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updated Arctic land ice mass balance

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main

Jason Box and Jason Box update for GLAMBIE ... now 11

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Arctic InSitu versus GRACE (ArcticInSituvGRACE) 2023

updated Arctic land ice mass balance output after: Box, J. E., Colgan, W. T., Wouters, B., Burgess, D. O., O'Neel, S., Thomson, L. I., & Mernild, S. H. (2018). Global sea-level contribution from Arctic land ice: 1971–2017. Environmental Research Letters: ERL [Web Site], 13(12), 125012. https://doi.org/10.1088/1748-9326/aaf2ed

The base data is from the WGMS compilation https://wgms.ch/data_databaseversions/ adding 'latest values' from https://wgms.ch/latest-glacier-mass-balance-data/

Regional Notes

Russian High Arctic (RHI) is here estimated based on regression with Svalbard (Svalbard vs RHI slope 1.1236, that is RHI mass balance is estimated to be 12% more negative than that of Svalbard) after RHI −22 GT/y from the 2000 to 2017 period (Sommer et al 2022): Sommer, C., Seehaus, T., Glazovsky, A., and Braun, M. H.: Brief communication: Increased glacier mass loss in the Russian High Arctic (2010–2017), The Cryosphere, 16, 35–42, https://doi.org/10.5194/tc-16-35-2022, 2022.

Arctic Canada, North and South are combined. They can probably be separated.

Iceland can be extended before 1988

The in-situ data are available for a longer period than GRACE, so the regional mass balance can be estimated for the period before GRACE using the regression parameters.

Methods

From Box et al. 2018: "Semi-empirical regional total mass balance assessment Akin to Dowdeswell et al (1997) and Meier et al (2007), we aggregate in situ glacier mass balance time series to upscale to regional values. We enhance the approach by an absolute calibration to GRACE estimates and by representing a later time period (the 2000s onward) with more pronounced climate change impacts on glacier mass balance. For each in situ mass balance record (i) having at least 80% of available data 1971–2017 (47 years), we calculate the 2003–2015 average (DBa) and standard deviation (s) and 1971–2017 anomalies (DBa′) rela- tive to the W08 (years 2003–2015) baseline. Each record is divided by the standard deviation, i.e. stan- dardized as: DBa-prime i,y = (DBa i,y - DBa i,2003-2015) /sBa i,2003-2015 The individual glacier DBa¢i values are averaged over six regions (all but Greenland is) (table 1) and multiplied by the W08 regional GRACE mass balance averages (table 1). By this approach, we estimate mass balance totals for each region and year in the 1971–2017 interval in a way that is scaled to the GRACE mass balance retrievals. Lacking in situ mass balance record from Arctic Canada South, table 1 Arc- tic Canada North and South mass balance values are summed into a single regional value and thus the com- bined region is represented by four Arctic in situ mass balance records."

Greenland

Greenland mass balance is from: Mankoff, Ken; Fettweis, Xavier; Solgaard, Anne; Langen, Peter; Stendel, Martin; Noël, Brice; van den Broeke, Michiel R.; Karlsson, Nanna; Box, Jason E.; Kjeldsen, Kristian, 2021, "Greenland ice sheet mass balance from 1840 through next week", https://doi.org/10.22008/FK2/OHI23Z, GEUS Dataverse, V449 Mankoff, K. D., Fettweis, X., Langen, P. L., Stendel, M., Kjeldsen, K. K., Karlsson, N. B., Noël, B., van den Broeke, M. R., Solgaard, A., Colgan, W., Box, J. E., Simonsen, S. B., King, M. D., Ahlstrøm, A. P., Andersen, S. B., and Fausto, R. S.: Greenland ice sheet mass balance from 1840 through next week, Earth Syst. Sci. Data, 13, 5001–5025, https://doi.org/10.5194/essd-13-5001-2021, 2021. doi: 10.5194/essd-13-5001-2021

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