Niccolò Maffezzoli
physicist, age 35

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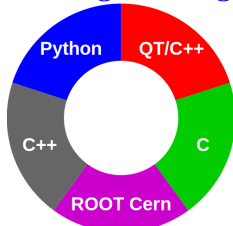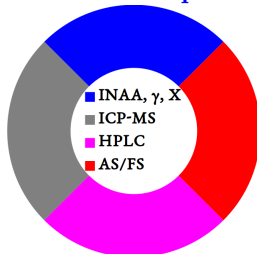
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GitHub
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Programming

PyTorch

ROOT
Data Analysis Framework

Analytical techniques

- INAA, γ, X
- ICP-MS
- HPLC
- AS/FS

Languages
Italian ★★★★★
English ★★★★★
French ★★★☆☆

I received my MSc. degree in Nuclear and Particle physics at the Milano-Bicocca University. My background ranged from applied particle physics to environmental radioactivity and high-energy physics. My master thesis and work at the nuclear fission reactor in Pavia (Italy) lead me in contact with the ice core science research field. My PhD and Postdoc positions at the Center for Ice and Climate (Copenhagen, Denmark) focused on Continuous Flow Analysis systems and inductively coupled plasma mass spectroscopy for the detection of chemical tracers in ice cores for past sea ice reconstructions. I continued my research on ice cores and sea ice reconstructions at the Italian National Research Council and at the University of Venice in 2018 and 2019. From 2020 to 2022 I carried out a Marie Curie Fellowship at the University of Venice with a project on Artificial Intelligence techniques applied to ice core analyses. From 2022 to 2023 I was PI of the ICENET project on glacier modeling using deep neural networks, at the National Research Council (Institute of Polar Sciences), in collaboration with the University of California, Irvine. Since October 2023 I am PI of the Marie Curie SKYNET project "Estimating the ice volume of Earth's glaciers via Artificial Intelligence and remote sensing". The results are in review in GMD, the code is available on Github: ICEBOOST. I am particularly passionate about deep learning and tackling Earth System science problems using generative AI approaches.

Academic positions
- 01/10/2023 – now **Marie Curie Postdoc** @ University of Venice, Venice, Italy
- 01/04/2023 – now **Assistant Specialist** @ University of California Irvine, USA
  01/09/2022 – 31/08/2023 **Postdoc** @ CNR -Institute of Polar Sciences, Venice, Italy
- 15/01/2022 – 31/08/2022 **Postdoc** @ University of Venice, Venice, Italy
- 15/01/2020 – 14/01/2022 **Marie Curie Postdoc** @ University of Venice, Venice, Italy
- 21/05/2018 – 14/01/2020 **Postdoc** @ CNR, Venice, Italy
- 01/10/2017 – 30/03/2018 **Postdoc** @ Niels Bohr Institute, University of Copenhagen, Denmark
- 01/09/2014 – 17/10/2017 **PhD, geophysics**
  Thesis: "sodium, bromine and iodine in polar ice cores"
  @ Niels Bohr Institute (17/10/2017), University of Copenhagen, Denmark

Education
- 03/11/2011 - 26/03/2014 **MSc, nuclear and particle physics**
  Final grade: 110/110 cum laude.
  Thesis: "Elemental characterization of alpine and antarctic ice cores using Instrumental Neutron Activation Analysis (INAA)" @ University of Milano-Bicocca, Milan, Italy
- 04/09/2008 - 28/09/2011 **BSc in physics**
  Thesis: "Characterization of a Germanium semiconductor detector for X and γ spectroscopy" @ University of Milano-Bicocca, Milan, Italy

Statistics and Data Analysis Teaching Assistant
- Teaching Assistant in "Applied statistics", University of Copenhagen (2015, 2016).
- Teaching Assistant in "Advanced methods in Applied statistics", University of Copenhagen (2017).
- Collaborator in "Applied Machine Learning", University of Copenhagen (2021, 2024).

Experimental physics and chemistry
- γ, X spectroscopy, nuclear activation analysis (INAA)
- Nuclear facility laboratory experience: TRIGA Mark II fission reactor, Pavia (IT)
- Continuous Flow Analysis (CFA), Mass spectroscopy (ICP-MS). International experience in the following laboratories: Physics of Ice Climate and Earth (DK), British Antarctic Survey (UK), University of Venice (IT), Curtin University (AUS), Desert Research Institute (USA), University of Bergen (NO).

Funded research proposals

- **MARIE CURIE GLOBAL FELLOWSHIP 2021, "Estimating the ice volume of Earth's glaciers via Artificial Intelligence and remote sensing, SKYNET", N. Maffezzoli, PI (University of Venice), €288K, Funded.**
  The research bridges Earth System Science and Artificial Intelligence, with the aim of estimating the Earth's glaciers using remote sensing and deep learning techniques. The project will be run from 2023 to 2026 and will be partnered with the University of California, Irvine and NASA's Jet Propulsion Laboratory.

- **CLIMATE CHANGE A.I. INNOVATION GRANT 2021, "Estimate the ice volume of all glaciers in High Mountain Asia with deep learning, ICENET", N. Maffezzoli, PI (National Research Council, Institute of Polar Sciences), $145K, Funded.**
  This project is essentially a pilot study for the much bigger SKYNET porject (above), and aims at exploring the concept and the potentials of image inpainting architectures to calculate glacier volumes. The project is partnered with the University of California, Irvine. The fiscal sponsor of the project is Future Earth International, Montréal, Quebec, Canada.

- **MARIE CURIE EUROPEAN FELLOWSHIP 2018, "Artificial Intelligence techniques for ice core analyses, ICELEARNING", N. Maffezzoli, PI (University of Venice), €171K, Funded.**
  This project explores the implementation of deep learning techniques for the autonomous identification of ancient particles in polar ice core records. The project was carried out in collaboration with the National Research Council (CNR, Italy), the University of Bergen (Norway) and the Niels Bohr Institute (Denmark).

Field experience

- Ice core drilling expeditions in Greenland (Renland, 2015 and EGRIP, 2016).
- Field campaigns in Svalbard (Ny-Ålesund, 2018, 2019, 2023).

Awards & Achievements

- Finalist (top-20) for the award *"Advancing Technology for Humanity. Most Promising Researcher in Robotics and AI"* (2023, link).
- Participation in $\approx$ 20 among conferences and workshops, including AGU (2021), EGU (2024, 2015, 2017, 2020), IPICS (2022, 2016), International Global Atmospheric Chemistry conference (IGAC 2018)
- Organizer of "Holocene workshop" (Helsingør, Denmark 2017)
- Part of European Research Council ERC project "ice2ice" (link)
- Winner of Early Career Scientist award for the 15th International Global Atmospheric Chemistry conference (Takamatsu, Japan, 2018)
- Winner of Marie Skłodowska-Curie Actions European Fellowship, €171K (2018 call, link)
- Winner of Climate Change AI Innovation Grants, $145K (2021 call, link)
- Winner of Marie Skłodowska-Curie Actions Global Fellowship, €288K (2021 call, link)

Publication shortlist

- **Maffezzoli, N.**, et al. A gradient-boosted tree framework to model the ice thickness of the World's glaciers (IceBoost v1), Geophysical Model Development, *in review*, (2023).
- **Maffezzoli, N.**, et al. Detection of ice core particles via deep neural networks, The Cryosphere, 17(2), pp.539-565 (2023).
- **Maffezzoli, N.**, et al. Sea ice in the northern North Atlantic through the Holocene: Evidence from ice cores and marine sediment records. Quaternary Science Reviews 273, 107249, (2021).
- Corella, J.P., **Maffezzoli, N.**, Spolaor, A., Vallelonga, P., Cuevas, C.A., Scoto, F., Müller, J., Vinther, B., Kjær, H.A., Cozzi, G. and Edwards, R., Barbante C. and Saiz-Lopez A. Climate changes modulated the history of Arctic iodine during the Last Glacial Cycle. Nature communications, 13(1), pp.1-9, (2022).
- Vallelonga, P., **Maffezzoli, N.**, Saiz-Lopez, A., Scoto, F., Kjær, H.A. and Spolaor, A. Sea-ice reconstructions from bromine and iodine in ice cores. Quaternary Science Reviews, 269, p.107133, (2021).
- Sadatzki, H., **Maffezzoli, N.**, Dokken, T.M., Simon, M.H., Berben, S.M., Fahl, K., Kjær, H.A., Spolaor, A., Stein, R., Vallelonga, P. and Vinther, B.M. Rapid reductions and millennial-scale variability in Nordic Seas sea ice cover during abrupt glacial climate changes. Proceedings of the National Academy of Sciences, 117(47), pp.29478-29486, (2020).
- **Maffezzoli, N.**, Vallelonga, P., Edwards, R., Saiz-Lopez, A., Turetta, C., Kjær, H.A., Barbante, C., Vinther, B. and Spolaor, A. A 120 000-year record of sea ice in the North Atlantic?. Climate of the Past, 15(6), pp.2031-2051, (2019)
- **Maffezzoli, N.**, Baccolo, G., Di Stefano, E. and Clemenza, M. The Ruthenium-106 plume over Europe in 2017: A source-receptor model to estimate the source region. Atmospheric Environment, 212, pp.239-249, (2019).
- Corella, J.P., **Maffezzoli, N.**, Cuevas, C.A., Vallelonga, P., Spolaor, A., Cozzi, G., Müller, J., Vinther, B., Barbante, C., Kjær, H.A. and Edwards, R. Holocene atmospheric iodine evolution over the North Atlantic. Climate of the Past, 15(6), (2019).
- Cuevas, C.A., **Maffezzoli, N.**, Corella, J.P., Spolaor, A., Vallelonga, P., Kjær, H.A., Simonsen, M., Winstrup, M., Vinther, B., Horvat, C., Fernandez, R.P., Kinnison, D., Lamarque, J-F., Barbante, C., and Saiz-Lopez, A., Rapid increase in atmospheric iodine levels in the North Atlantic since the mid-20th century, Nature Communications, 9, 1452 (2018).

- **Maffezzoli, N.**, Spolaor A., Barbante C., Bertò M., Frezzotti M., Vallelonga P., Bromine, iodine and sodium in surface snow along the 2013 Talos Dome–GV7 traverse (northern Victoria Land, East Antarctica), The Cryosphere, (2017).
- Vallelonga, P., **Maffezzoli, N.**, Moy, A. D., Curran, M. A. J., Vance, T. R., Edwards, R., Hughes, G., Barker, E., Spreen, G., Saiz-Lopez, A., Corella, J. P., Cuevas, C. A., and Spolaor, A.: Sea-ice-related halogen enrichment at Law Dome, coastal East Antarctica, Climate of the Past, 13, 171-184, (2017).