Testing and improving model physics, downscaling, and parameterizations
Discussion Lead: Ethan Gutmann
Rapporteur: <u>Tobias Jonas</u>

• HW: Downscaling of larger-scale meteorological fields is a very important topic, but very challenging at the same time

• JP: Coming up with a downscaling toolbox available to the community is in fact one of initial ideas of INARCH

• EG: training such tools is sometimes hampered by inaccurate observations

• Quick poll: ¼ of the audience uses downscaling tool, most of which do statistical downscaling, some dynamical downscaling

• EG: the choice of methodology is critically dependent on the involved scales

• MS: the ability to accurately measure snow precipitation in mountain catchments is important towards further improving model. Maybe a combination of gridded reanalysis data and weather forecast data is a way to go

• JP: data assimilation seems promising in this regard. Since SNODAS, the material that TJ has presented is the only other / new product. This approach will be interesting to follow up on in the future.

• MK: There are some problems with SNODAS. 50% difference in SWE at high sites, mid elevation are good however, which is where most of the data comes from.

• TJ: It is important to promote collaboration with folks from atmospheric sciences. A session on methodology to improve meteorological forcing fields as input to snow hydrological models at DACA-13 (IAHS, IACS, IAMAS) was a first good example. Also IUGG-15 hosted some good session on this topic.

• JP: Same here: ICAM-15.

• GK: Happy to see that the ideas that led to MOCA-09 have been followed up on.

• EG: AMS mountain meteorology conference in the US (<= to be checked if correct) seems to be the equivalent of ICAM

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• JP: Speaking of model uncertainties: it is important to keep track of them.

• EG: RE made a good point: using a multi model approach you can get them all to reflect observations, but if tuned individually they have different sensitivities to climate change

• TJ: To better constrain model uncertainties it is important to have validation data for more than just SWE, such as snow lysimeter, albedo, snow surface temperature, etc.

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• JP: INARCH downscaling tool kit: should we follow up on that? At least we could list available methods. Should we have a working group on that?

• MB: Downscaling wind can be quite CPU intensive, but see look up table approach from R. Mott

• TJ: See also A. Winstral's methods.

• IZ: INARCH will encompass test sites that allow to further investigate

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MS: what do we actually need, do we need all these detailed processes to get better hydrographs?.

JP: Let's do sensitivity tests to find out

EP: in this case, you need to recalibrate your runoff model every time to iterate you input data.

MB: we should also try to make complex approaches simpler to make them applicable if input data availability is limited.

GK: I like to support MB. This is quite important. Needed model complexity could be tested using data denial experiments.

TJ: also supports MB's vote. Model development research should not become too disconnected from needs regarding operational applications

MK: There are still people who use spread sheet model to predict snow melt.

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IZ: having talked about downscaling, what about upscaling?

HW: SnowMIP is going in this direction

JP: Then why not include Dischma (catchment) with Weissfluhjoch dataset (point scale) which has been assigned as a SnowMIP site?

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