Curriculum Vitae

Stein Sandven

Born: 12. March 1952
Education: Cand real in physical oceanography, University of Bergen 1979.
Position: Research director at Nansen Environmental and Remote Sensing Center,
Professor II at UNIS in satellite remote sensing
Former director of Nansen Environmental and Remote Sensing Center
Present position: Senior scientist and coordinator of the EU H2020 projects INTAROS (2016-2022) and CAPARDUS (2020-2022)
Publications: see https://www.nersc.no/staff/stein-sandven

Started work career as research assistant at Geophysical Institute, University of Bergen 1979-1983. Worked with data analysis and polar oceanography. Visiting scientist at Dept. of Oceanography at Univ. of Washington, Seattle, USA in 1981-82. Worked with data collection, data analysis, software development for analysis of oceanographical data. Employed as scientist at NERSC when it was established as a research foundation in 1986. Senior scientist at NERSC from 1987 with responsibility for data collection and data analysis from the MIZEX and SIZEX projects in the Greenland and Barents Sea, which were implemented from 1983 to 1992.

From 1994 he was assistant director and leader of the Remote Sensing Group at NERSC. From 1995 he has generated several international and national research and application projects related to satellite remote sensing and polar oceanography. He has been leader or task leader of more that 60 research projects He has been coordinator of 18 EU projects and 15 ESA projects from 1995 to present. He has established extensive international network with scientists in Arctic climate research, ocean and sea ice research and in satellite earth observation.

He has been instrumental in establishing the Arctic Regional Ocean Observing System (Arctic ROOS - www.arctic-roos.org.) as one of the regional systems of EuroGOOS (www.eurogoos.eu). Arctic ROOS has now 20 member institutions form 10 countries. The objective of Arctic ROOS is to develop and implement operational monitoring and forecasting systems in the Arctic Ocean and adjacent seas. The systems are based on state-of-the-art remote sensing, in situ observations, numerical modelling, data assimilation and dissemination systems for products and services.

In the last two decades he has conducted a series of projects for offshore companies related to oil and gas exploration in Arctic waters. The companies included Statoil, Total, Shell, Shtokman Development AG and Gaz de France de Suez. From 2009 he has been involved in development of the Svalbard Integrated Observing System (SIOS) which was an EU research infrastructure preparatory phase project from 2010-2014. In 2018 SIOS was established as a legal entity located at in Svalbard with funding from the Research Council of Norway (https://sios-svalbard.org/). Since 2006 he has been teaching students at UNIS in satellite remote sensing of sea ice and ocean processes. From 2016 he is responsible for the course “Shipping in the Arctic” at UNIS.

He has been coordinator of many Arctic research projects during the last 30 years, including 19 EU projects, 16 ESA projects and 20 projects under the Research Council of Norway. From 2011 to 2018 he was the science leader of the ESA CCI sea ice project (2012-2018). From 2017 his main responsibility and fulltime job is to coordinate the H2020 project Arctic Integrated Observation System (INTAROS), which runs from 2016 to 2021. INTAROS has 47 partners from 20 countries and a budget of 15.5 MEURO. As coordinator of INTAROS, he works with the major organisations, programmes and projects related to Arctic observing systems in Europe, North America and Asia. From 2020 to 2022 he is coordinator of the Coordination and Support Action CAPARDUS under H2020. Presently he is member of the advisory boards for several new Arctic projects funded by EU and the Research Council of Norway.

Updated: March 2021

Main fields of expertise and research activities:
Marine and polar remote sensing, polar and coastal oceanography, sea ice research with emphasis on remote sensing methodology. Scientific publications have addressed sea ice, oceanography and ocean acoustics in the Nordic Seas and the Arctic. Papers with focus on satellite remote sensing are dealing with sea ice observations with different types of sensors, sea ice classification, sea ice drift, and validation of sea ice remote sensing with in situ observations. More than 60 referee papers have been published with focus on ocean and sea ice process studies and development of operational observing systems for the Arctic using both satellite, in situ, and underwater sensors.

Supervision of students

Cand Sc./Master students
1990: Cand. Sc. Kathleen Geiger, UiB/NERSC
1991: Cand. Sc. Torill Hamre and Morten Stette, UiB/NERSC
1995: Cand Sc. Øyvind Elnan, UiB/NERSC
2007: M. Sc. Johan Wåhlin, Univeristy of Luleå/NERSC
2007: M. Sc. Oles Kit, UiB/NERSC
2012: M Sc. Ben Robson, UiB/NERSC

PhD students:
1994: Dr. Sc. Torill Hamre, UiB/NERSC
2000: Ph D. Andrey Bogdanov, St. Petersburg University / NIERSC.
2003: Dr. Ing. Maria Lundhaug, NTNU/NERSC.
2008: Alexandra Yarigina, St. Petersburg State University / NIERSC
2009: Dr. Sc. Natalia Zakhvatkina, St. Petersburg State University/NIERSC
2014: Dr. Sc. Marta Zygmuntowska, NERSC
2017: Stefan Muckenhuber, UNIS/UIB/NERSC

Membership

From 2002-2008: Member of ESA CryoSat CalVal Science and Advisory Group
From 2007 - 2018: Elected chair of Arctic Regional Ocean Observing System (Arctic ROOS).
From 2008: Member of Norwegian Academy of Science for Polar Research.
From 2009: Member of ESA – Russian Space Agency panel of Arctic Earth Observation
From 2010: Member of Norwegian Academy of Technical Sciences
From 2016-2019: Member of Scientific Advisory Board of the Japanese research programme “Arctic Challenge for Sustainability 2015-2020 (ArcS)

Recent publications

Johannessen, O. M., L. P. Bobylev, E. V. Shalina, **S. Sandven**: Sea ice in the Arctic – Past, present and Future., 575 pp, Springer Polar Sciences, © Springer Nature Switzerland AG 2020. https://doi.org/10.1007/978-3-030-21301-5

Smith GC, Allard R, Babin M, Bertino L, Chevallier M, Corlett G, Crout J, Davidson F, Delille B, Gille ST, Hebert D, Hyder P, Intrieri J, Lagunas J, Larnicol G, Kaminski T, Kater B, Kauker F, Marec C, Mazloff M, Metzger EJ, Mordy C, O’Carroll A, Olsen SM, Phelps M, Posey P, Prandi P, Rehm E, Reid P, Rigor I, **Sandven S**, Shupe M, Swart S, Smedstad OM, Solomon A, Storto A, Thibaut P, Toole J, Wood K, Xie J, Yang Q and the WWRP PPP Steering Group (2019): *Polar Ocean Observations: A Critical Gap in the Observing System and Its Effect on Environmental Predictions From Hours to a Season.* Front. Mar. Sci. 6:429. doi: 10.3389/fmars.2019.00429

Lee CM, Starkweather S, Eicken H, Timmermans M-L, Wilkinson J, **Sandven S,** Dukhovskoy D, Gerland S, Grebmeier J, Intrieri JM, Kang S-H, McCammon M, Nguyen AT, Polyakov I, Rabe B, Sagen H, Seeyave S, Volkov D, Beszczynska-Möller A, Chafik L, Dzieciuch M, Goni G, Hamre T, King AL, Olsen A, Raj RP, Rossby T, Skagseth Ø, Søiland H and Sørensen K (2019): *A Framework for the Development, Design and Implementation of a Sustained Arctic Ocean Observing System*. Front. Mar. Sci. 6:451. doi:10.3389/fmars.2019.00451

O.M. Johannessen, **S. Sandven,** I.P. Chunchuzov & R.A. Shuchman (2019). Observations of internal waves generated by an anticyclonic eddy: a case study in the ice edge region of the Greenland Sea, Tellus A: Dynamic Meteorology and Oceanography, 71:1, 1-12. https://doi.org/10.1080/16000870.2019.1652881

Updated: March 2021

Vihma, T., Uotila, P., **Sandven, S.**, Pozdnyakov, D., Makshtas, A., Pelyasov, A., Pirazzini, R., Danielsen, F., Chalov, S., Lappalainen, H. K., Ivanov, V., Frolov, I., Albin, A., Cheng, B., Dobrolyubov, S., Arkhipkin, V., Myslenkov, S., Petäjä, T., and Kulmala, M.: Towards an advanced observation system for the marine Arctic in the framework of the Pan-Eurasian Experiment (PEEX), Atmos. Chem. Phys., 19, 1941-1970, https://doi.org/10.5194/acp-19-1941-2019, 2019.

Thomas Lavergne, Atle Macdonald Sørensen, Stefan Kern, Rasmus Tonboe, Dirk Notz, Signe Aaboe, Louisa Bell, Gorm Dybkjær, Steinar Eastwood, Carolina Gabarro, Georg Heygster, Mari Anne Killie, Matilde Brandt Kreiner, John Lavelle, Roberto Saldo, **Stein Sandven**, and Leif Toudal Pedersen. The Cryosphere, 13, 49-78, https://doi.org/10.5194/tc-13-49-2019, 2019

Park J-W, Korosov A, Babiker M, **Sandven S,** Won J-S. Efficient Thermal Noise Removal for Sentinel-1 TOPSAR Cross-Polarization Channel. IEEE Transactions on Geoscience and Remote Sensing. 2018;56(3)

Muckenhuber S, **Sandven S.** Sea ice drift data for Fram Strait derived from a feature-tracking algorithm applied on Sentinel-1 SAR imagery

Shalina EV, **Sandven S**. Snow depth on Arctic sea ice from historical in situ data. The Cryosphere. 2018;12(6).

Demchev, D. V. Volkov; E. Kazakov; P. F. Alcantarilla; **S. Sandven**; V. Khmeleva, Sea Ice Drift Tracking From Sequential SAR Images Using Accelerated-KAZE Features, IEEE Transactions on Geoscience and Remote Sensing , 2017, Volume: 55, Issue: 9, 5174 – 5184, doi: 10.1109/TGRS.2017.2703084

Muckenhuber, S. and **Sandven,** S.: Open-source sea ice drift algorithm for Sentinel-1 SAR imagery using a combination of feature tracking and pattern matching, The Cryosphere, 11, 1835-1850, https://doi.org/10.5194/tc-11-1835-2017, 2017.

Lauer A.; V. Eyring; M. Righi; M. Buchwitz; P. Defourny; M. Evaldsson; P. Friedlingstein; R. de Jeu; G. de Leeuw; A.Loew; C. J. Merchant; B. Müller; T. Popp; M. Reuter; **S. Sandven;** D. Senftleben; M. Stengel; M. Van Roozendael; S. Wenzel; U. Willén. Benchmarking CMIP5 models with a subset of ESA CCI Phase 2 data using the ESMValTool. Remote Sensing of Environment 2017. http://dx.doi.org/10.1016/j.rse.2017.01.007.

Sagen H, Worcester PF, Dzieciuch M, Geyer F, **Sandven S**, Babiker M, Beszczynska A, Dushaw B, Cornuelle B. Resolution, identification, and stability of broadband acoustic arrivals in Fram Strait. Journal of the Acoustical Society of America. 2017;143(3).

Zakhvatkina, N, A. Korosov, S. Muckenhuber, **S. Sandven,** M. Babiker, Operational algorithm for ice-water classification on dual-polarized RADARSAT-2 images The Cryosphere., 2017 11, 33-46, doi:10.5194/tc-11-33-2017.

Muckenhuber, S. A. A. Korosov, and **S. Sandven,** Open-source feature-tracking algorithm for sea ice drift retrieval from Sentinel-1 SAR imagery The Cryosphere, 10, 913-925, doi:10.5194/tc-10-913-2016, 2016

Muckenhuber, S., Nilsen, F., Korosov, A., and **Sandven, S**.: Sea ice cover in Isfjorden and Hornsund, Svalbard (2000–2014) from remote sensing data, The Cryosphere, 10, 149-158, doi:10.5194/tc-10-149-2016, 2016.

Kern S., K. Khvorostovsky, H. Skourup, E. Rinne, Z. S. Parsakhoo, V. Djepa, P. Wadhams, and **S. Sandven**: The impact of snow depth, snow density and ice density on sea ice thickness retrieval from satellite radar altimetry: results from the ESA-CCI Sea Ice ECV Project Round Robin Exercise. The Cryosphere, 9, 37–52, 2015, www.the-cryosphere.net/9/37/2015/, doi:10.5194/tc-9-37-2015

Mikhalevsky, P.N., H. Sagen, P. Worcester, A. Baggeroer, S. Moore, C. Lee, K. Vigness-Raposa, L. Freitag, A. Beszczynska-Moeller, T. Duda, B. Dushaw, J.C. Gascard, A. Gavrilov, A. Morozov, W. Munk, M. Rixen, **S. Sandven,** E. Skarsoulis, K. Stafford, and E. Tveit, Multipurpose acoustic networks in the integrated Arctic Ocean observing system, Invited Community White Paper, Arctic Observing Summit, 18 pp., Vancouver, Canada April 30 – May 2, 2013. Published as part of special issue on Arctic Observing Systems in the Journal "Arctic". VOL. 68, SUPPL. 1 (2015), http://dx.doi.org/10.14430/arctic4449

Gao, Y, Sun, J, Li, F, He, S, **Sandven, S,** Yan, Q, Zhang, Z, Lohmann, K, Keenlyside, N, Furevik, T, Suo, L: Arctic sea ice and Eurasian climate: A review. Advances in Atmospheric Sciences. 2014, Vol 32, doi 10.1007/s00376-014-0009-6

Sandven S., H. Sagen, L. Bertino, A. Beszczynska-Möller, E. Fahrbach, P. F. Worcester, M. A. Dzieciuch, W. Walczowski, P. Wieczorek, E. Skarsoulis, A. Morozov, D. Dumont, C. Lee, B. D. Dushaw, E. Hansen, and H. Rohr. The Fram Strait integrated ocean observing and

modelling system. In *Sustainable Operational Oceanography*, Proceedings of the Sixth International Conference on EuroGOOS, 4–6 October 2011, Sopot, Poland, pp. 50-58, Published by EuroGOOS, 2013 (http:// http://eurogoos.eu/documents/conference-proceedings/)

Zygmuntowska, M., K. Khvorostovsky, V. Helm, and **S. Sandven,** Waveform analysis of airborne synthetic aperture radar altimeter over Arctic sea ice. The Cryosphere Discuss., 7, 1215-1242, 2013. www.the-cryosphere-discuss.net/7/1215/2013/, doi:10.5194/tcd-7-1215-2013

Hollmann, R., C.J. Merchant, R. Saunders, C. Downy, M. Buchwitz, A. Cazenave , E. Chuvieco, P. Defourny, G. de Leeuw, R. Forsberg , T. Holzer-Popp, F. Paul, **S. Sandven,** S. Sathyendranath , M. van Roozendael, W. Wagner. The ESA Climate Change Initiative: satellite data records for essential climate variables. Bulletin of the American Meteorological Society 2013 ; e-View doi: http://dx.doi.org/10.1175/BAMS-D-11-00254.1

Zakhvatkina, N, V. Alexandrov, O. M. Johannesse, **S. Sandven.** I. Frolov. Classification of sea ice types in ENVISAT Synthetic Aperture radar images. IEEE Trans. Geosc. Rem. Sens, 51, 2587-2600, 2013

Freitas, C., K. M. Kovacs, M. Andersen, J. Aars, **S. Sandven,** M. Skern Mauritzen, O. Pavlova and C. Lydersen. Importance of fast ice and glacier fronts for female polar bears and their cubs during spring in Svalbard, Norway. Marine Ecology Progress Series, Vol. 447: 289 – 304, 2012. doi: 10.3354/meps09516.

Dumont, D., V. Squire, **S. Sandven**, H. Sagen L. Bertino. Forecasting waves in ice for Arctic Operators. Oil and Gas Review, 9, 2011, pp 18 - 20

Smedsrud, L. H., A. Sirevaag, K. Kloster, A. Sorteberg and **S. Sandven,** Recent wind driven high sea ice area export in the Fram Strait contributes to Arctic sea ice decline. The Cryosphere, 5, 821–829, 2011, www.the-cryosphere.net/5/821/2011/ doi:10.5194/tc-5-821-2011.

Alexandrov, V, **S. Sandven**, J. Wåhlin and O. M. Johannessen. The relation between sea ice thickness and freeboard in the Arctic. The Cryosphere, 4, 373-380, 2010 (www.the-cryosphere.net/4/373/2010/) (doi :10.5194/tc-4-1-2010).

Dushaw, (In alphabetic order) Au, Beszczynska-Möller, Brainard, Chiu, Cornuelle, Duda, Dzieciuch, Fahrbach, Forbes, Freitag, Gascard, Gavrilov, Gould, Howe, Jayne, Johannessen, Lynch, Martin, Menemenlis, Mikhalevsky, Miller, Munk, Nystuen, Odom, Orcutt, Tossby, Sagen, **Sandven,** Simmen, Skarsoulis, Stephen, Vinogradov, Worcester and Wunsh. "A Global Ocean Acoustic Observing Network." Community white paper, OceanObs09, Venice Italy, 21-25 Sept 2009.

Breivik, L.-A., T. Carrieres, S.Eastwood, A.Fleming, F. Girard-Ardhuin, J. Karvonen, R. Kwok, W. N. Meier, M. Mäkynen, L.Toudal Pedersen, **S. Sandven**, M. Similä, R. Tonboe. *Remote sensing of sea ice.* Community White Paper, OceanObs09, Venice Italy, 21-25 Sept. 2009.

Hamre, T., H. Krasemann, S. Groom, D. Dunne, G. Breitbach, B. Hackett, K. Sørensen and **S. Sandven.** Interoperable web GIS services for marine pollution monitoring and forecasting. J. Coast. Conserv. 13: 1- 13, 2009.

Sandven, S. Sea ice monitoring in European Arctic Seas using a multisensor approach. Chapter in the book *"Remote Sensing of the European Seas" (Eds. Barale and Gade) Springer Science and Business Media B. V.,* 2008, pp. 487 – 498.

Alexandrov, V.Y., V.A. Volkov, **S. Sandven**, M. Babiker, K. Kloster (2008). Detection of Arctic icebergs on the base of satellite information. *Earth Observations and Remote Sensing,* **3**, pp. 44-55 [in Russian].

Johannessen O. M., V. Yu Alexandrov, I. Ye. Frolov, **S. Sandven**, M. Miles, L. P. Bobylev, L. H. Pettersson, V. G. Smirnov and E. U. Mironov. Polar Seas Oceanography, Remote Sensing of Sea ice in the Northern Sea Route: Studies and Applications. Praxis Springer, 2007.

Sandven, S. and O. M. Johannessen, Sea ice monitoring by Remote Sensing, chapter 8, pp 241 – 283, in Remote Sensing of the Marine Environment (ed. J. Gower), Manual of Remote Sensing, Third Edition, Volume 6, Published by American Society for Photogrammetry and Remote Sensing, 2006, Maryland, USA, 338 pp.

Sandven, S, O. M. Johannessen and K. Kloster. Sea ice monitoring by Remote Sensing. Article in Encyclopedia of Analytical Chemistry. Instrument and Application. Copyright © 2000 John Wiley & Sons, Ltd. All rights reserved. DOI: 10.1002/9780470027318.a2320. Article Online Posting Date: September 15, 2006. (http://mrw.interscience.wiley.com/emrw/9780470027318/eac/article/a2320/current/abstract)

Alexandrov V.Y., Johannessen O.M., **and Sandven S**. Satellite SARs. SAR sea ice monitoring in the Arctic (2005). Chapters 9.1.1. and 9.1.2 in: A. Pasmurov and J. Zinoviev "Radar Imaging and Holography". Stevenage, Herts, UK, The Institution of Electrical Engineers, Michael Faraday House, 2005, p. 191-204.