

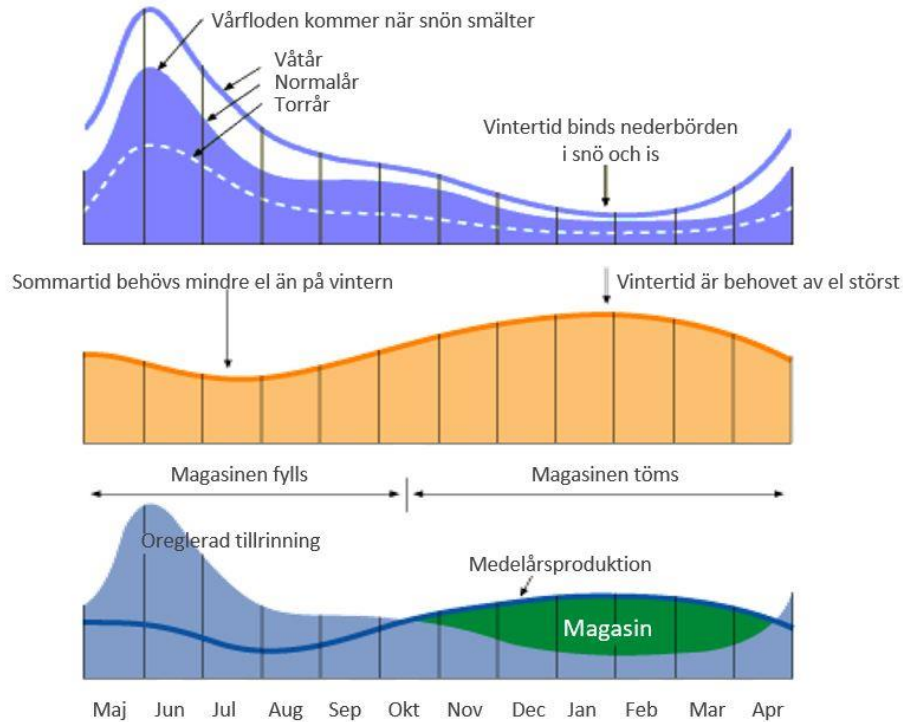
Långtidsprognoser för vattenresurshantering - Multimodeller

Kean Foster
DHI Sverige, november 2020



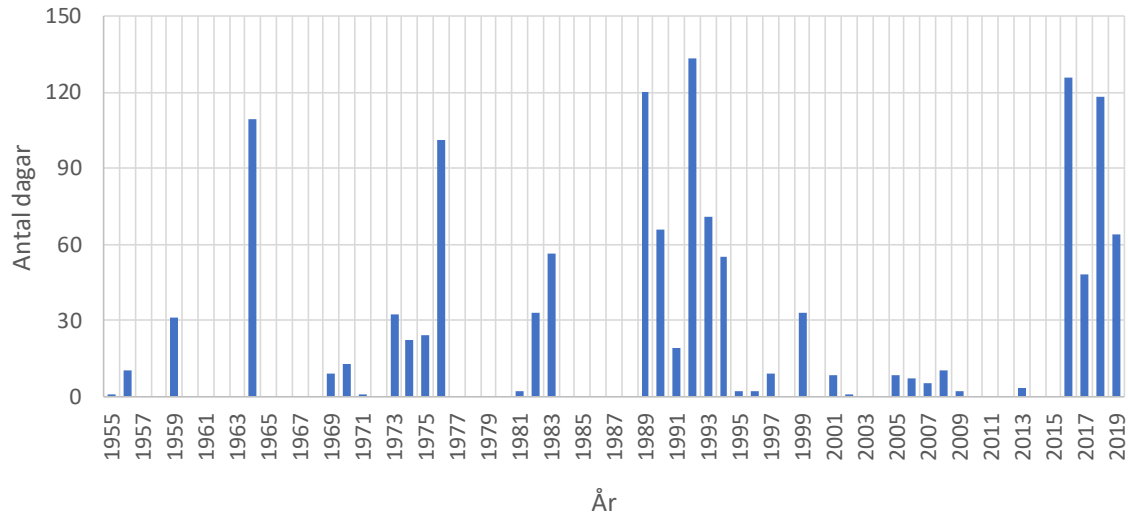
Varför?

Reglering



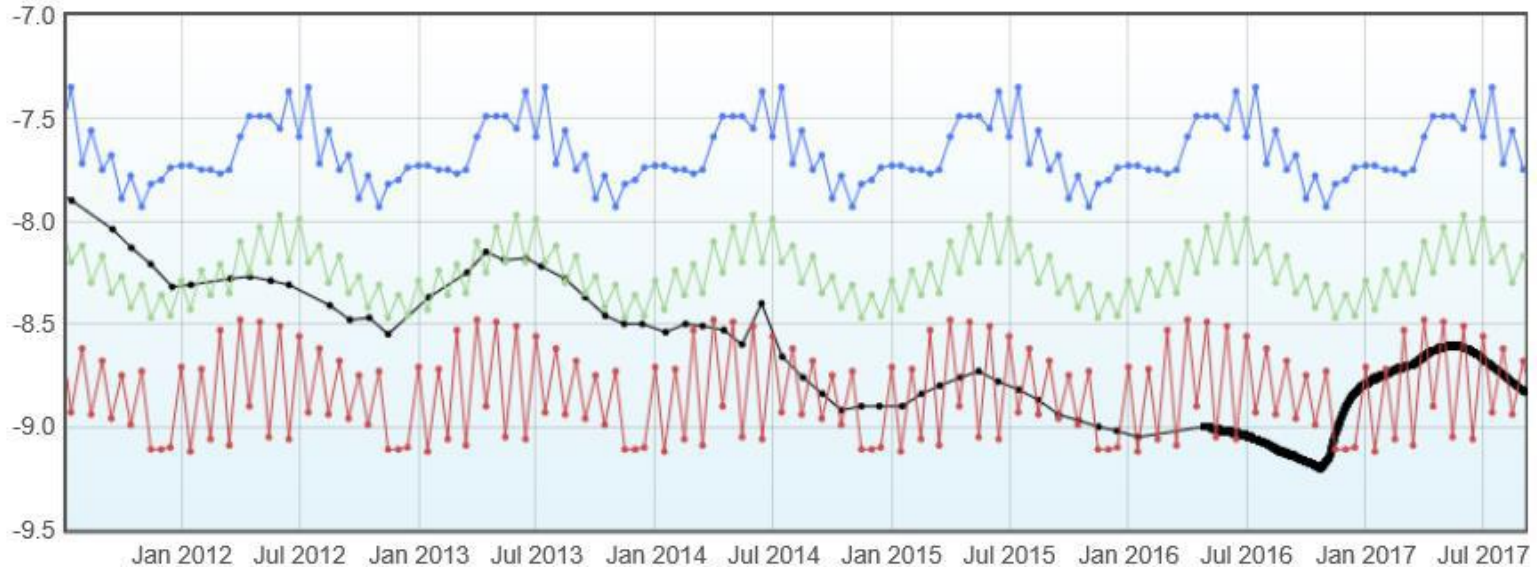
Varför?

Emsfors, antal dagar med $Q < MLQ_{ref}$

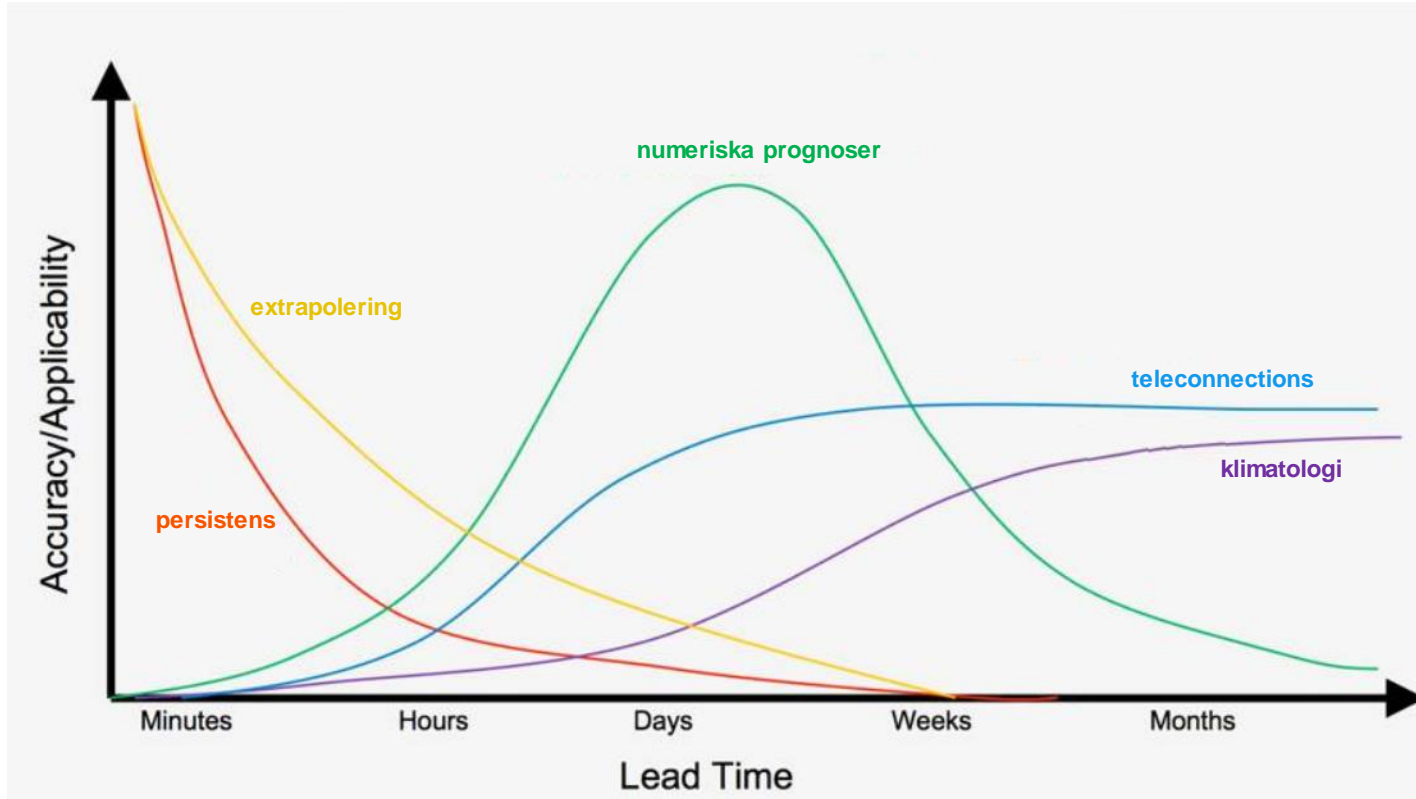


Varför?

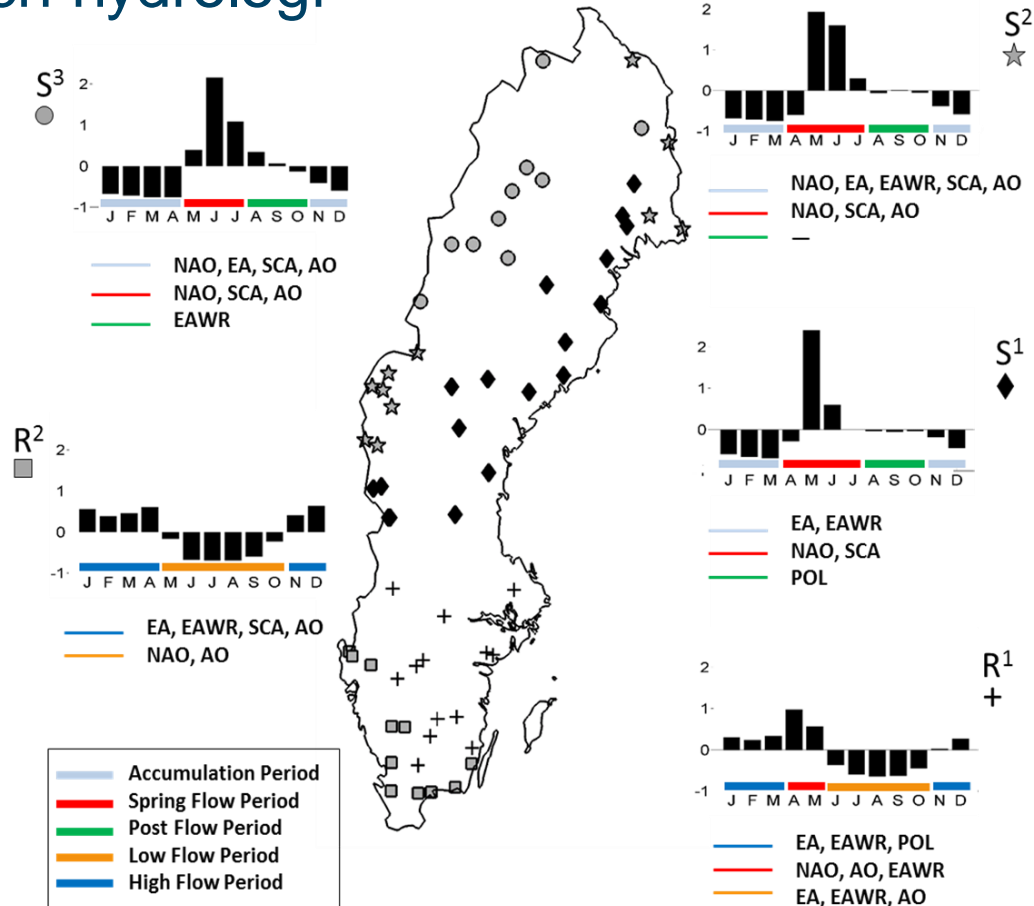
Grundvattennivå för station: Böda_7 (7_7) - meter under markytan



Prognoser



Klimat och hydrologi



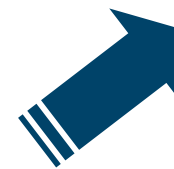
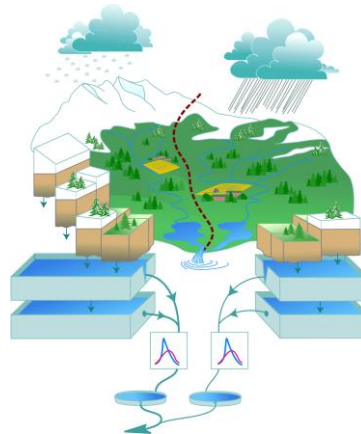
Historisk ensemble

Historiska tidsserier

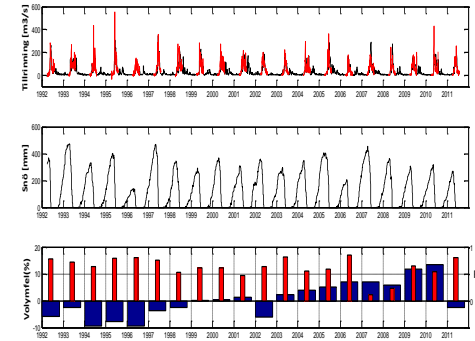
1961, 1962, 1963, 1964, 1965,
1966, 1967, 1968, 1969, 1970,
1971, 1972, 1973, 1974, 1975,
1976, 1977, 1978, 1979, 1980,
1981, 1982, 1983, 1984, 1985,
1986, 1987, 1988, 1989, 1990,
1991, 1992, 1993, 1994, 1995,
1996, 1997, 1998, 1999, 2000,
2001, 2002, 2003, 2004, 2005,
2006, 2007, 2008, 2009, 2010,
2011...



Modell



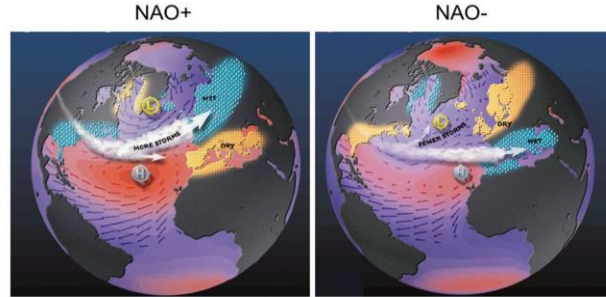
Prognos



Analoger (Reducerad historisk ensemble)

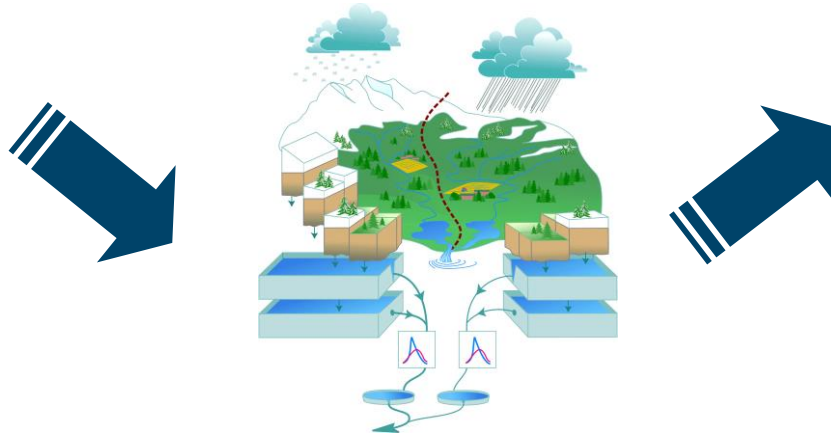
Historiska tidsserier

1961, **1962**, 1963, 1964, 1965,
1966, 1967, 1968, 1969, 1970,
1971, 1972, **1973, 1974**, 1975,
1976, 1977, 1978, 1979, 1980,
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1986, **1987**, 1988, 1989, 1990,
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2001, 2002, 2003, 2004, 2005,
2006, 2007, 2008, **2009, 2010**,
2011...

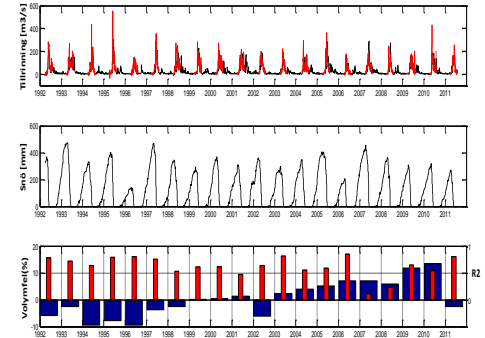


From <http://www.ideo.columbia.edu/NAO> by Martin Visbeck

modell

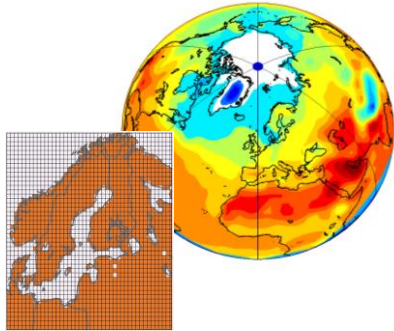


Prognos



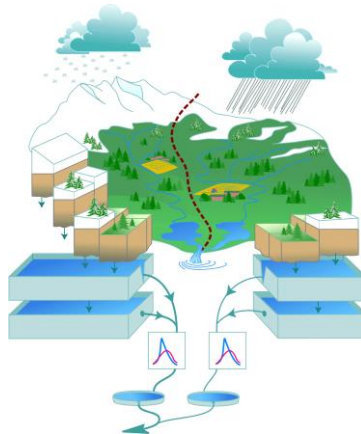
Numeriska prognoser

numerisk prognosmodell

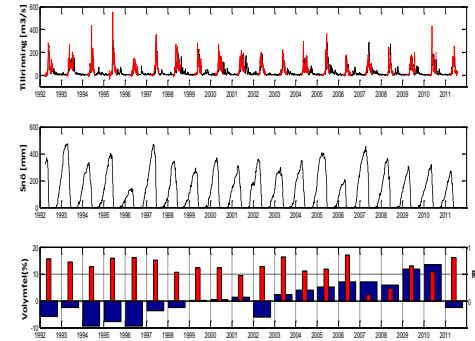


~100 km

modell

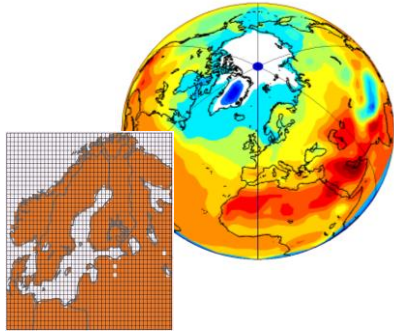


Prognos



Statistisk nedskalning

numerisk prognosmodell

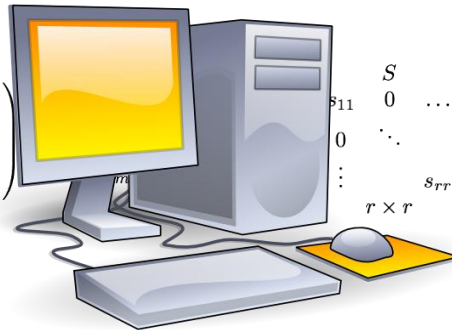


~100 km

modell

$$X = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & \dots \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & & & x_{mn} \end{pmatrix}$$

$m \times n$



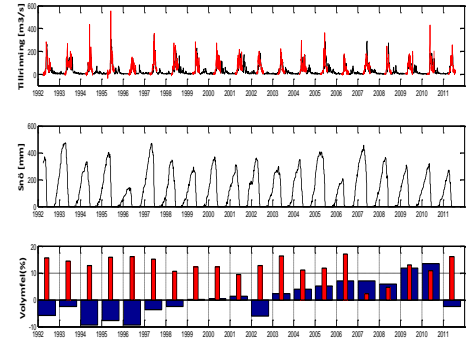
$$S = \begin{pmatrix} s_{11} & 0 & \dots \\ 0 & \ddots & \\ \vdots & & s_{rr} \end{pmatrix}$$

$r \times r$

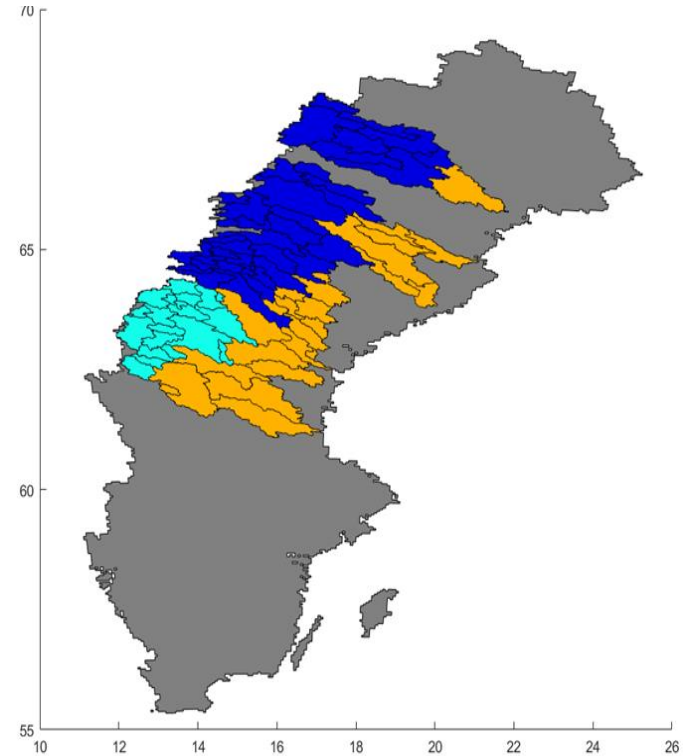
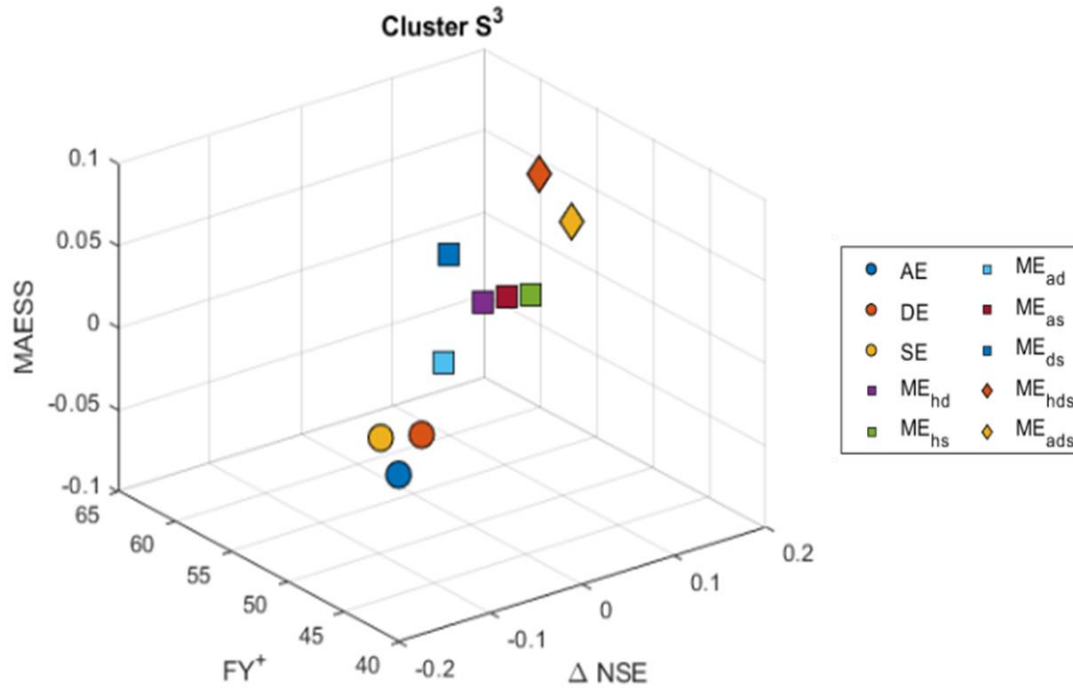
$$V^T = \begin{pmatrix} v_{11} & \dots & v_{1n} \\ \vdots & \ddots & \vdots \\ v_{r1} & & v_{rn} \end{pmatrix}$$

$r \times n$

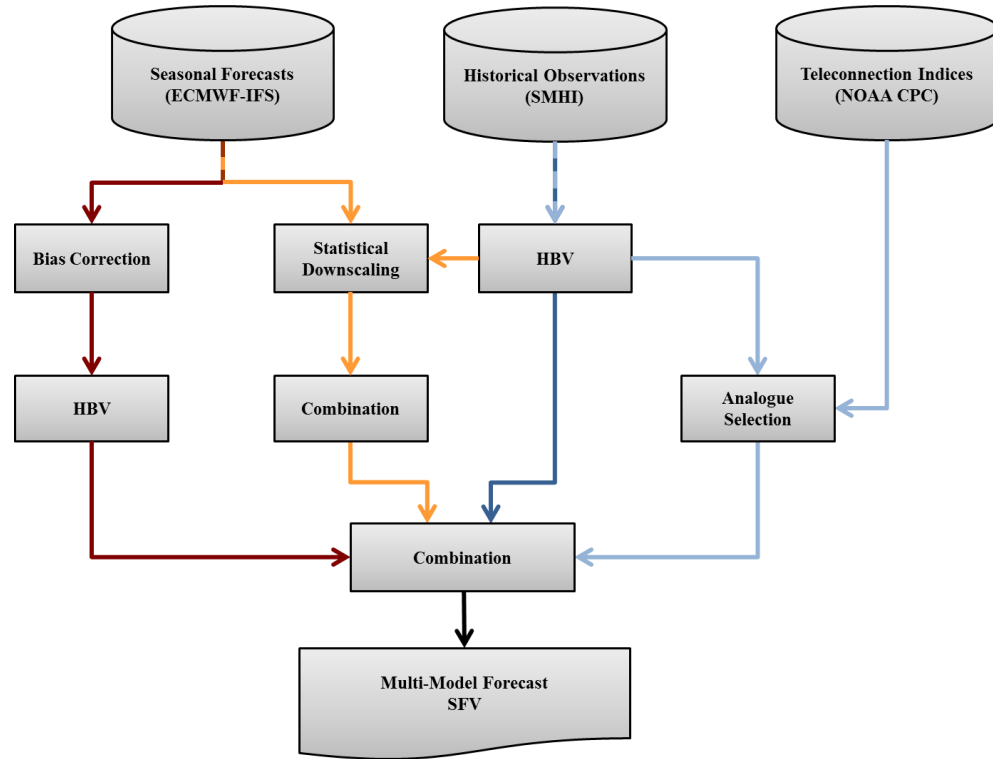
Prognos



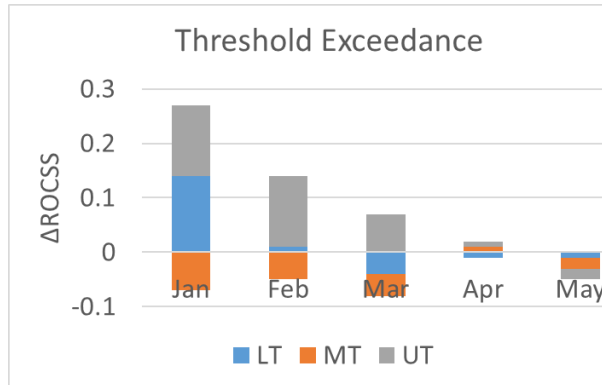
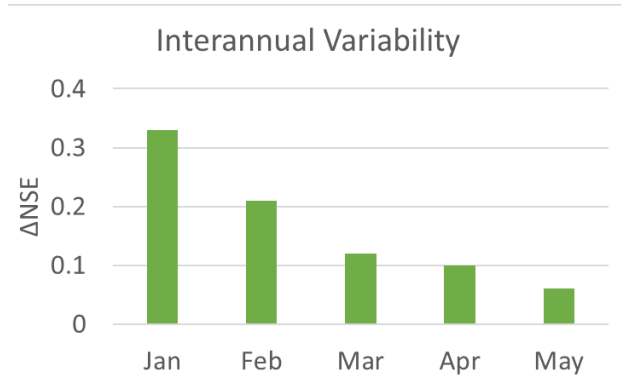
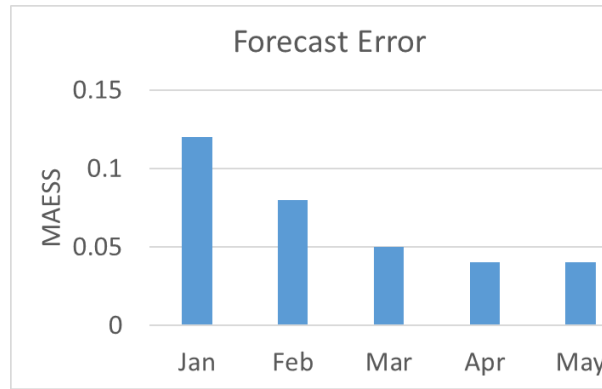
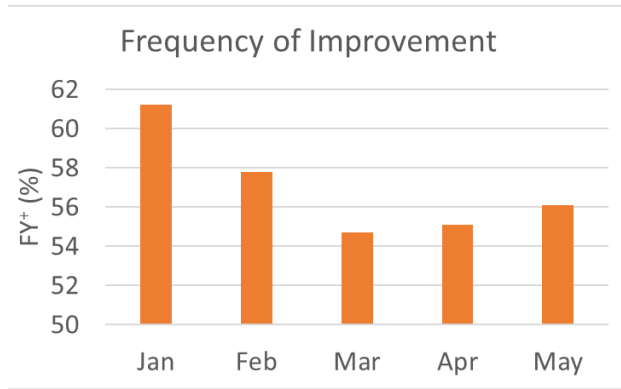
Modellprestanda



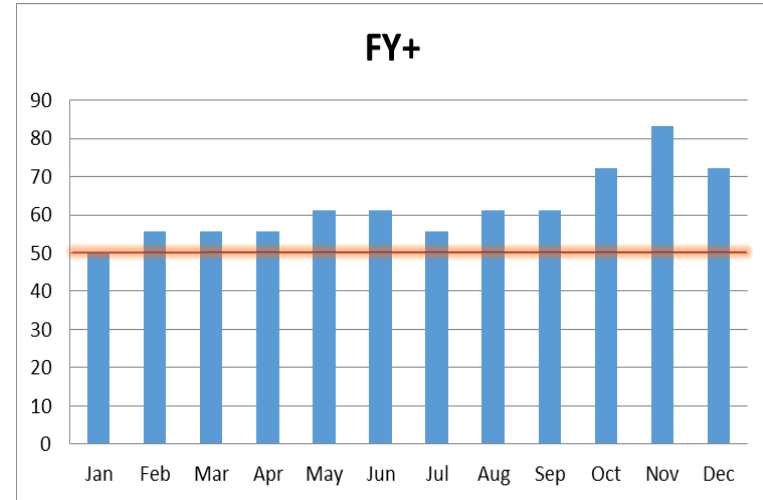
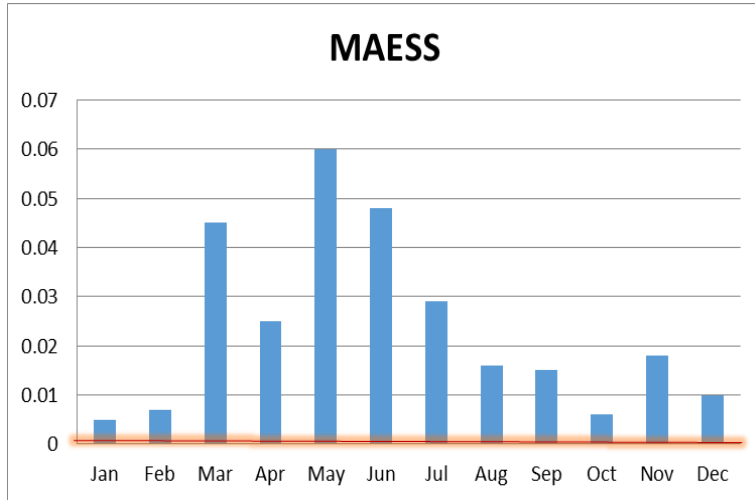
Multimodell



Multimodell resultat



Prognoser året runt – delresultat (Umeälven)



Tillämpningar

Prognoser / scenarioverktyg

- Avrinning
- Vattennivåer
- Grundvattennivåer

Future City Water (LBVA)

- Vattentäkt (AI / ML)
 - Yt- och grundvatten

