

IACS Working Group on Debris Covered Glaciers

Status report for the period September 2021 – August 2022

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This is the fourth report of the WG, which was established in September 2018 aiming to advance our ability to map debris thickness, identify model complexity required to estimate sub-debris melt and coordinate knowledge exchange on debris-covered glaciers. We note that the pandemic has continued to greatly affect progress over the past year, affecting the WG leads, members, and a lack of presence at meetings.

1) Melt model intercomparison:

The multi-author publication (led by Francesca Pellicciotti) comparing 14 sub-debris melt models over multiple locations and climatic zones remains close to completion. The paper, co-lead by Adria Fontrodona Bach, has more than 30 co-authors who have contributed either models or data or both. Two iterations have been conducted with all co-authors and a final version ready for submission is currently being prepared. We hope that the paper will be submitted by January, and that with an additional year the manuscript can be published.

2) Working group status and meetings:

The current membership remains at 67, coming from 18 nations, with 1/3 of the members being female. No formal working group meetings were held in the past year, mostly because of the pandemic and little attendance to the major conferences. Instead, meetings to support the manual on field measurements (see below) were held online.

3) Special issue in Frontiers:

The Frontiers Journal Research Topic “Debris-Covered Glaciers: Formation, Governing Processes, Present Status and Future Directions“, edited by WG members is now complete; including an editorial summarizing the main achievements of the 20 papers presented therein (Shukla et al., 2022).

<https://www.frontiersin.org/articles/10.3389/feart.2022.1021292/full>

4) UNESCO manual on field measurements on debris-covered glaciers

Meetings were held to support this new initiative that was started in 2021 (led by WG members Anderson, Fyffe, Sakai, Schoessow, Steiner) to produce a joint, free, UNESCO-IACS publication ‘Methods manual for the study of debris-covered glaciers’. A limited series of well-attended online global roundtables were held and progress is being made to synthesize content.

5) Data sharing platform and planned publication:

The shared zenodo data community continues to grow with 32 datasets currently represented there, some of which are themselves larger community collections (<https://zenodo.org/communities/iacswgondcgs/>). A list of >100 further datasets that the community wishes to make freely available on this platform is collected but are to be added by individual authors as and when they can. An Earth System Science Data (ESSD) publication accompanying the zenodo community collection has been drafted, but not yet submitted as we were awaiting some more submissions to the platform. A submission may be

possible with an extension. Expanding and continuing this data collection is one of the legacy products of the WG.

6) Debris thickness mapping

Several WG members have independently made much progress in this area over the course of the WG – and these advances have helped define the relevant information gap to be addressed in the planned community effort and publication. Unfortunately, due to a lack of remaining time and time from members to support the effort, this effort is no longer being pursued in the current working group.

Funding aspects:

We have not spent any money so far in 2022. Our only outgoing remains the GBP 98.88 for the hosting of rockyglaciers.org for 10 years.

Request of extension:

The working group activities have been substantially slowed down by the pandemic (family care duties, disrupted working flows, cancellation or limited attendance to conferences, limited travels). All the three WG leads have also had major career moves. We are therefore requesting a one-year extension to bring to completion the WG goals, and in particular the Melt Model Intercomparison (MMI) paper, and the ESSD data paper, which we are confident will both represent major contributions. We will also use the additional year to hold a last closing meeting of Phase I at EGU or AGU (now that travels are allowed and participation in person is again possible).

Addendum: request for a Phase II of the WG.

Request of Phase II of the working group:

The WG has been an exciting opportunity to consolidate a vibrant community around an emerging topic. For phase I, we had identified three main tasks: i) melt model intercomparison; ii) debris thickness intercomparison; and iii) knowledge exchange platform. We have enjoyed working together and with the broad community that formed around the WG. We would like to request a Phase II of the WG to maintain the momentum, consolidate activities started during phase I, build on ideas stemmed during Phase I and provide a white paper and horizon-scanning publication to leave a legacy of synthesis of knowledge on DCG. We would address the following objectives and tasks:

- 1) **Debris thickness estimates:** learning from the preliminary efforts in Phase I, we will focus on i) a perspective/review publication that summarises current approaches (without carrying out a detailed intercomparison exercise); ii) a global debris thickness reconstruction that advances over current efforts to represent the “consensus” product.
- 2) A **database of debris properties**, based on both literature values and recalculation from existing datasets. This stems from a major result of the MMI: that uncertainty in debris properties is the major source of uncertainty in melt simulations. It will provide a key service for future efforts on debris-covered glaciers modelling.
- 3) A **meeting on debris covered glaciers** organised in 2024 opened to the entire community beyond the active members to consolidate a synthesis of what we know about debris-covered glaciers and where we should go in the future. We foresee a **white paper** and a journal special issue.
- 4) A **horizon scan paper** (similar to the Orr et al, 2022, Earth Future) to identify the priorities and research questions for the future of DCG research, which we would like to leave as legacy of this phase II.
- 5) A **possible additional focus** on either debris remobilisation, sources, short-term transport; or debris long-term evolution/modelling. We have had preliminary conversations with scientists from both communities and we would consolidate one topic and task if our request is accepted.

Francesca will be keen to remain WG lead. Activity 1) will benefit from a recent granted project to reconstruct global debris thickness, its changes and importance for glacier hydrology and evolution, where Dave is also involved. Dave and Lindsey, while remaining active members of the WG, opt to step down from the leadership. Duncan Quincey will be willing to co-lead the phase II of the WG, and he brings expertise in remote sensing of DCG that has been missing from the activities of Phase I. We will seek one or two early career scientists to join us (e.g. Catriona Fyffe, Yota Sato, Marin Kneib, Jakob Steiner, some of them have already expressed their interest) if this request is accepted. We would try to account for diversity in expertise/scientific interests, geography and gender.

REFERENCES

Orr, A., Ahmad, B., Alam, U., Appadurai, A., Bharucha, Z. P., Biemans, H., et al. (2022). Knowledge priorities on climate change and water in the Upper Indus Basin: A horizon scanning exercise to identify the top 100 research questions in social and natural sciences. *Earth's Future*, 10, e2021EF002619. <https://doi.org/10.1029/2021EF002619>