KRISTIAN LAUTRUP NIELSEN

Applied Weather & Climate Scientist

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PROFILE

Please allow me to introduce myself, I am a applied weather and climate scientist with approximately eight years of experience connecting meteorology, energy and scientific software. Developing forecasting methods and operational workflows from data acquisition and quality control through modelling, verification and delivery. Experience includes WEFEX extreme- weather forecasting, machine-learning seasonal prediction, renewable-energy and electricity-demand analysis, and contributions to five EU-funded projects. Combines scientific depth with hands-on Python development and practical decision-support products.

PROFESSIONAL EXPERIENCE

World Energy & Meteorology Council (WEMC)

Data Engineer - climate and energy services **2021-present**

- Develop and maintain scientific Python workflows for weather and seasonal forecasting, climate-risk analysis and energy applications, including WEFEX and EU-funded research collaborations.

- Build and maintain operational seasonal forecast processing for an energy-sector client: ECMWF and NMME retrieval, model harmonisation, regional aggregation, bias correction, ensemble summaries and CSV delivery.This included the practical implementation of recurring seasonal forecast services.

- Conducted research into multi-model seasonal prediction of temperature and precipitation, evaluating individual models and combinations using Brier Skill Score and CRPSS. Implemented model-independence metrics to investigate shared forecast errors and complementary predictive information. Developed Random Forest approaches to selecting model subsets and ensemble size using forecast-skill and independence features. This work combines scientific method development and probabilistic verification.

- Calculations of infrastructure risks for future climate scenarios in specifically using CMIP6 models over the European domain. This has also included work into estimation of compound low energy generation and high demand events.

- Develop the backend, scientific methodology and operational processing framework for WEFEX (Weather & Seasonal Forecast Extremes), integrating ECMWF IFS/AIFS ensemble and seasonal forecasts with ERA5 reference climatologies to assess temperature, precipitation, wind-speed and wind-gust extremes. Implement data retrieval, GRIB-to-NetCDF conversion, variable harmonisation, wind diagnostics, percentile-based event probabilities and forecast verification using Brier Skill Score (BSS) and neighbourhood-based Brier Skill Score (NBSS), producing gridded, ADM0 and ADM1 outputs that relate ensemble forecasts to local climatological thresholds for practical decision support.

- Translate methods and results into project deliverables, maps and stakeholder presentations.

Underwriters Laboratories (UL) - Barcelona, Spain

Research Scientist **2018-2021**

- Tailored seasonal climate forecasts for renewable-energy users through SECLI-FIRM, from user needs and data harmonisation to forecast verification and service delivery.

- Contributed to automated ERA5 retrieval and post-processing, multi-model forecast research and assessment of climate-change impacts on renewable-energy production.

- Presented seasonal forecasting methods and applications, including hydropower-resource forecasts for Colombia during strong El Niño events.

EU-FUNDED PROJECT CONTRIBUTIONS

SECLI-FIRM - Horizon 2020

Tailored seasonal climate services for renewable-energy decisions at UL. Continued related multi-model research at WEMC, investigating forecast combinations, model independence, ensemble-size effects and probabilistic skill against ERA5.

FOCUS-Africa - Horizon 2020

Develop Random Forest workflows for rainy-season onset and cessation, combining observed rainfall, climate drivers and dynamical seasonal forecasts. Implement operational processing using MSWEP/CHIRPS and seasonal data; assess skill through hindcasts and contribute first-author research (in-review) on onset prediction in Southeast Africa.

FOCI - Horizon Europe

Analyse climate and non-CO2-emission impacts on renewable resources and electricity demand. Develop weighted compound renewable-stress indicators (paper being written), compare climate-model responses and test sensitivity to thresholds and hydrological lags.

CROSSEU - Horizon Europe

Leading a Case Study on compound climate risks to European power systems. Prepare harmonised CMIP6 wind, solar, hydro and demand time series for plan4res workflows; analyse marginal costs, unmet demand and socioeconomic vulnerability, and prepare data and indicators for the Decision Support System.

ENGAGEMENT - NextGenerationEU / Italian PNRR

Develop extreme-climate-index and geospatial exposure workflows for Italy. Transform OpenStreetMap infrastructure into climate-grid-aligned datasets, including voltage-filtered power-line density, with additional transport, telecommunications and agricultural exposure layers.

SELECTED PERSONAL PROJECT

Weather Forecasting Platform (www.lautrups.com)

Developed a weather platform combining Python forecast and observation processing, MySQL storage and interactive web interfaces. Built workflows for retrieving, processing and presenting weather and seasonal forecasts, alongside scheduling and reliability tools covering job locking, timeouts, resource checks and recovery. Implemented automated tests for selected processing functions and a weather-regime classification workflow, clustering and ensemble probability aggregation.

TECHNICAL SKILLS

Python and scientific data:	xarray, NumPy, pandas, SciPy, Dask, NetCDF, GRIB, Zarr, MySQL, APIs.
Forecasting and ML:	scikit-learn, Random Forest, XGBoost, gradient boosting, different bias correction methods, ensemble verification, BSS/CRPSS.
Geospatial and visualisation:	GeoPandas, Shapely, rasterisation, regional aggregation,Dash, plotly, pysheds, matplotlib, Cartopy.
Systems:	Linux, Bash, Git, Conda, cron, WordPress integration, automated pipelines, codex, logging and monitoring.
Data sources:	ERA5/ERA5-Land, ECMWF IFS/AIFS and seasonal forecasts, C3S, NMME, MSWEP, CHIRPS, GFS, station observations and CMIP climate projections.

EDUCATION

MSc, Climate Change: Impacts, Mitigation and Adaptation
University of Copenhagen, Denmark | 2013-2016

BSc, Geophysics
University of Copenhagen, Denmark | 2010-2013

SELECTED PUBLICATIONS AND CONFERENCE CONTRIBUTIONS

- Krikken, Geertsema, Nielsen & Troccoli (2024). **The Added Value of Statistical Seasonal Forecasts**. Climate, 12(6), 83. doi:10.3390/cli12060083.
- Goodess et al., including Nielsen (2022). **The Value-Add of Tailored Seasonal Forecast Information for Industry Decision Making**. Climate, 10(10), 152. doi:10.3390/cli10100152.
- Kristian Nielsen, Penny Boorman, Meshack Mliwa, Omari Hamisi Juma and Alberto Troccoli. **Machine Learning Prediction of the Rainy-Season Onset in Southeast Africa** (In review)
- Presentation at ECMWF UEF2026: **Introducing WEFEX: Forecasting Extreme Weather Risks Across Europe.**

LANGUAGES

Danish - native | **English** - full professional proficiency | **Catalan** - B1 | **German** - limited proficiency.