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EDITORIAL

Observations and geophysical value-added datasets for cold high mountain and polar regions

The Earth's cold regions, in particular, the Arctic, Antarctic, and High-Mountain Asia (HMA), are dominated by the changing cryosphere and have inherently fragile environments (Guo, 2018; Kulmala, 2018; Guo et al., 2020; Li et al., 2020; Yao et al., 2022; Group on Earth Observations (GEO), 2022). Warming has reshaped the regions where the cryosphere is located; it has also been affecting water availability in lowland downstream areas, opening up northern sea routes, and affecting the stability of roads and infrastructure in permafrost rich areas (Pulliainen et al., 2019). Changes in the phase of water and its consequences have thus had a major impact on the environment and the lives of billions of people.

Timely and accurate information on the elements that comprise the cryosphere, including snow, glaciers, permafrost, freshwater ice, sea ice, and solid precipitation, provide the data-evidenced support to the protection of these cold regions' fragile ecosystems and environment, facilitating the sustainable exploitation of environmental resources, providing driven data for hydrometeorological model, and supporting the safe use of infrastructure over land and ocean (Pulliainen et al., 2019; Guo et al., 2020). The availability of data and information thus helps with the achievement of United Nations Sustainable Development Goals (UN SDGs) (Hu et al., 2017; Qiu et al., 2016; Qiu et al., 2017; Zhao et al., 2021; Zhao et al., 2021; GEO, 2022).

Awareness of the open sharing and interoperability of Earth observations and value-added datasets has been promoted by international programs and projects; for example, the Group on Earth Observations (GEO), the GEO Cold Regions Initiative (Qiu et al., 2016; Pirazzini et al., 2020; GEO, 2022), and the Pan-Eurasian Experiment program (Lappalainen et al., 2022), as well as environmental projects concerned with polar regions, such as the Integrated Arctic Observation System (INTAROS), which is part of the EU's Horizon 2020 project (Sandven et al., 2020), and its counterpart project Multi-Parameters Arctic Environmental Observations and Information Services funded by Ministry of Science and Technology of China (MARIS); the ERA-PLANET Strand-4 Integrative and Comprehensive Understanding on Polar Environments project (iCUPE) (Petäjä et al., 2020); the CASEarth Poles project (Li et al., 2020), which is part of the Chinese Academy of Sciences Big Earth Data Science Engineering Program (Guo, 2018); the Digital Belt and Road Program Working Group on High Mountain and Cold Regions (Qiu et al., 2017); and the Third Pole Environment (Yao et al., 2012; Yao et al., 2022).

Many recent developments have been concerned with the rich deliverables of data gathered continuously by the increasing number of national and international Earth observation systems to the public. However, the opening up of datasets is posing challenges for the study of the Earth's cold regions. In particular, the lack of the efficient data stream services is needed to address emergency challenges, Earth science research, and UN SDGs (Guo, 2018).

This special issue includes eight papers. Five of these are concerned with open value-added datasets on snow (Jiang et al., 2022), lake ice (Wang et al., 2021), glaciers (Lhakpa et al., 2022), sea ice (Zhao et al., 2021), and heat fluxes (Duan et al., 2022), respectively, and two others are about the applications based on the in situ and value-added data from remote sensing (Wu et al., 2021; Chalov et al., 2022). In another study (Liang et al., 2021), Big Earth Data is successfully used to study the melting of Antarctic ice based on cloud computing; the original EW mode dataset was open in this issue for further development. These papers cover research in the Arctic (Chalov et al., 2022; Wang et al., 2021; Wu et al., 2021), Antarctic (Liang et al., 2021; Zhao et al., 2021), and HMA (Duan et al., 2022; Jiang et al., 2022; Lhakpa et al., 2022). Five of the studies are based on series of remote sensing data covering several decades; three are based on in situ measurements and modeling. The snow, Tibetan Plateau heat flux, and lake ice data products are available for free download online. For the first time, advice for shipping using the Northern Sea Route is released (Wu et al., 2021).

All the data and applications complement existing knowledge about the Earth's cold high mountain and polar regions; follow up these efforts on open data and the forth-coming efforts, GEO Cold Regions Initiative (GEOCRI, www.geocri.org) will strengthen international open data stream using novel methods for the next three years (GEO, 2022).

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Data availability statement

Data sharing is not applicable to this article as no new data were created.

References

Chalov, S., Moreido, V., Ivanov, V., et al. (2022). Assessing suspended sediment fluxes with acoustic Doppler current profilers: Case study from large rivers in Russia. *Big Earth Data*. *6*(4), 381–384. https://doi.org/10.1080/20964471.2022.2116834

Duan, A., Liu, S., Wenting, H., et al. (2022). Long-term daily dataset of surface sensible heat flux and latent heat release over the Tibetan Plateau based on routine meteorological observations. *Big Earth Data*, *6*(4), 1–12. https://doi.org/10.1080/20964471.2022.2037203

Group on Earth Observations (GEO). (2022) 2023-2025 GEO work programme. *GEO-18-7.3, GEO-18–2-3*. November. https://earthobservations.org/documents/geoweek2022/GEO-18-7.3_2023-2025%20Work%20Programme.pdf

Guo, H. (2018). Steps to the digital Silk Road. *Nature*, *554*(7690), 25–27. https://doi.org/10.1038/d41586-018-01303-y

Guo, H., Li, X., & Qiu, Y. (2020). Comparison of global change at Earth's "three poles" using space-borne Earth observation. *Science Bulletin*, *4*. https://doi.org/10.1016/j.scib.2020.04.031
Hu, Z., Kuenzer, C., Dietz, A. J., et al. (2017). The potential of earth observation for the analysis of cold region land surface dynamics in Europe—A review. *Remote Sensing*, *9*, 1067. https://doi.org/10.3390/rs9101067
Jiang, L., Yang, J., Zhang, C., et al. (2022). Daily snow water equivalent product with SMMR, SSM/I and SSMIS from 1980 to 2020 over China. *Big Earth Data*, *6*(4), 1–15. https://doi.org/10.1080/20964471.2022.2032998
Kulmala, M. T. (2018). Build a global Earth observatory. *Nature*, *553*(7686), 21–23. https://doi.org/10.1038/d41586-017-08967-y
Lappalainen, H. K., Petäjä, T., Vihma, T., et al. (2022). Overview: Recent advances in the understanding of the northern Eurasian environments and of the urban air quality in China – a Pan-Eurasian Experiment (PEEX) programme perspective. *Atmospheric Chemistry and Physics*, *22*(7), 4413–4469. https://doi.org/10.5194/acp-22-4413-2022
Lhakpa, D., Qiu, Y., Lhak, P., et al. (2022). Long-term records of glacier evolution and associated proglacial lakes on the Tibetan Plateau (1976–2020). *Big Earth Data*, *6*(4), 1–18. https://doi.org/10.1080/20964471.2022.2131956
Liang, D., Guo, H., Zhang, L., et al. (2021): Sentinel-1 EW mode dataset for Antarctica from 2014–2020 produced by the CASEarth cloud service platform. *Big Earth Data*, *6*(4), 1–16. https://doi.org/10.1080/20964471.2021.1976706
Li, X., Che, T., LI, X., et al. (2020). CASEarth Poles - Big data for the three poles. *Bulletin of the American Meteorological Society the bulletin of the American Meteorological Society*, *3*(9), E1475–1491. https://doi.org/10.1175/BAMS-D-19-0280.1
Petäjä, T., Duplissy, E., Tabakova, K., et al. (2020). Overview: Integrative and Comprehensive Understanding on Polar Environments (iCUPE)–concept and initial results. Atmospheric Chemistry and Physics, *20*(14), 8551–8592. https://doi.org/10.5194/acp-20-8551-2020
Pirazzini, R., Tjernström, M., Sandven, S., et al. (2020). INTAROS synthesis of gap analysis of the existing Arctic observing systems. *EGU General Assembly 2020*, Online 4–8 May 2020, EGU2020–20091. https://doi.org/10.5194/egusphere-egu2020-20091
Pulliainen, J., Cheng, B., & Qiu, Y. (2019). Sustainable earth observations for the Arctic, the Antarctic and the high-altitude mountain cold regions. *International Journal of Digital Earth*, *12*(8), 858–859. https://doi.org/10.1080/17538947.2019.1633737
Qiu, Y., Massimo, M., Li, X., et al. (2017). Observing and understanding high mountain and cold regions using big earth data. *Bulletin of Chinese Academy of Sciences of bulletin of Chinese Academy of Sciences of bulletin of Chinese Academy of Sciences*, *32*(Z1), 82–94.
Qiu, Y., Savela, H., Key, J. R. et al. (2016). Statement on the GEO cold region initiative (GEOCRI). In *Arctic observing summit 2016*, University of Calgary, Arctic Institute of North America. 2016. https://earthobservations.org/documents/meetings/201603_arctic_summit/201603_arctic_summit_geocri_statement.pdf
Sandven, S., Sagen, H., Beszczynska-Möller, A., Vo, P., Houssais, M. -N., Sørensen, M., Sejr, M. K., Dzieciuch, M., Worcester, P., Storheim, E., Geyer, F., & Rønning, B. (4–8 May, 2020). *Implementation of a multipurpose Arctic ocean observing system, EGU General Assembly 2020*. Online EGU2020-20347. https://doi.org/10.5194/egusphere-egu2020-20347
Wang, X., Qiu, Y., Zhang, Y., et al. (2021). A lake ice phenology dataset for the Northern Hemisphere based on passive microwave remote sensing. *Big Earth Data*. *6*(4), 381–384. https://doi.org/10.1080/20964471.2021.1992916
Wu, A., Che, T., Li, X., et al. (2021). A ship navigation information service system for the Arctic Northeast Passage using 3D GIS based on big Earth data. *Big Earth Data*. *6*(4), 381–384. https://doi.org/10.1080/20964471.2021.1981197
Yao, T., Thompson, L., Chen, D. et al. (2022). Reflections and future strategies for Third Pole Environment. Nat Rev Earth Environ, *3*, 608–610. https://doi.org/10.1038/s43017-022-00342-4
Yao, T. D., Thompson, L. G., Mosbrugger, V., et al. (2012). Third Pole Environment (TPE). Environmental Development 3, 52–64. https://doi.org/10.1016/j.envdev.2012.04.002

Zhao, J., Cheng, J., Tian, Z., et al. (2021). Snow and ice thicknesses derived from Fast Ice Prediction System Version 2.0 (FIPS V2.0) in Prydz Bay, East Antarctica: Comparison with in-situ observations. *Big Earth Data*. *6*(4), 381–384. https://doi.org/10.1080/20964471.2021.1981196

Zhao, T., Cosh, M. H., Roy, A., et al. (2021). Remote sensing experiments for Earth system science. *International Journal of Digital Earth*, *14*(10), 1237–1242. https://doi.org/10.1080/17538947.2021.1977473

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