

# SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

**Reporting year** 2026

**Project Title:** Regional reanalysis demonstrators for Copernicus  
Climate Change Service Evolution

**Computer Project Account:** 'spnoschy'

**Principal Investigator(s):** Harald Schyberg

**Affiliation:** Norwegian Meteorological Institute

**Name of ECMWF scientist(s)  
collaborating to the project  
(if applicable)** -

**Start date of the project:** 1 January 2025

**Expected end date:** 31 December 2026

## Computer resources allocated/used for the current year and the previous one (if applicable)

Please answer for all project resources

|                                            |          | Previous year |       | Current year |       |
|--------------------------------------------|----------|---------------|-------|--------------|-------|
|                                            |          | Allocated     | Used  | Allocated    | Used  |
| <b>High Performance Computing Facility</b> | (units)  | 208.3 M       | 47.2M | 80M          | 16.6M |
| <b>Data storage capacity</b>               | (Gbytes) | 210 800       | -     | 210 800      | -     |

### **Summary of project objectives** (10 lines max)

This Special Project is for computer resources for carrying out research and for running regional reanalysis demonstrators which are candidates for producing future regional reanalysis products in the Copernicus Climate Change Service (C3S). This is part of the Horizon-Europe project CopERNIcus climate change Service Evolution (CERISE) coordinated by ECMWF (see <https://cerise-project.eu/>). In general the CERISE project aims to enhance the quality of the C3S reanalysis and seasonal forecast portfolio, with a focus on land-atmosphere coupling. This project is specifically for the parts of CERISE developing, implementing and running regional land surface reanalysis demonstrators as well as coupled land-upper-air 3D reanalysis demonstrators over European and Arctic areas. The developments take place within the HARMONIE-AROME regional NWP code framework.

### **Summary of problems encountered** (10 lines max)

None

### **Summary of plans for the continuation of the project** (10 lines max)

After completing the one-year demonstration production of the fully coupled 3D pan-Arctic reanalysis demonstrator CARRA3-Pv1 (CARRA3 prototype version 1), we will continue to analyse and evaluate this demonstrator data set, including comparisons to independent observations and other reanalysis data sets such as CARRA2 and ERA5. After configuration and development efforts, a prototype pan-European reanalysis CERRA2-Pv1 (Copernicus European Regional Reanalysis 2nd generation prototype version 1) is ready for final evaluation and demonstration production and the plan is to produce a one-year data set with that as well followed by an evaluation of the data set.

### **List of publications/reports from the project with complete references**

So far a technical report (deliverable report) has been provided:

Blyverket, Jostein, Åsmund Bakketun, Hilde Haakenstad, Eivind Støylen, Harald Schyberg: CARRA-Land-Pv2 prototype 1991-1992 and 2015-2016. CERISE Deliverable report D4.3, 1 December 2025.

### **Summary of results**

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

The activity since the Special Project start has consisted of implementing and testing elements of data assimilation for regional reanalysis and surface upper-air coupling methodology in numerical weather prediction. Developments include preparing offline land surface only model experiments to evaluate the unified land data assimilation system applying Local Ensemble Transform Kalman Filter (LETKF) as well as preparation of coupling and assimilation strategies for full 3D reanalysis systems.

For the CARRA-Land-Pv2 reanalysis demonstrator (Copernicus Arctic Regional ReAnalysis Land Prototype version 2) we assimilated 2m temperature and snow depth using a local ensemble transform Kalman filter (LETKF) with a multivariate update of the SURFEX soil and snow prognostic variables. This demonstrator extended the developments of the previous Arctic land demonstrator CARRA-Land-Pv1 (in situ snow only assimilation and smaller domain) to include the assimilation of 2m temperature and including soil temperature, moisture and snow prognostic variables in the control vector on a large pan-Arctic domain. The production of this demonstrator has been completed, covering two one-year periods, 1990-09-01 to 1991-09-01 and 2015-09-01 to 2016-09-01, and an initial analysis of the data set and its quality is available in a technical report (deliverable report).

We have also implemented tested coupling methodologies and strategies in preparation of the configuration of the CARRA3-Pv1 fully coupled Arctic reanalysis demonstrator. The system includes unified surface assimilation with the LETKF inline methodology. The coupling methodology developments includes the so-called analyzed forcing option benefitting from time-dense near-surface observations as well as assimilation of near surface observations (2m temperature and humidity) in the HARMONIE-AROME upper-air 3D-VAR system. The production of the one-year demonstration reanalysis CARRA3-Pv1 data set (2015-09-01 to 2016-09-01) has now been completed and it is available to the project partners for further analysis. A deliverable report with initial analysis of the data set and results is underway and will be provided by end July 2026.

In addition to these experiments with 3D-Var assimilation, outer-loop land-atmosphere coupling in a 4D-var framework has been implemented by SMHI to prepare for the the ensemble based European reanalysis demonstrator, CERRA2-Pv1. For this reanalysis demonstrator a system has now been configured and an initial configuration is in test production.