

Advancing High-Resolution Land Cover in ICON/EXTPAR

Opportunities with ECOCLIMAP-SG+ML

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Motivation – Why Land Cover Matters

Hectometric NWP

Accurate surface heterogeneity is essential for energy & water fluxes in hi-res NWP at hectometric scale

Dynamic Field

Land cover changes substantially on ~5-year timescales (urbanisation, land management) – unlike soil or orography.

Current Dataset

GlobCover2009 (300 m) is the operational standard in ICON/EXTPAR but shows systematic deficiencies.

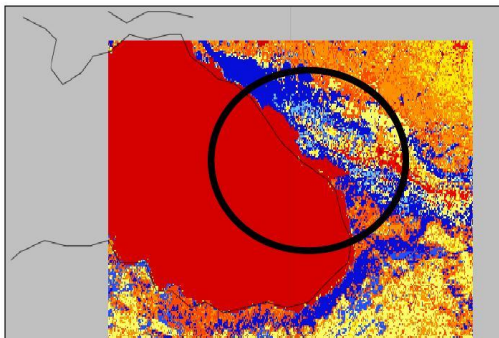
Key message from the coordination process

Growing interest across DWD, MeteoSwiss, ACCORD/FMI, COSMO and C-SRNWP / EUMETNET to move towards a modern, high-resolution land-cover dataset for European NWP systems.

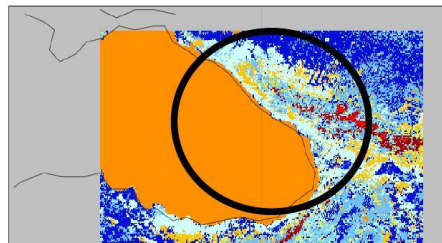


Limitations of GlobCover2009

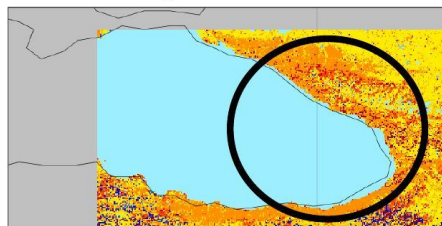
Uncertainties in Land-Cover



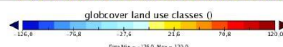
GLC2000 land use classes



GLCC USGS land use / land cover system



globcover land use classes



Black Sea Region:

Globcover 2009
(now used to derive land-sea mask)

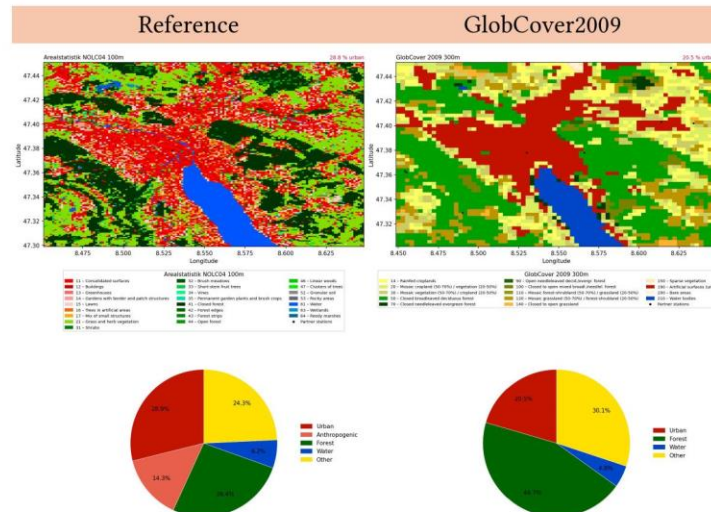


Observed deficiencies

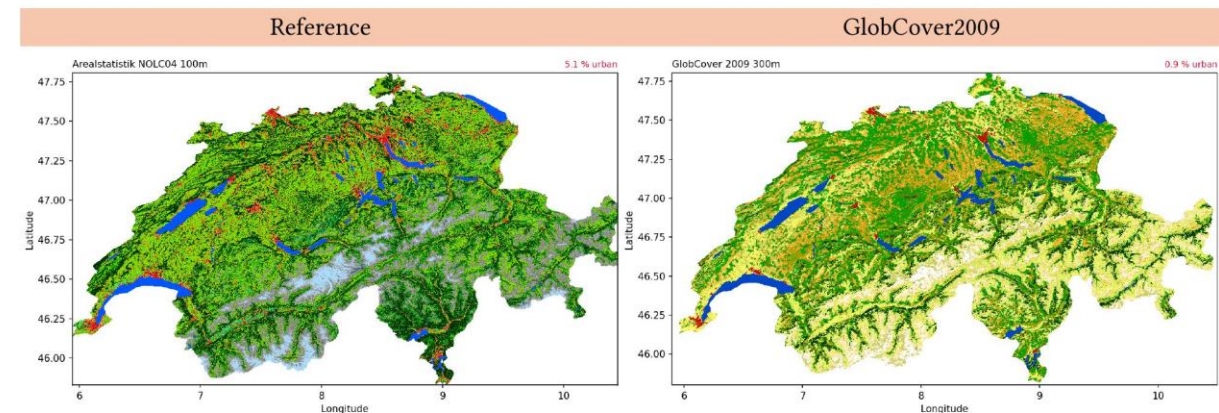
- Strong underestimation of urban areas
- Overestimation of forest cover
- Inconsistencies between GLC2000, GLCC and GlobCover
- Processing errors can affect land-sea mask and local model performance
- Static dataset – does not capture 5-year dynamics

Evidence from Switzerland (MeteoSwiss)

Land-Cover Comparison Reference Zürich



Land-Cover Datasets Comparison



Key finding (Yann der Weid, MeteoSwiss)

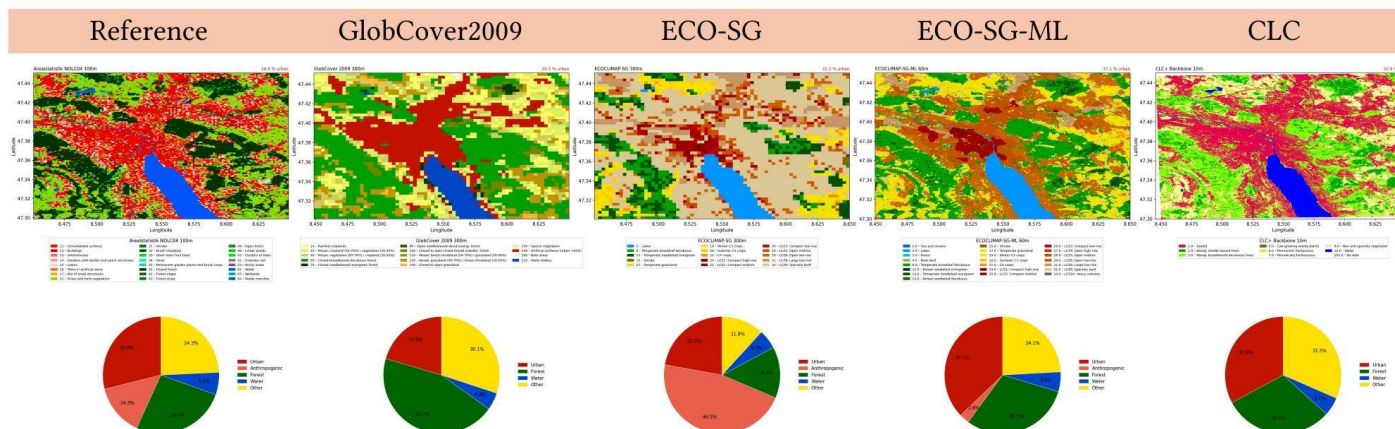
Compared with the Swiss national reference, GlobCover2009 reduces the urban fraction from ~5.1 % to only 0.9 % over Switzerland and from ~20 % to ~10 % over Zurich. Forest is correspondingly overestimated. These biases are critical for high-resolution ICON runs and surface scheme evaluation.



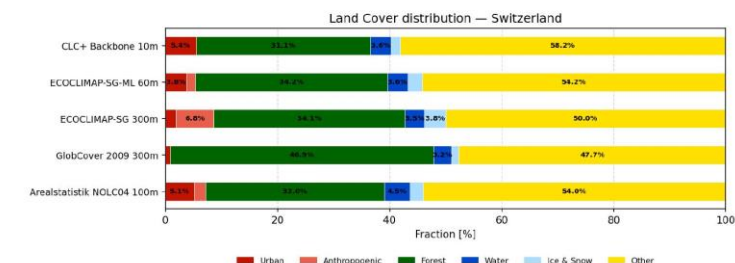
Multi-Dataset Comparison – Zurich & Switzerland



Land-Cover Datasets Comparison Zürich



Land-Cover Datasets Comparison



ECOClimap-SG / SG-ML

Closest to the Swiss reference for both urban and forest fractions. 60 m resolution + LCZ classes provide a clear advantage over 300 m GlobCover.



ECOCLIMAP-SG+ML – Key Advantages

1 60 m resolution

Five times finer than GlobCover2009 – captures heterogeneity and urban structure.

2 33 classes + LCZ

Detailed Local Climate Zones for urban areas; hierarchical primary/secondary labels.

3 ML-augmented

Agreement-based fusion + machine learning; quality score per pixel available.

4 Proven benefit

FMI experiments show improved land-sea mask, fluxes and complex-terrain representation.

5 Update pathway

Scripts at Meteo-France based on ESA-CCI; ML retraining on new releases.

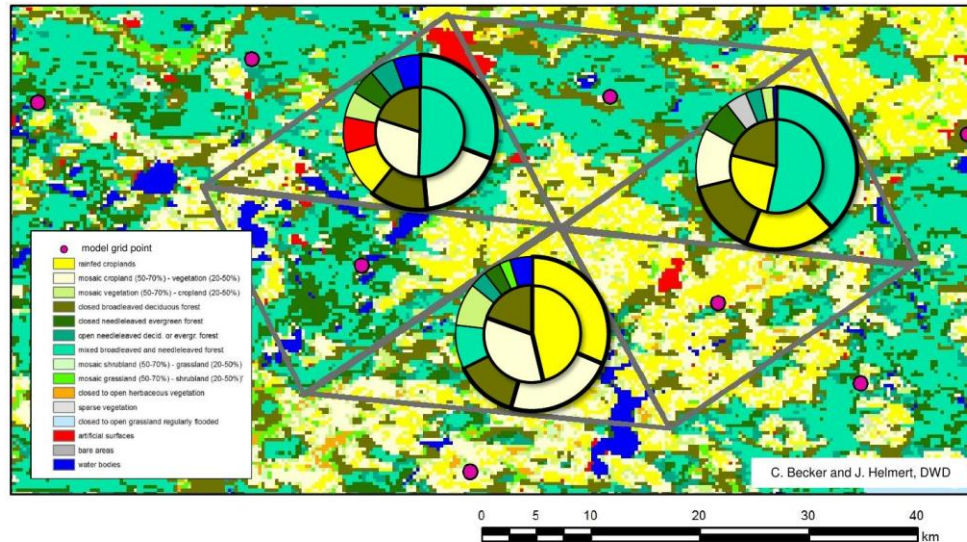
6 Community product

Developed within ACCORD – already tested by FMI, Met Éireann and others.



Technical Integration into ICON / EXTPAR

Generating Tiles from LCCS in ICON-NWP



Current workflow

GlobCover → 22 LCCS macro-classes → direct Look-Up Tables → TERRA parameters (plant cover, LAI, Z0, root depth, urban fraction).

Required for ECO-SG+ML

- New LUTs for 33 classes (incl. LCZ)
- Aggregation / tile generation at higher resolution
- Seasonal LAI / PLCOV cycles
- Regular 5-year update cycle



Coordination Meeting – 15 June 2026

Presentations from DWD, MeteoSwiss, FMI/ACCORD

Jürgen Helmert (DWD)

Motivation, GlobCover limitations, dynamic land cover, EXTPAR status

Yann der Weid (MeteoSwiss)

Swiss reference comparison – clear advantage of ECOCLIMAP-based datasets

Panu Maalampi (FMI)

High-res experiments: land-sea mask, fluxes, complex terrain, resolution impact

Open discussion

Jürgen Helmert (DWD), Jan-Peter Schulz (DWD), Linda Schlemmer (DWD), Günther Zängl (DWD), Christoph Gebhardt (DWD), Christian Steger (MeteoSwiss), Yann der Weid (MeteoSwiss), Mikael Stellio (C2SM), Panu Maalampi (FMI), Ekaterina Kurzeneva (FMI), Rudolf Mård (FMI), Patrick Samuelsson (SMHI), Emily Gleeson (Met Éireann)

Update mechanisms, ESA-CCI scripts, ML retraining, tile generation, funding



White Paper – Structure & Recommendations

Title: Advancing Decametric Land Cover for ICON and European NWP: The Case for ECOCLIMAP-SG+ML

- 1 Support continued development & maintenance of ECOCLIMAP-SG+ML (~8 500 €/year via EUMETNET/C-SRNWP)
- 2 Initiate prototype integration into EXTPAR at DWD + parallel testing at MeteoSwiss
- 3 Establish a coordinated ~5-year update cycle aligned with ESA-CCI releases
- 4 Prepare detailed implementation plan (LUTs, aggregation, parameters) by end of 2026
- 5 Form a small task group under C-SRNWP Expert Team on Surface Processes



Next Steps & Call for Contributions

Now	COSMO GM	Kilkenny (EWGLAM)	2026–27
Review of draft White Paper by COSMO community	Presentation & discussion; collect COSMO contributions	Final White Paper presented to SRNWP / EWGLAM	Prototype EXTPAR integration & evaluation runs

We welcome comments, additional results and contributions, especially from the surface-modelling community to strengthen the White Paper before the EWGLAM meeting in Kilkenny.



Summary

1. GlobCover2009 has clear, documented deficiencies for high-resolution NWP.
2. ECOCLIMAP-SG+ML (60 m) offers a scientifically and operationally attractive alternative.
3. A joint White Paper with concrete recommendations is ready for community review.
4. Modest EUMETNET/C-SRNWP funding can secure continuous updates and quality.
5. COSMO input is essential before the Kilkenny EWGLAM meeting.

Thank you

Questions, comments and contributions are very welcome.