SMHI

Development of a high-resolution flood forecasting system in Sweden

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Summary

Main objective

To develop the national flood forecasting system for improved performance and support for intense short-duration rainfall events (cloudbursts) and flash flooding

Main activities

1. Develop the national hydrological model S-HYPE for **1-hour time step**
2. Produce a historical high-resolution precipitation forcing data set
3. Improve the description of urban areas
4. Evaluate different high-resolution meteorological forecasts
5. Suggest new tools for real-time visualization of short-duration rainfall

Main result

Pre-operational version of a national 1-hour flood forecasting system

Cloudburst consequences

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Hela gården är förstörd

Tvingas bo i husbil

Bengt och Lena Hjorths garageuppfart efter regnkaoset.

Foto: ANNA TÄRNHUVUD DÖLJ BILDTEXT

Regn orsakar översvämningar i Malmö

Polisen: Lämna bilen hemma

(1:12 min)

Bilar bärgas från den översvämmade inre ringvägen i Malmö på söndagen. Foto: Stig-Åke Jönsson/TT.

GP

Jeep användes vid guldsmedsrån

mer TV >>

Här står polisen | 19°

Onsdag 28 augusti 2013

Nyheter Sport Kultur & Nöje Ekonomi Konsument Bostad Resor Motor Mat

GÖTEBORG SVERIGE VÄRLDEN BOHUSLÄN HALLAND VÄSTERGÖTLAND MÖLNDAL/HÄRR

Spårvagnsupphandlingen

Regnkaoset gav störningar i trafiken

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Bild: Läsarbild

SYDSVENSKAN

Välj hur du vill l

Obegränsad tillgång. I

Från 59 kr/mån.

MALMÖ LUND OMKRETSEN SPORT EKONOMI OPINION KULTUR & NÖJEN SKÅNE SVERIGE ÅS

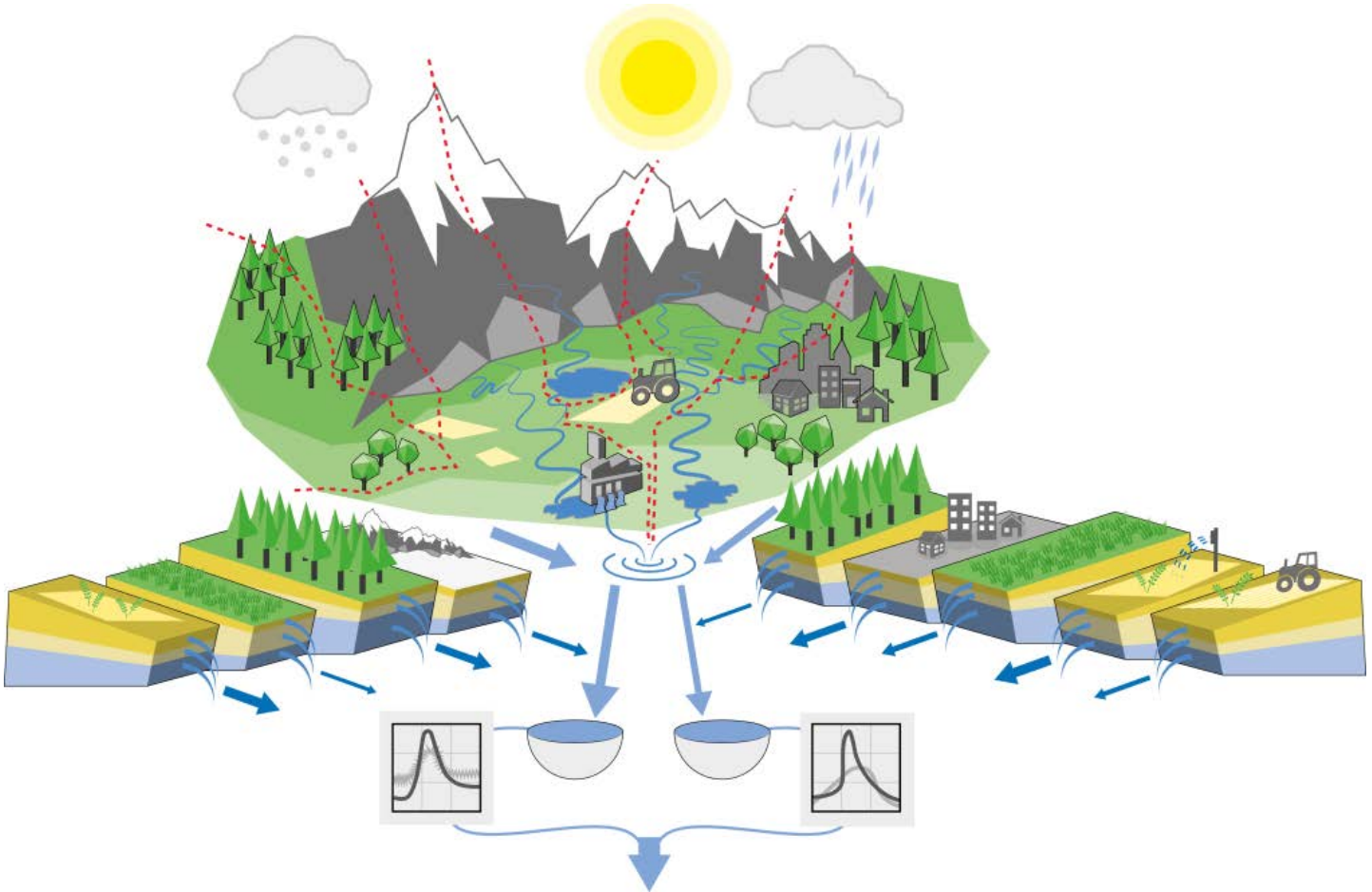
VELLINGE LOMMA KÄVLINGE STAFFANSTORP SVEDALA BURLÖV TRELLEBORG ESLÖV

Regnnotan slutade på 15 miljoner

Today's forecasting system

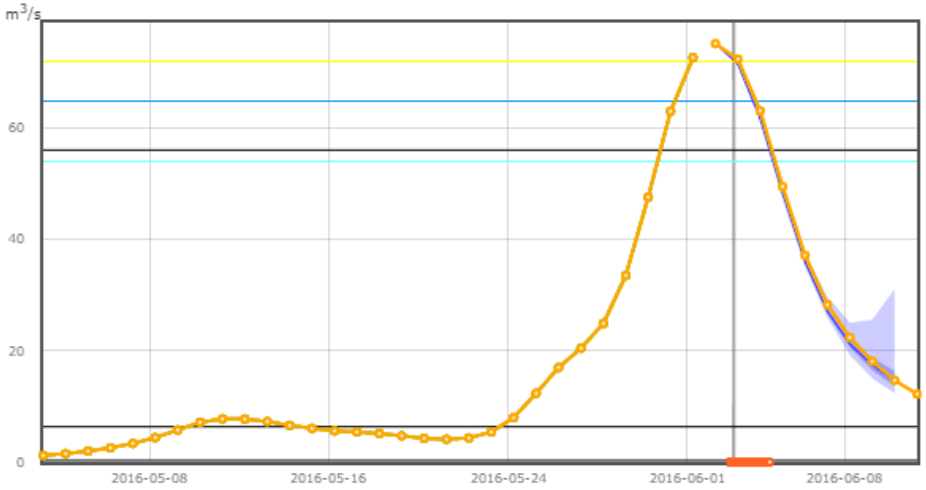
HYdrological Processes for the Environment – HYPE

- ✓ Open source: http://hype.sourceforge.net
- ✓ Open data: http://hypeweb.smhi.se



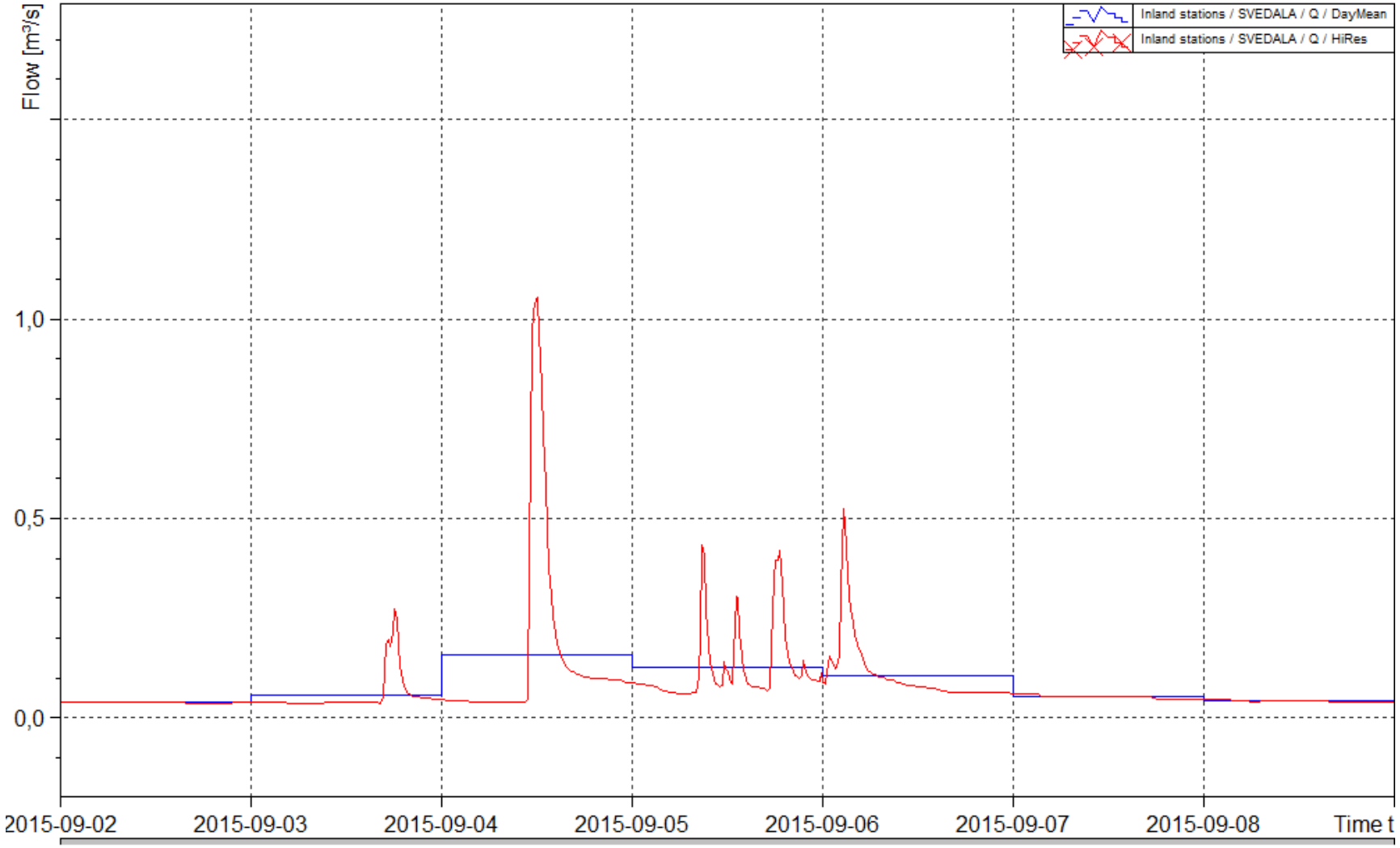
Today's forecasting system

- Sweden-HYPE (S-HYPE) model
- Around 37 000 sub-catchments with median size 7 km^2
- Daily time step, 10 days ahead, including ensemble forecasts



Daily time step → limited applicability for flash floods and other consequences of cloudbursts

Discharge: 1 day vs. 15 min

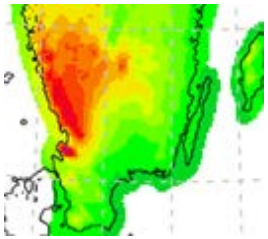


1. High-resolution precipitation data set

Station data (1-day)

Optimal interpolation

Gridded field 4×4 km²



Radar data
(2×2 km², 15 min)

Merge by quantile mapping procedure

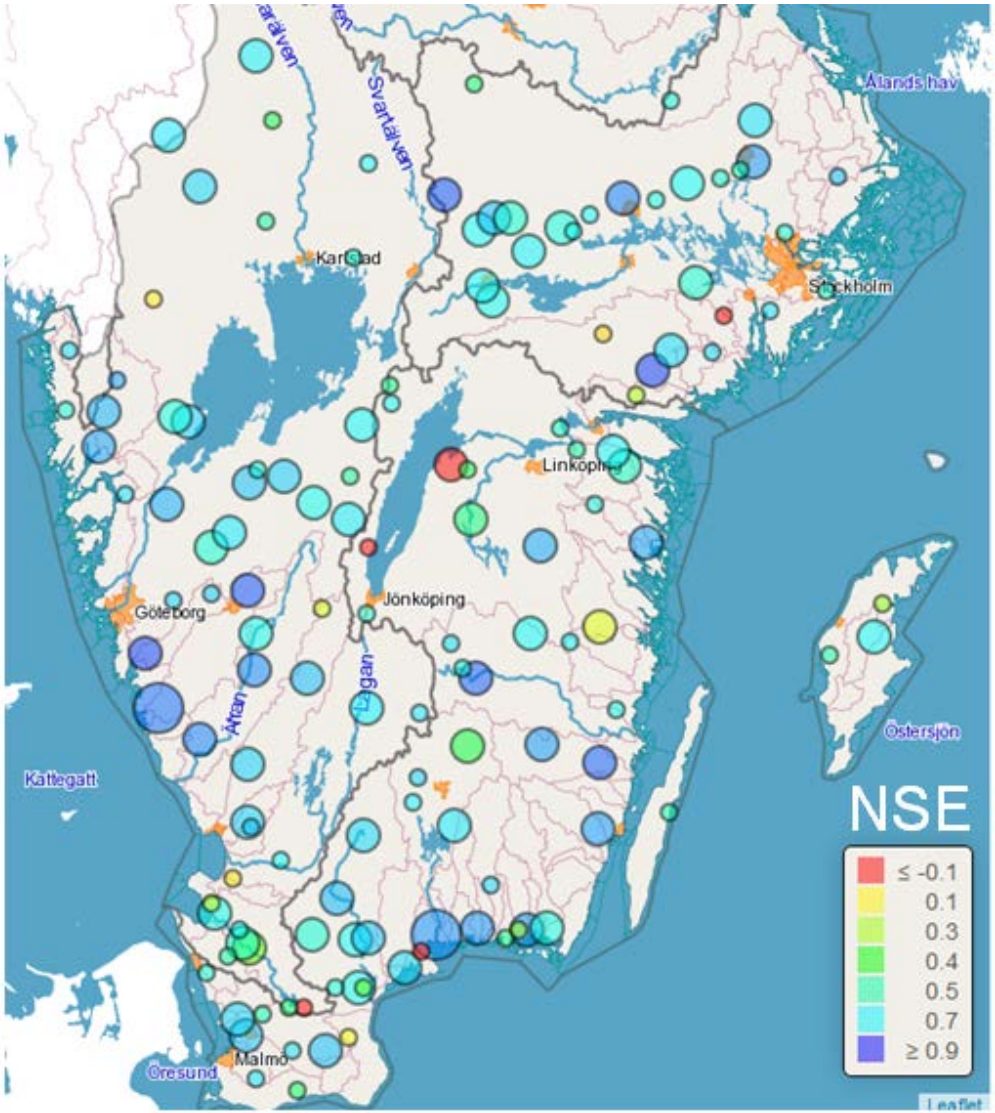
HIPRAD

(gauge adjusted, 2×2 km², 15 min)

Berg et al., Journal of Hydrology, 2016

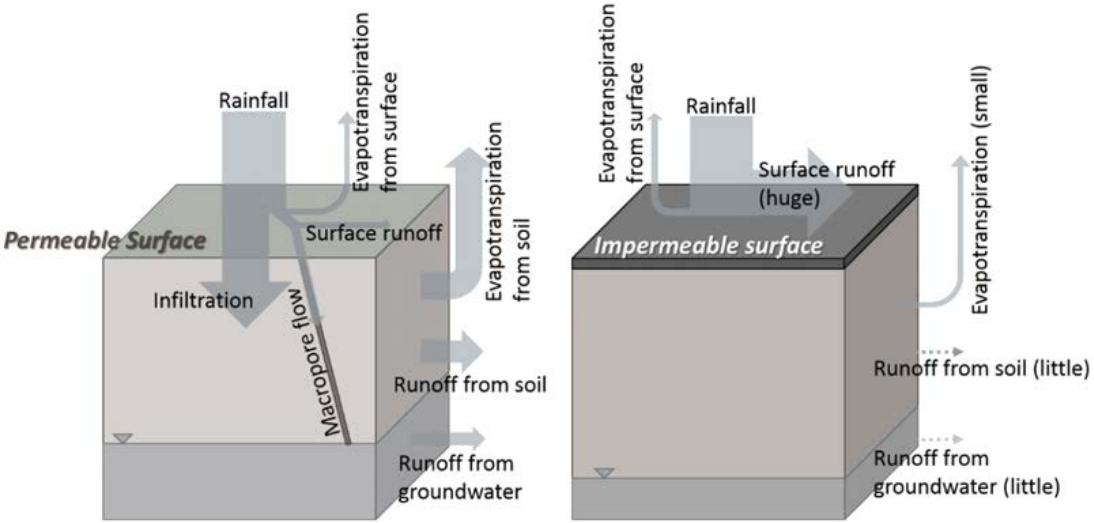
2. Developing S-HYPE for 1-hour time step

HYPE parameter assessment, adjustment and re-calibration

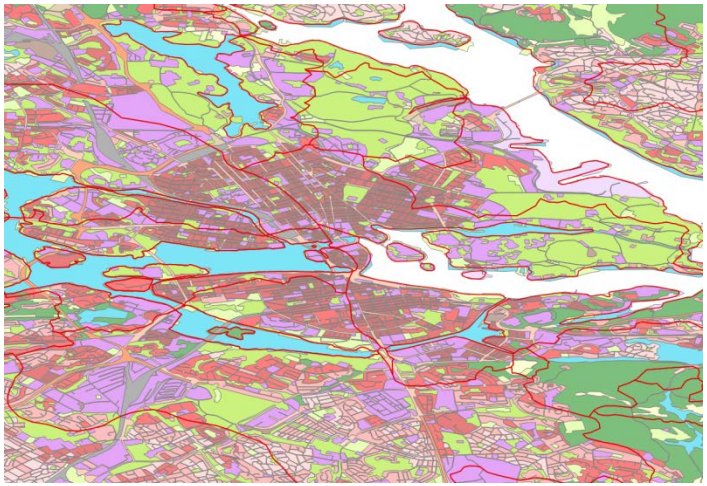


3. Improved description of urban surface

Urban HYPE class



Detailed land use



RURAL

URBAN

EEA URBAN ATLAS

4. Meteorological forecasts

- Deterministic forecast Harmonie-AROME
  (66 h ahead, 1-h time step, 2.5 km)

- Deterministic nowcast-NWP-hybrid KNEP
  (36 h ahead, 1-h time step, 2.5 km)

- Ensemble forecast HarmonEPS
  (48 h ahead, 1-h time step, 2.5 km, 11 members)

Evaluated for observed short-duration rainfall extremes and in flooding case studies
(e.g. Olsson et al., Urban Water Journal, 2014)

5. Visualization of short-duration prec.

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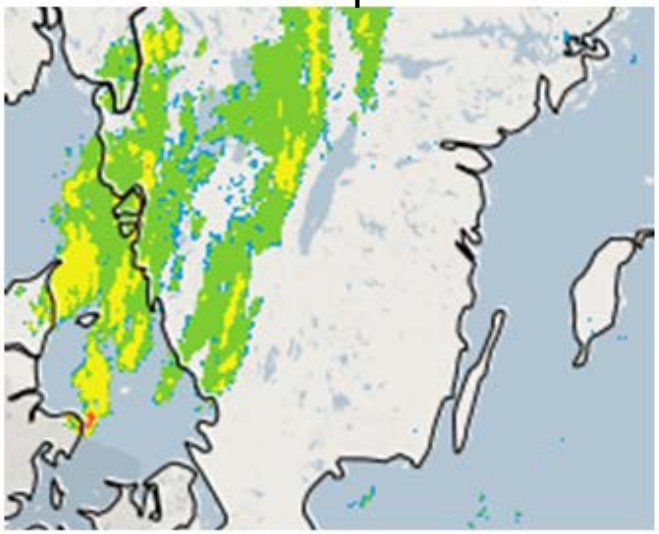
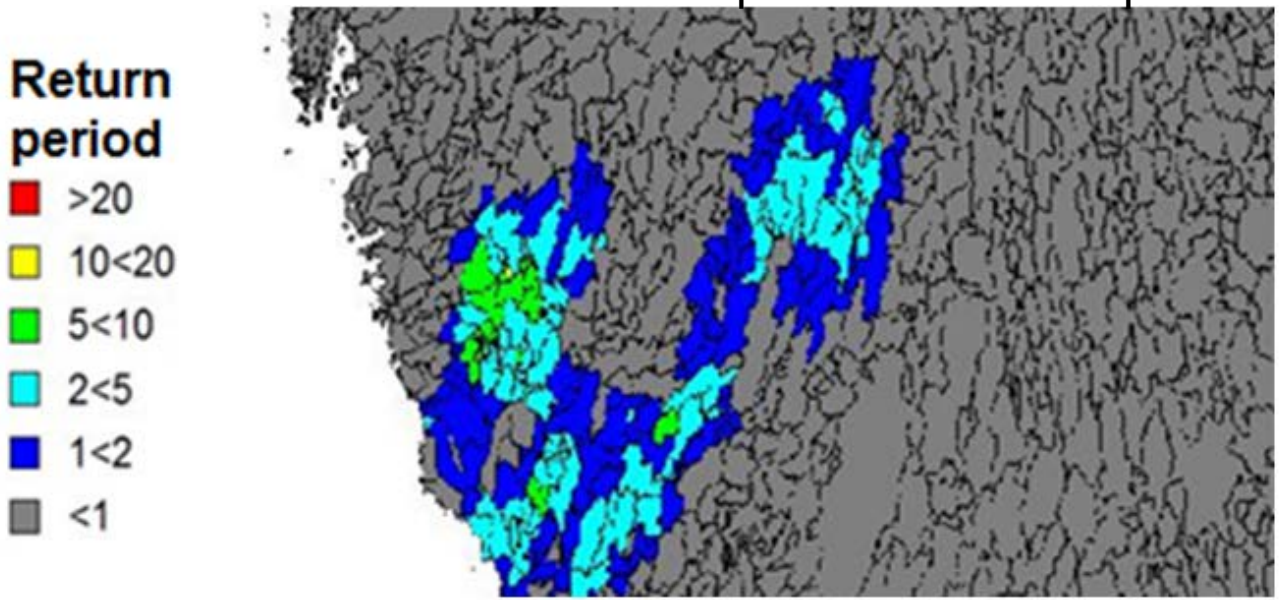
Station network

Radar sequence

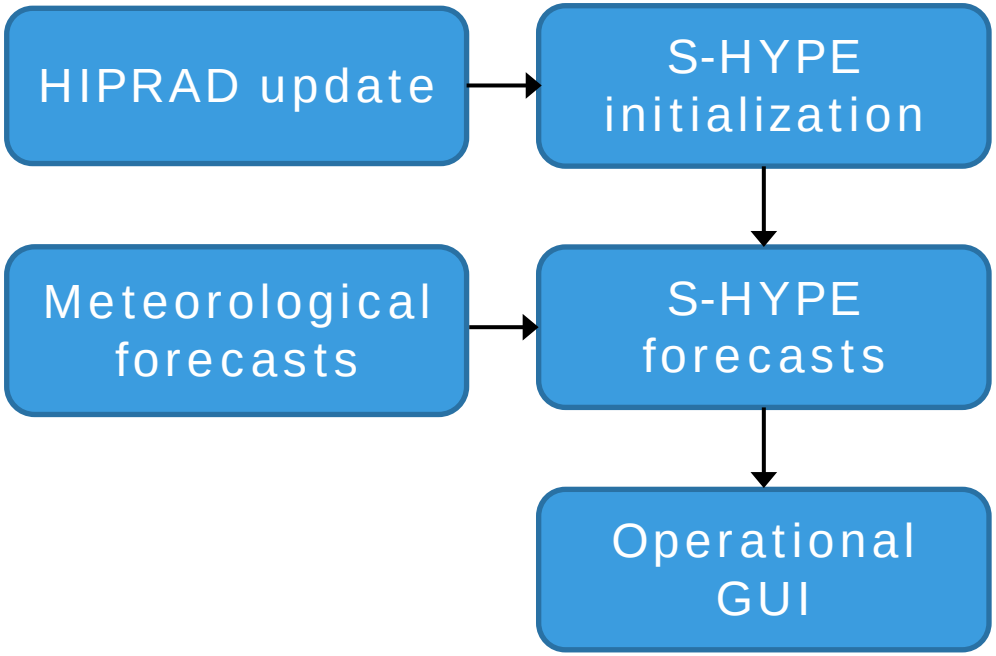


HIPRAD sub-basin accumulations expressed as return period



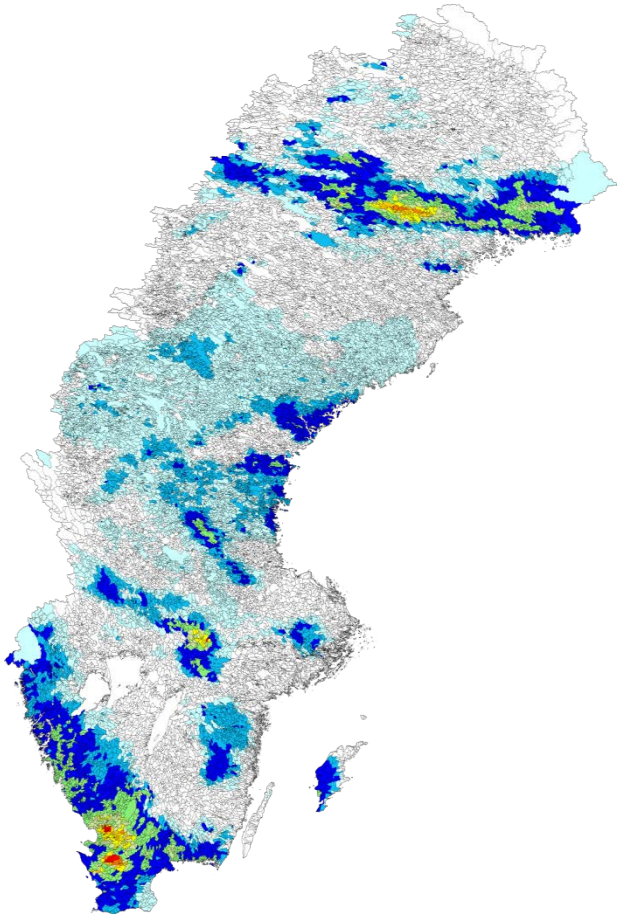
Pre-operational 1-hour system

Every hour:



Maps of maximum 1-hour prec.

now-X h ← | → now+X h
(observation) *(forecast)*



Thank you!