

HIGH-RESOLUTION HYDROLOGICAL SEASONAL FORECASTING FOR WATER RESOURCES MANAGEMENT OVER EUROPE



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INTRODUCTION TO EDgE

The research program: Copernicus Climate Change Service (C3S) aims to provide climate-derived information for improved decision making regarding mitigation and adaptation strategies in Europe at timescales from seasonal to multi-decadal.



PROJECTS

SWICCA - Service for Water Indicators in Climate Change Adaptation

EDgE - End-to-end Demonstrator for improved decision making in the water sector in Europe

ECEM - European Climatic Energy Mixes

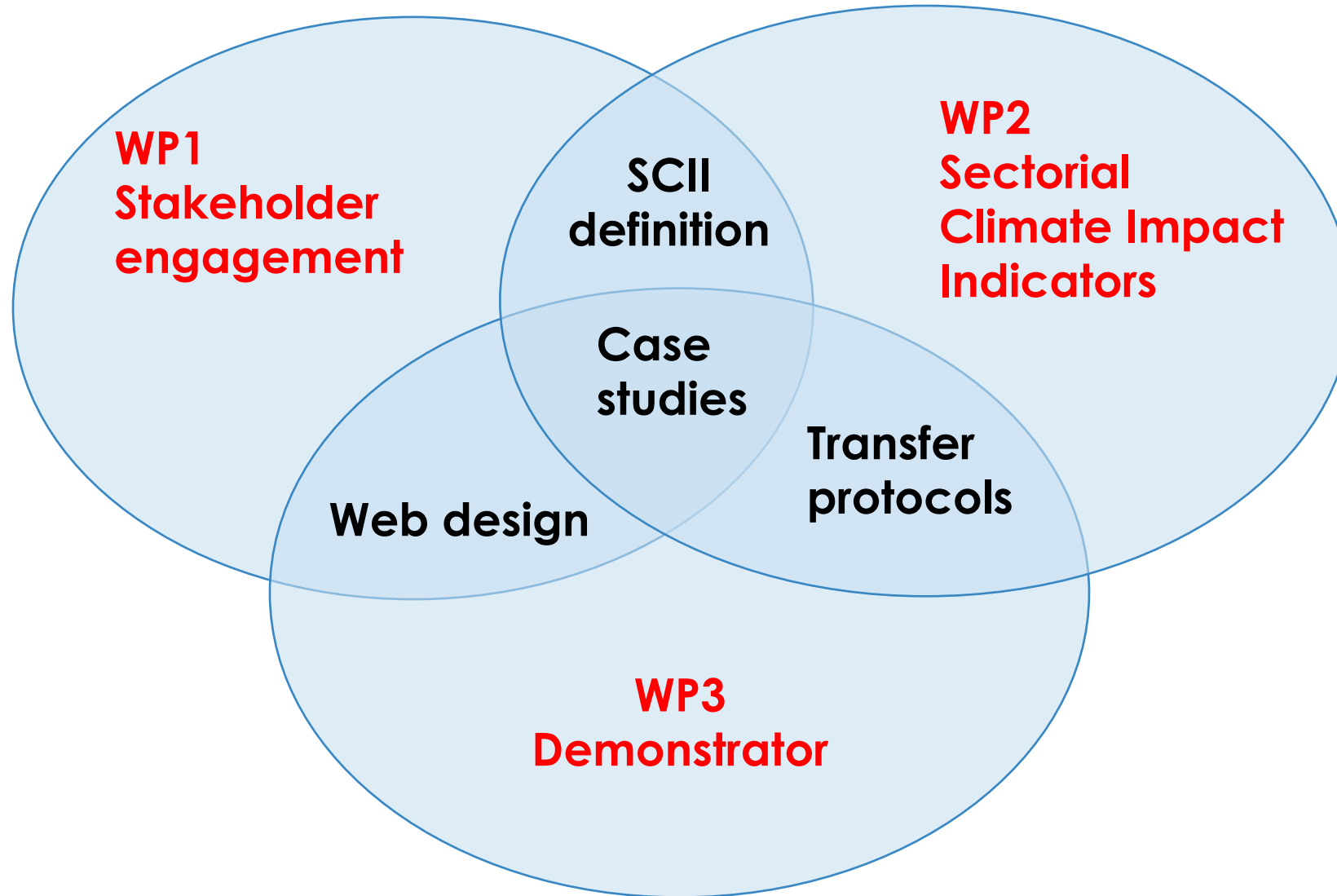
CLIM4ENERGY - A service providing climate change indicators tailored for the energy sector

UrbanSIS - Climate Information for EU Cities

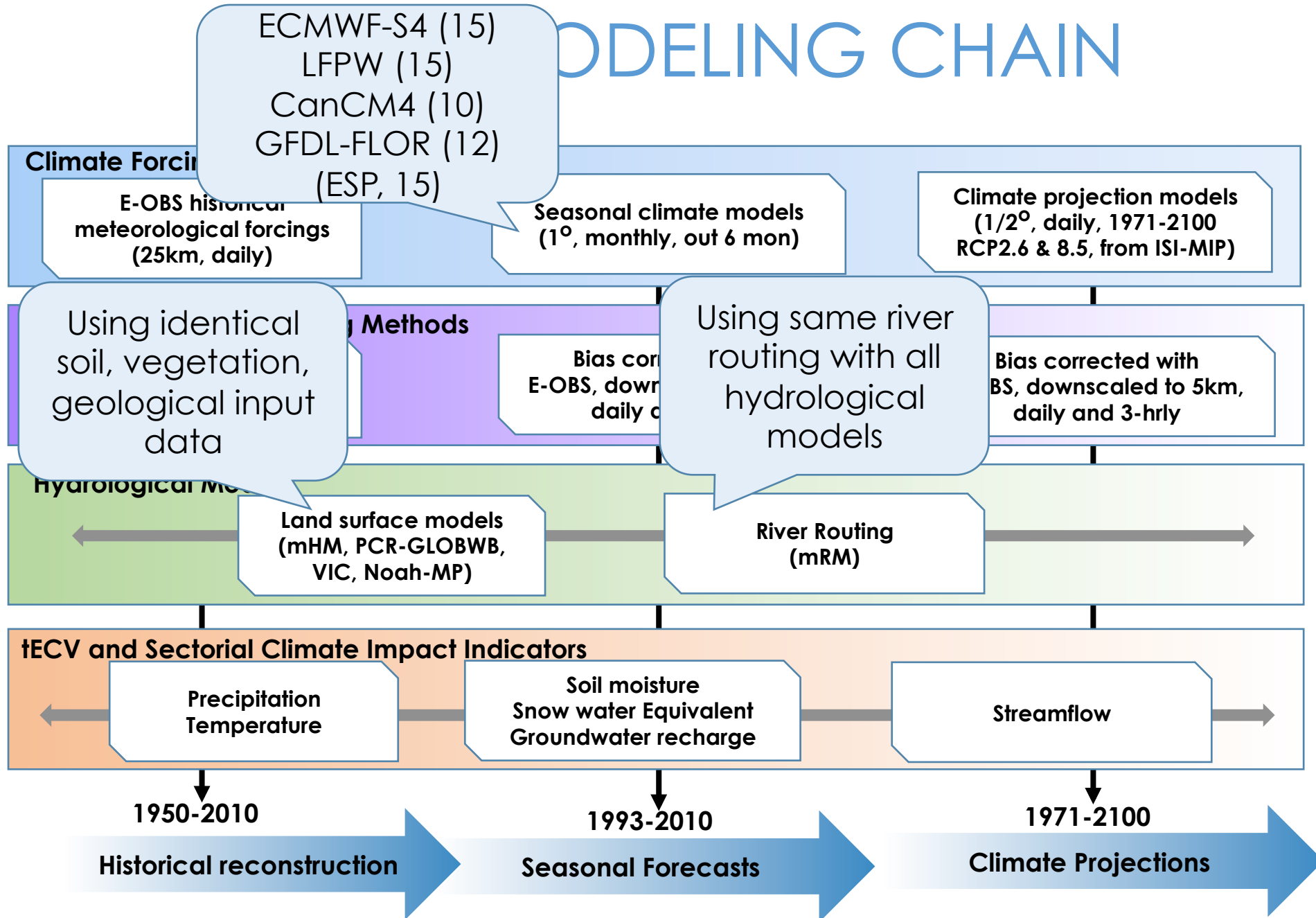
AgriCLASS - Agricultural Climate Advisory Services

WISC: Wind Storm Climate Service

EDgE PROJECT ORGANIZATION



MODELING CHAIN



ECMWF-S4 (15)
LFPW (15)
CanCM4 (10)
GFDL-FLOR (12)
(ESP, 15)

Climate Forcing
E-OBS historical meteorological forcings (25km, daily)

Seasonal climate models (1°, monthly, out 6 mon)

Climate projection models (1/2°, daily, 1971-2100 RCP2.6 & 8.5, from ISI-MIP)

Using identical soil, vegetation, geological input data

Methods
Bias correction (E-OBS, down daily)

Using same river routing with all hydrological models

Bias corrected with BS, downscaled to 5km, daily and 3-hrly

Hydrological Models

Land surface models (mHM, PCR-GLOBWB, VIC, Noah-MP)

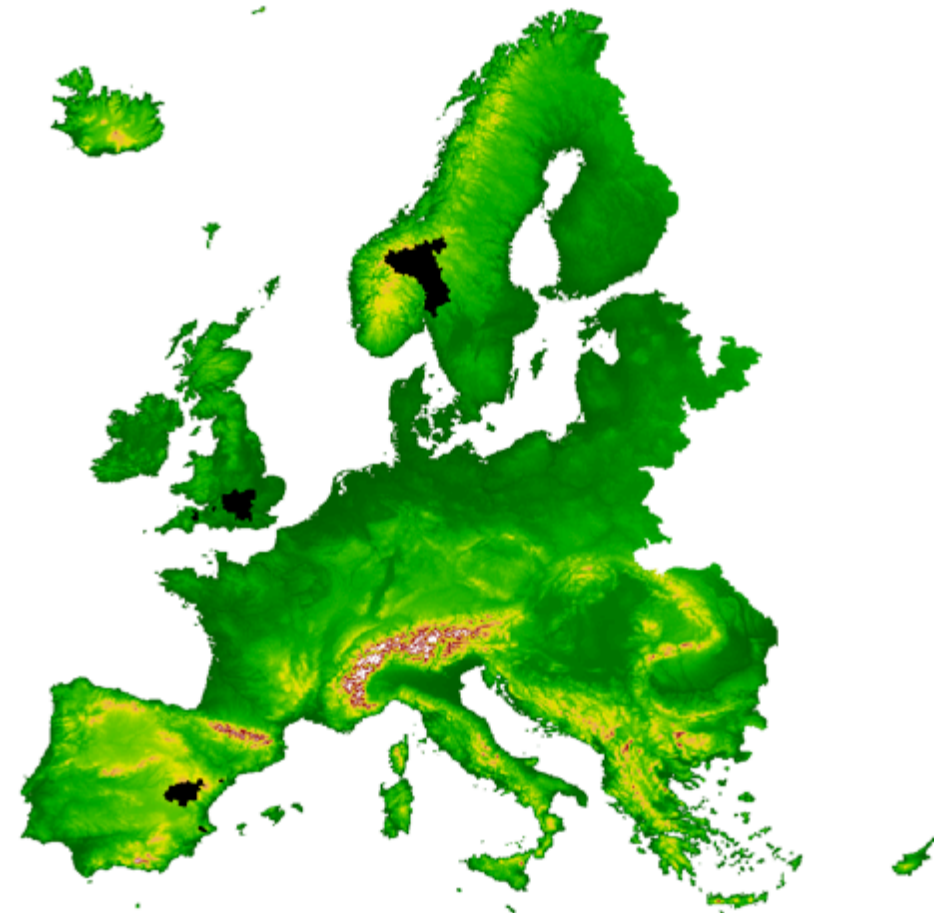
River Routing (mRM)

TECV and Sectorial Climate Impact Indicators
Precipitation, Temperature, Soil moisture, Snow water Equivalent, Groundwater recharge, Streamflow

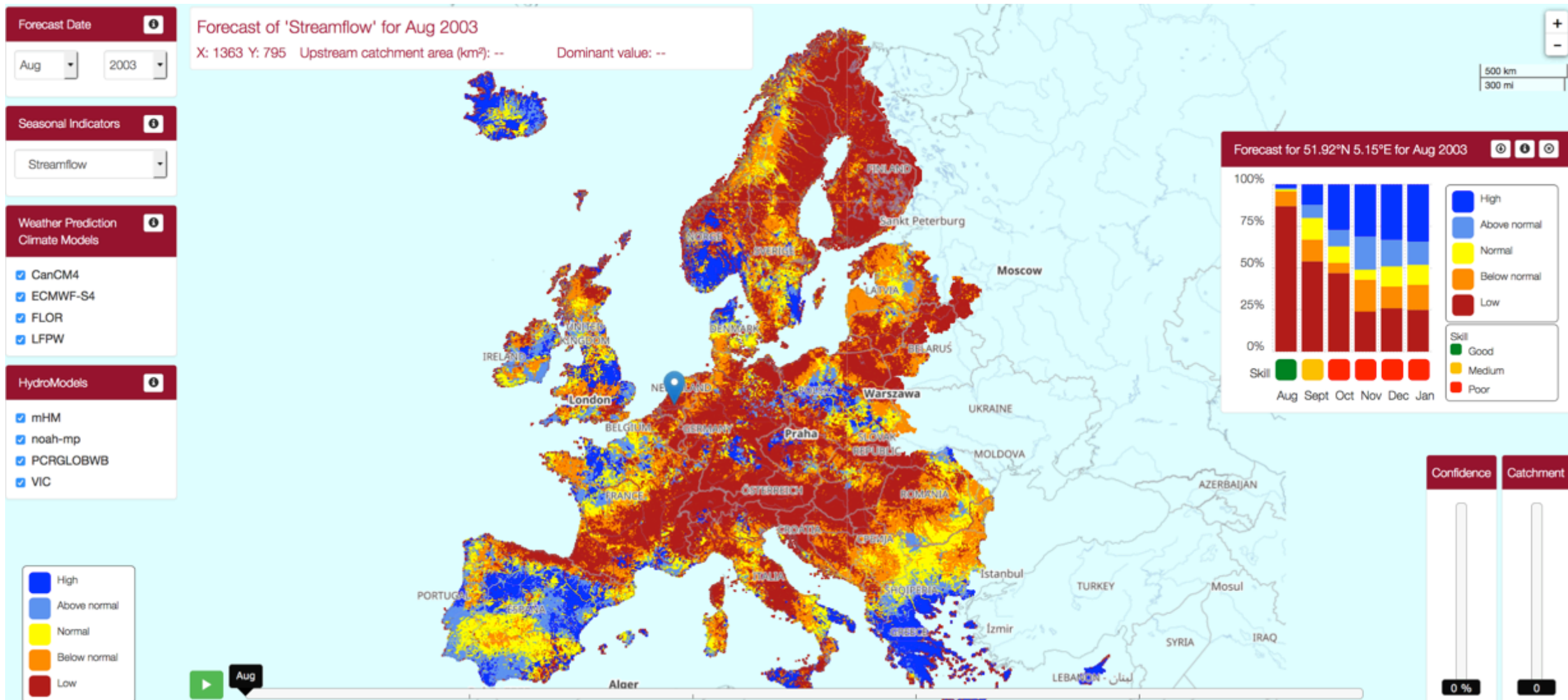
1950-2010 → 1993-2010 → 1971-2100
Historical reconstruction → Seasonal Forecasts → Climate Projections

DOMAIN, SKILL AND UNCERTAINTY

- Baseline forecast, Ensemble Streamflow Prediction (ESP)
- Brier score (accuracy)
- Spread for uncertainty



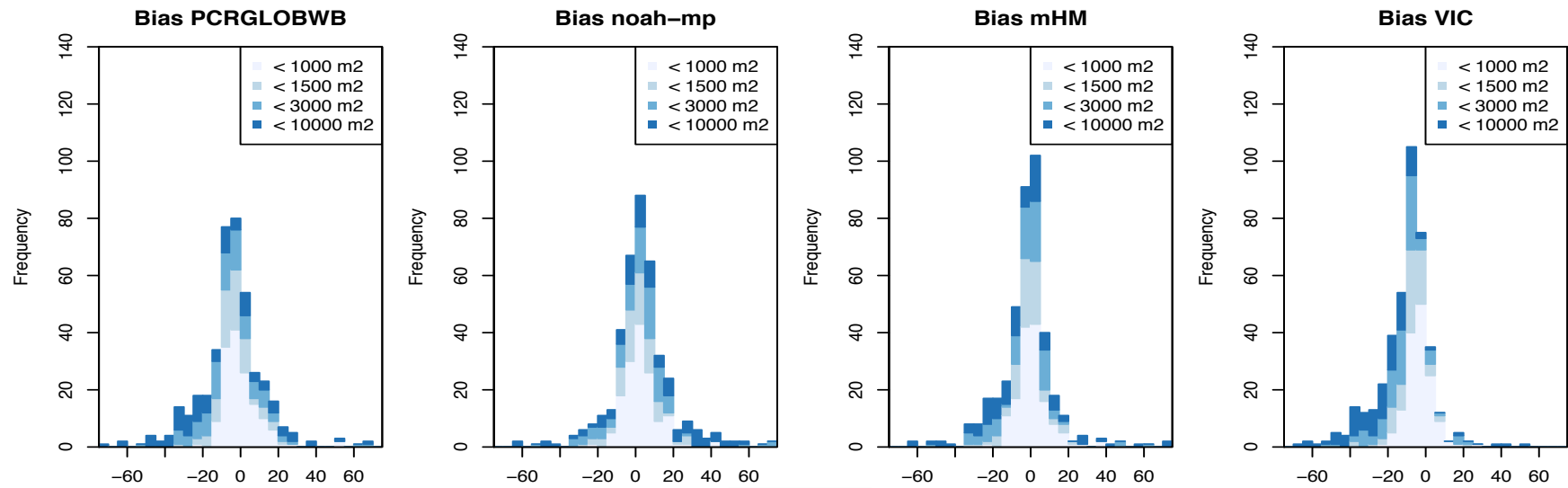
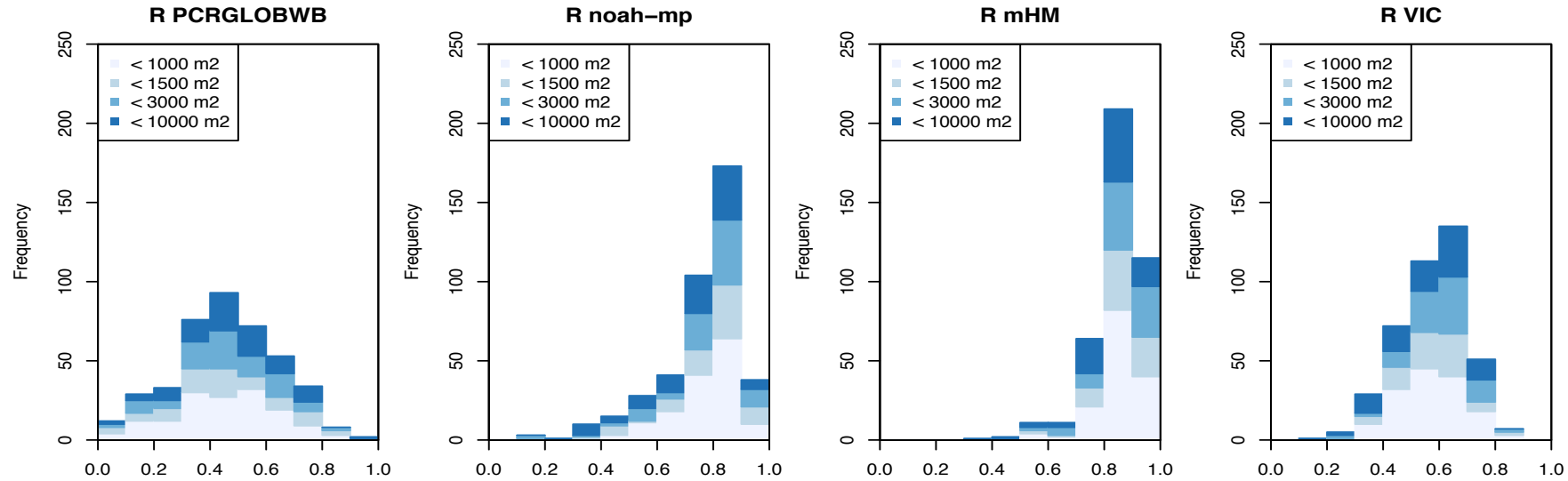
HIGH-RESOLUTION SEASONAL FORECASTING



<http://edge.climate.copernicus.eu/Apps/#seasonal>

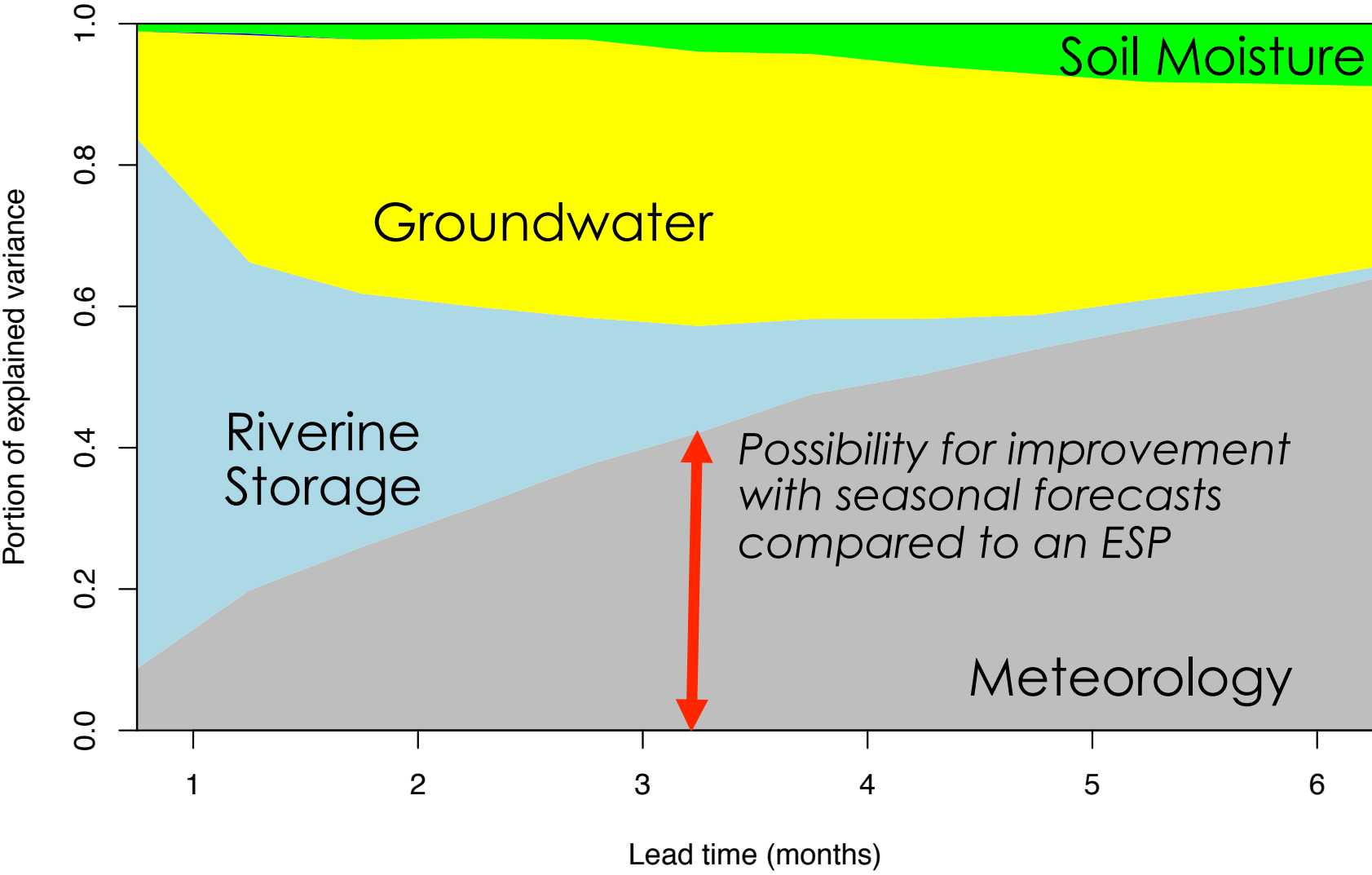
MODEL VALIDATION

Correlation

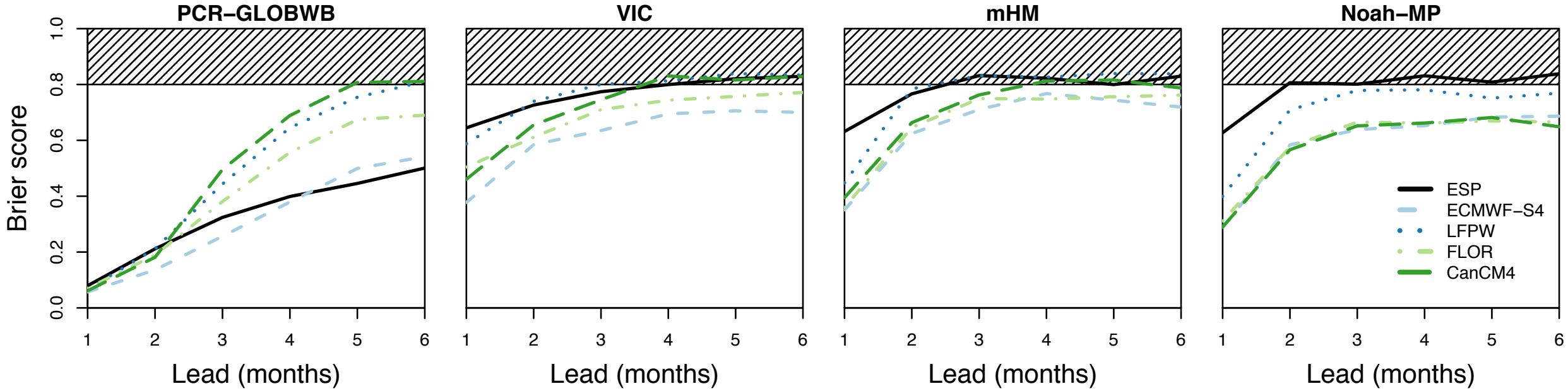


Bias

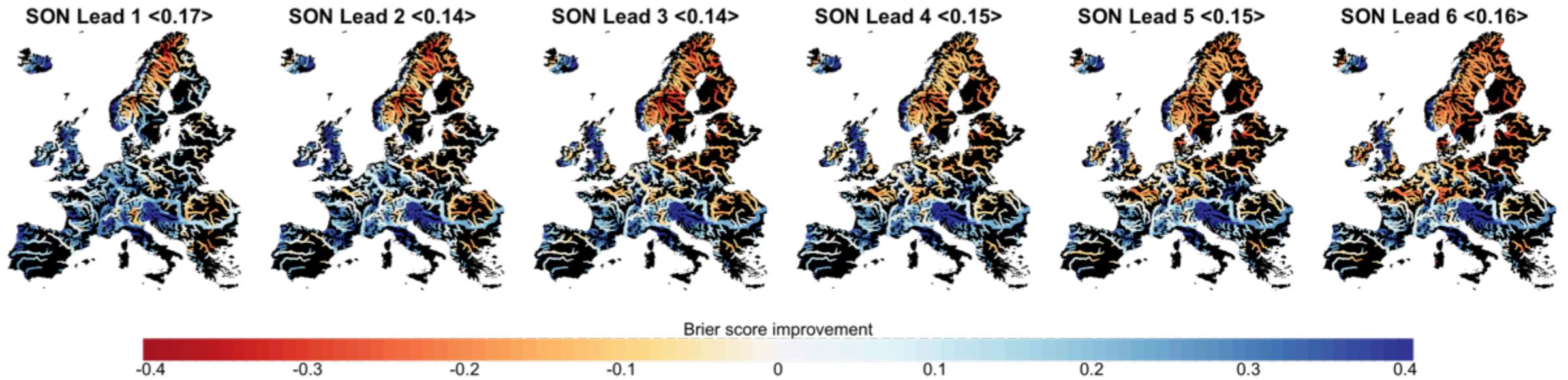
FORECAST SKILL



DYNAMIC FORECAST IMPROVEMENTS



SPATIAL IMPROVEMENT TO ESP



Brier Score Improvement

SOURCE OF UNCERTAINTY

SON Lead 1 <0.43/0.57>

SON Lead 2 <0.39/0.61>

SON Lead 3 <0.38/0.62>



% Uncertainty (GCM/HM)

Completely GCM dominated

Completely HM dominated

100/0

90/10

80/20

70/30

60/40

50/50

40/60

30/70

20/80

10/90

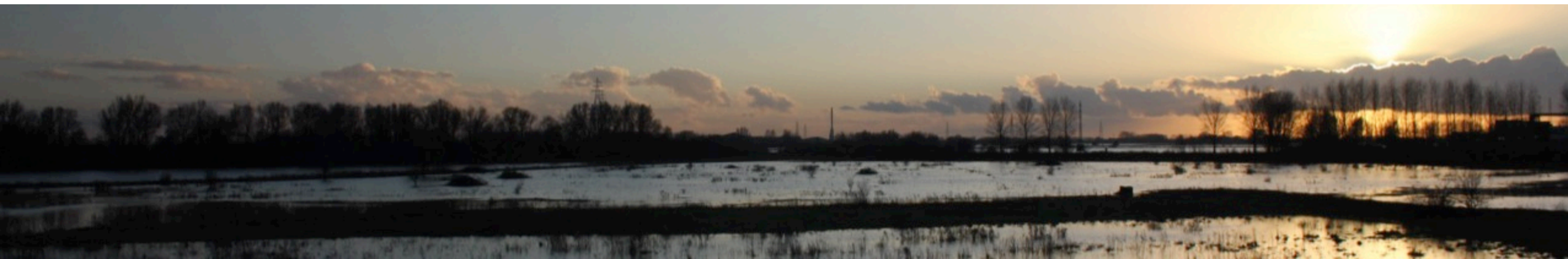
0/100

Completely GCM Dominated

Completely HM Dominated

CONCLUSIONS

- We have a forecasting system that is:
 - High-resolution (5km)
 - Pan-European
 - Multi-variable
 - Multi-seasonal model
 - Multi-hydrological model
 - Consistently parameterized
 - **Skillful**
 - **Provides meaningful output to decision makers**



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