – delayed 2021
- Selection of Publications:

- Lakkala, K. et al. Validation of TROPOMI Surface UV Radiation Product, *Atmos. Meas. Tech. Discuss*., https://doi.org/10.5194/amt-2020-121, in review, 2020.
- Fountoulakis, I. *(2020)* Solar UV Irradiance in a Changing Climate: Trends in Europe and the Significance of Spectral Monitoring in Italy. *Environments* 7(1), 1-31.
- Felton S.J et al. *(2020)* Photoprotection conferred by low level summer sunlight exposures against pro-inflammatory UV insult. *J. Photochemical and Photobiological Sciences* (in press)
- Hülsen G. et al. *(2020)* Second solar ultraviolet radiometer comparison campaign UVC-II. *Metrologia* 57,doi: 10.1088/1681-7575/ab74e5.
- Schmalwieser A. et al.*(2019)* The Austrian UVA-Network. *Photochem Photobiol* 95, 1258-1266.
- Isner, J-C. et al. *(2019)* Short and long term effects of UV-A on Arabidopsis are mediated by 1 a novel cGMP phosphodiesterase. *Current Biology* 29(15), 2580-85
- Lakkala, K. et al. *(2018)* Performance of the FMI cosine error correction method for the Brewer spectral UV measurements*, Atmos. Meas. Tech*., 11, 5167–5180, https://doi.org/10.5194/amt-11-5167-2018.

QASUME campaigns 2019





4 QASUME campaigns were performed in 2019:

- 22 May to 26 May at DSA, oslo, Norway.
- 17 June to 27 June at INTA, El Arenosillo, Spain (RBCCE-XII).
- 29 June to 1 July at AEMET Madrid, Spain.
- 4 July to 8 July at ARPA Aosta, Aosta, Italy.

A total of 19 spectroradiometers were calibrated relative to QASUME, resulting in traceable measurements of spectral solar UV irradiance with expanded uncertainties (k=2) below 6% for most instruments.

3DRT - Three-Dimensional Radiative Transfer

Website: http://i3rc.gsfc.nasa.gov

WG 3DRT's current Co-Chairs are **Alexander Marshak** and Jean-Luc Widlowski. WG 3DRT integrates the interests of a variety of applications of 3D RT, including clouds, with the work of I3RC (Intercomparison of 3D Radiative Transfer Codes), and complex vegetation as considered by RAMI (Radiation Transfer Model Intercomparison).

The 3DRT working group's goals include:

* evaluating methods available for 3D atmospheric RT calculations;
* providing benchmark results for testing and debugging 3D RT codes;
* developing 3D RT community tools.

3D RT events (July 2019-June 2020):

- 3D session at the 2019 AGU Fall Meeting: "Observing and simulating aerosol-cloud-radiation interactions in a 3-D atmosphere" Dec. 10, 2019.
- The special issue in the Remote Sensing: "Remote Sensing of Cloud and Aerosol Properties in a 3D Atmosphere" (open for submissions until Dec. 31, 2020).

Some numbers for July 2019-June 2020:

- The I3RC Monte Carlo code was given to 5 people (2 - China, 2 - US, 1 - France). This is up from 4 last year, but lower than the typical number in previous years (12-14). The drop may have come from the release in 2017 and 2018 of two other versions of the I3RC code by Alexandra Jones, which include thermal emission and broadband capability.

- The I3RC online simulator gained 21 new users (5 - US, 5 - Germany, 3 - China, 2 - France, 2 - Israel, and 1 - Switzerland, Spain, Russia, and Belgium each). The total number of old and new users stood at 55 at the end of June 2020.

New IRC working group on: Hyperspectral Measurements and Modelling

- Original proposal by Piet Stammes in Aug 2017 at IAMAS in Cape Town
- Well received by IRC
- No activities yet due to lack of time
- Co-chairs needed!
- Proposal: to limit scope to the solar spectral range (so no hyperspectral Thermal IR)
- Hyperspectral remote sensing of trace gases, aerosols and clouds: Latest satellites: TROPOMI on S-5P (ESA); GEMS on GK-2B (S-Korea)
- Methods: e.g. Differential Optical Absorption Spectroscopy (DOAS).

Plans and report

- Collect information from various sources: conferences, workshops, journal articles, books
- DOAS workshop 13-15 July 2020, completely virtual. 160 participants, organized by KNMI; https://www.knmiprojects.nl/projects/doas-workshop-2020
- It worked very well:
  - 15-min oral presentations via Webex and YouTube
  - 1-min poster announcements via Webex and YouTube
  - posters, questions, discussions and coffee tables via Slack
- In 2021: Workshop “Remote sensing in O2 absorption bands” in Berlin, 31 May-2 June, organized by FUB.

Working Group Reformulation Report

The 11 Current IRC Working Groups
ASA - Atmospheric Spectroscopy Applications Chair: Iouli Gordon
BSRN - Baseline Surface Radiation Network Co-Chairs: Amelie Driemel and Christian Lanconelli
CR - Clouds and Radiation (Rapporteur) Rapporteur: Stefan Kinne
CIRC - Continuous Intercomparision of Radiation Codes Co-Chairs: Eli Mlawer and Lazaros Oreopoulos
GDAP - GEWEX Radiation Panel (Rapporteur) Rapporteur: Remy Roca
GEB - Global Energy Balance Co-Chairs: Norman Loeb and Martin Wild
ICLAS - International Coordination group for Laser Atmospheric Studies Chair: Alex Papayannis
IPRT - International Polarized Radiative Transfer Co-Chairs: Claudia Emde and Bernhard Mayer
ITWG - International TOVS Working Group Co-Chairs: Liam Gumley and Vincent Guidard
UV - Solar UltraViolet Radiation Co-Chairs: Julian Groebner and Ann Webb
3DRT (I3RC) - Three-Dimensional Radiative Transfer Chair: Alexander Marshak

Working Group Reformulation Report

Proposed Elimination of two working groups:

1. CIRC - Continuous Intercomparision of Radiation Codes
   - The Earth Science RT community targeted by CIRC has moved on to other efforts like RFMIP[1] and CKDMIP[2]
   - There is no clear funding support model for the activity,
   - The DOE products that were the cornerstone of the measurement-based strategy of CIRC are not at the forefront of the DOE program that initially supported them.
   - Co-chairs Oreopoulos & Mlawer propose that we “sunset” the CIRC WG
2. GDAP - GEWEX Radiation Panel
   - GDAP and been unresponsive to the IRC for several years now.
   - No. WG reports have been provided for sever years; has openly stated a desire to not contribute to the IRC.

[1] Radiative Forcing Model Intercomparison Project, part of the WCRP; Co-Chairs: Robert Pincus, Piers Forster and Bjorn Stevens

[2] Correlated K-Distribution Model Intercomparison Project; Initiated by Robin Hogan, ECMWF and University of Reading

Working Group Reformulation Report

Three candidate new working groups:

1. A new, broader RT intercomparison initiative

Justification:

- Recommended by Oreopoulos & Mlawer.
- Could comprise RFMIP and CKDMIP and potential include intercomparisons of 3D, polarized, and sounding-assimilation-simulator-LBL RT codes.
- A bigger *RT intercomparison* IRC working group will likely need a different leadership structure, possibly with sub-group chairs
- This new intercomparison WG will eliminate some current fragmentation in the community that uses and develops RT tools across many of these applications.

Potential Co-chairs:

- Robert Pincus, Robin Hogan, Christine Chiu

Working Group Reformulation Report

Three candidate new working groups:

2. A new working group on Total and Spectral Solar Irradiance

Goals:

- Assess the magnitude and uncertainties in the total solar irradiance (TSI) and spectral solar irradiance (SSI).
- Assess the magnitude and uncertainty of variability in total and spectral solar irradiance on solar rotation and solar cycle timescales.
- To understand the drivers of solar irradiance variability.
- To identify and constrain the significance of solar irradiance variability on Earth's climate.

Members:

- People who measure and model TSI and SSI or their solar activities proxies; people who assess TSI and SSI forcing within climate models

Proposed Co-chairs:

- Odele Coddington (CU/LASP) & Natalie Krivova (MPS)

Working Group Reformulation Report

Three candidate new working groups:

3. Application of machine learning to next-generation cloud-aerosol remote sensing

Scope:

- Emerging retrievals such as multi-pixel convolutional approaches of aerosol and cloud properties and radiative effects in complex scenes; can be extended to trace gas retrievals

Goals:

- Explore various different multi-pixel and/or spectral algorithms
- Ensure physical consistency
- Formal assessment of information content in pattern- and contrast-based retrieval algorithms
- Promote transition of machine learning algorithms to operational applications

Potential Co-chairs:

- Sebastian Schmidt (CU/LASP) & Hironobu Iwabuchi, Tohoku University

Working Group Reformulation Report

One working group currently in formulation:

Hyperspectral Measurements and Modelling

- Proposed by Piet Stamnes in 2017 and approved by IRC
- See proposal here:http://www.irc-iamas.org/files/Stammes_Hyperspectral_proposal.pptx
- Since 2017 Dr. Stamnes has had little time to commit to the WG.
- The need for this WG is still strong with many satellite spectrometer data becoming available.
- Piet is looking for a co-chair to assist with organization and reporting.

Summary of Discussion on the Working Group Reformulation

A. The IRC has decided to retire the following two working groups:

1. CIRC - Continuous Intercomparision of Radiation Codes
   Justification: The Earth Science RT community targeted by CIRC has moved on to other efforts like RFMIP1 and CKDMIP2. There is no clear funding support model for the activity; for example, the US Department of Energy (DOE) products that were the cornerstone of the measurement-based strategy of CIRC are not at the forefront of the DOE program that initially supported them. Co-chairs L. Oreopoulos & E. Mlawer propose that we "sunset" the CIRC WG and the IRC agrees. A new intercomparion working group may be proposed next year based on the models of RFMIP1 and CKDMIP2.

2. GDAP - GEWEX Radiation Panel
   Justification: GDAP has been unresponsive to the IRC for several years now. No WG reports have been provided for several years; the WG Chair has openly stated a desire to not contribute to the IRC. The IRC has agreed to terminate this WG.

B. No formal WG proposals were presented at this IRC BM. However, concepts for three new WGs were presented:

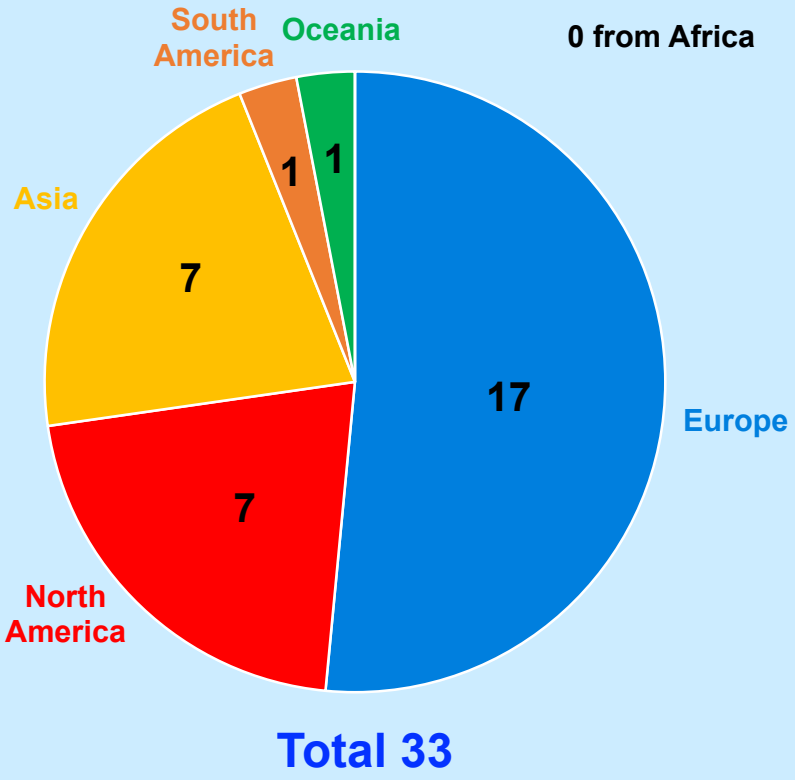
   1. A new intercomparison initiative, likely based on RFMIP1 and CKDMIP2

   2. A new working group on Total and Spectral Solar Irradiance

   3. Application of machine learning to next-generation cloud-aerosol remote sensing

- *We will solicit proposals for new IRC WGs at the 2021 IRC BM*

Upcoming Election for the Commissioners (2021-2024 term)



Outgoing members

- 6 from Europe
- 3 from North America
- 1 from Oceania
- 3 from Asia

Total 13 members

Next IRC Business Meeting

@IRS 2021 in Thessaloniki, Greece

Heads-Up: IRS 2024 Bid Proposals

Past venues
1996: Fair Banks (NA)
2000: St Petersburg (Europe)
2004: Busan (Asia)
2008: Iguazu (SA)
2012: Berlin (Europe)
2016: Auckland (Oceania)
2020: Thessaloniki (Europe)

We have a preference to have a venue in the Americas or Asia.