

**Recent changes in areal snow
water equivalents in Finland
Esko Kuusisto/SYKE
12.1.2009**

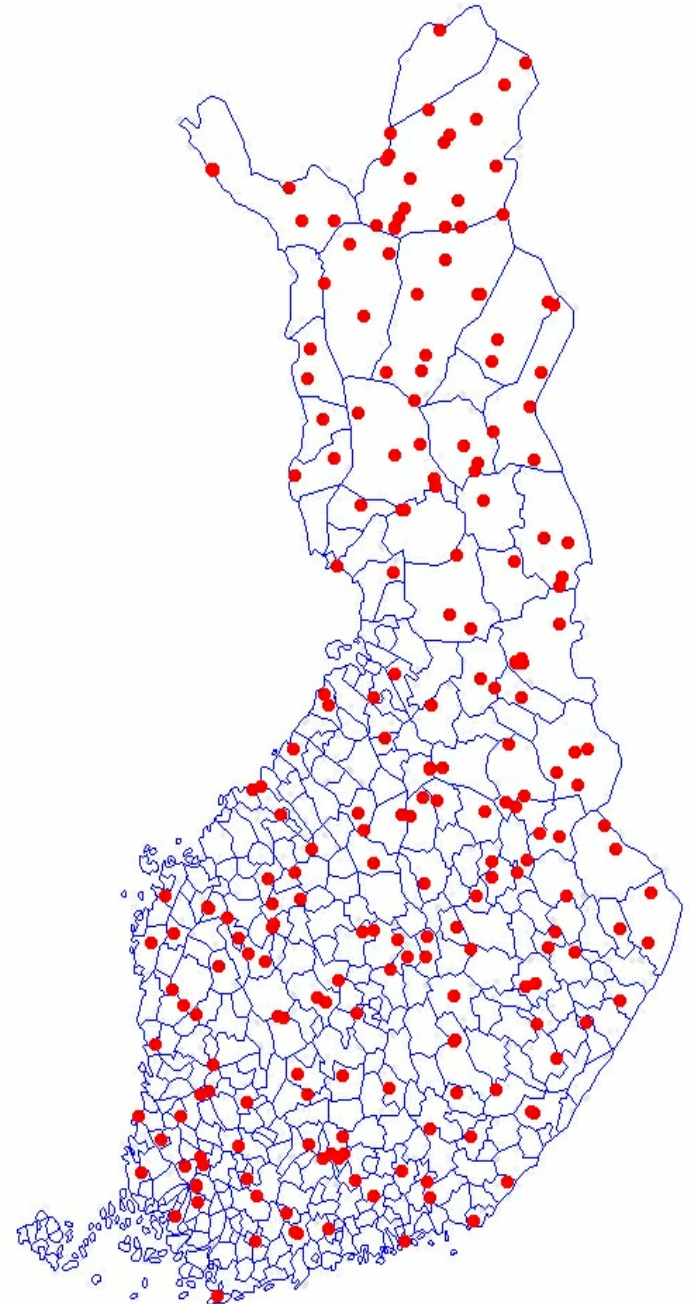


Comparison of precipitation gauges at Vihti, 1980

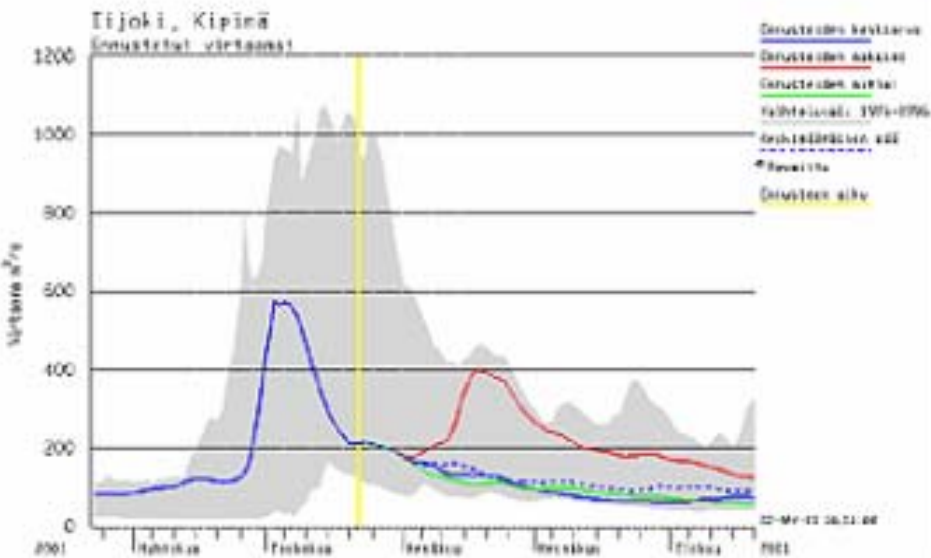


Network of snow courses:

- Around 150 snow courses
- 50 or 80 snow depths, 8 or 10 snow densities
- Water equivalent calculated also separately for forests and open areas
- Results used to calculate water equivalents at grid points (10 x 10 km)
- Grid point values used to calculate areal values for river basins



WATERSHED SIMULATION AND FORECASTING SYSTEM (WSFS)



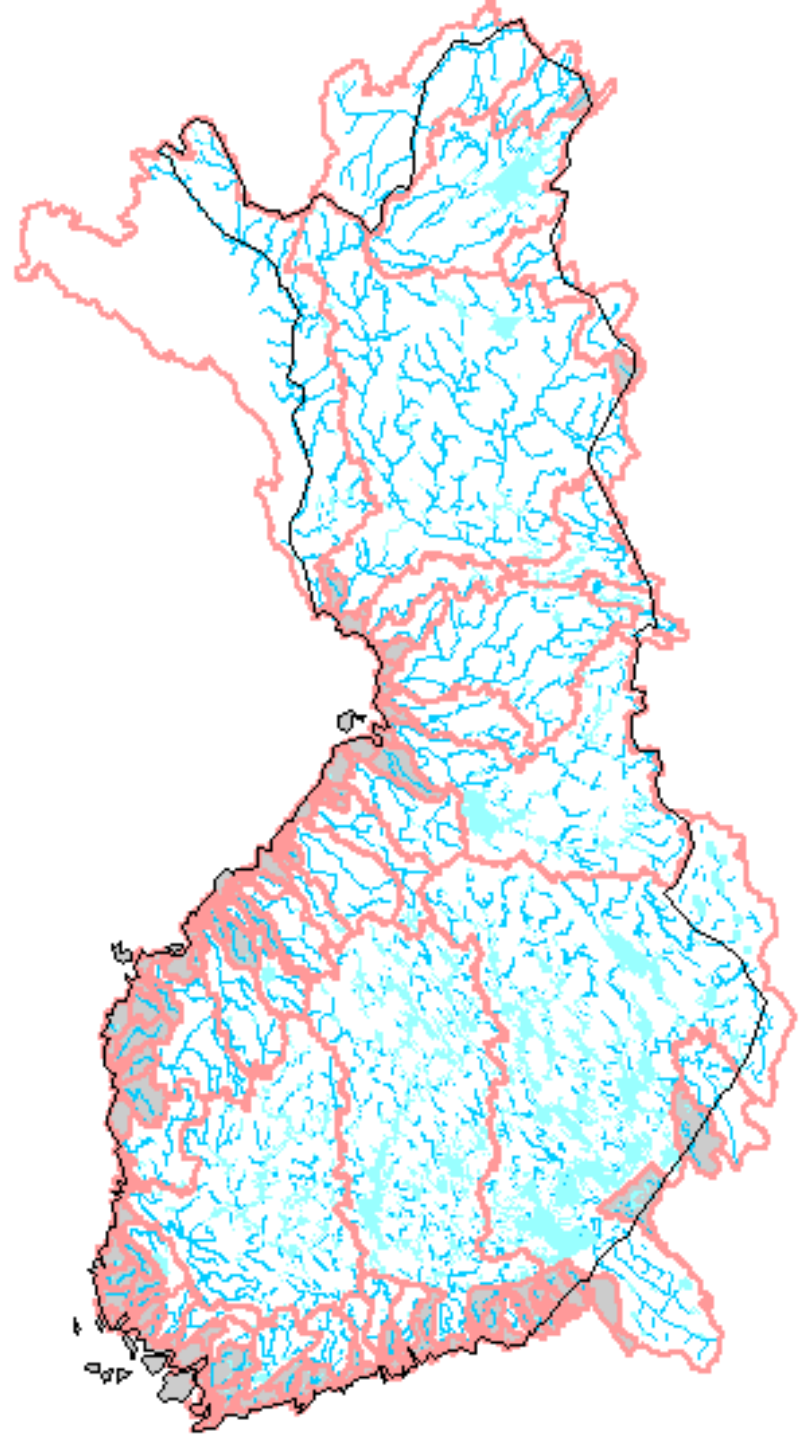
Hydrological Forecasts and Applications

Components and connections:

- Distributed watershed models
 - submodel for snow
- Real time data transfer and local data bank
- Updating procedures for simulation accuracy
- GIS: elevation model, land use, vegetation cover
- Hydrological data bank
- Meteorological data bank FMI
- Satellite and weather radar/FMI data
- Meteorological forecasts ECMWF and FMI
- WWW-user interface

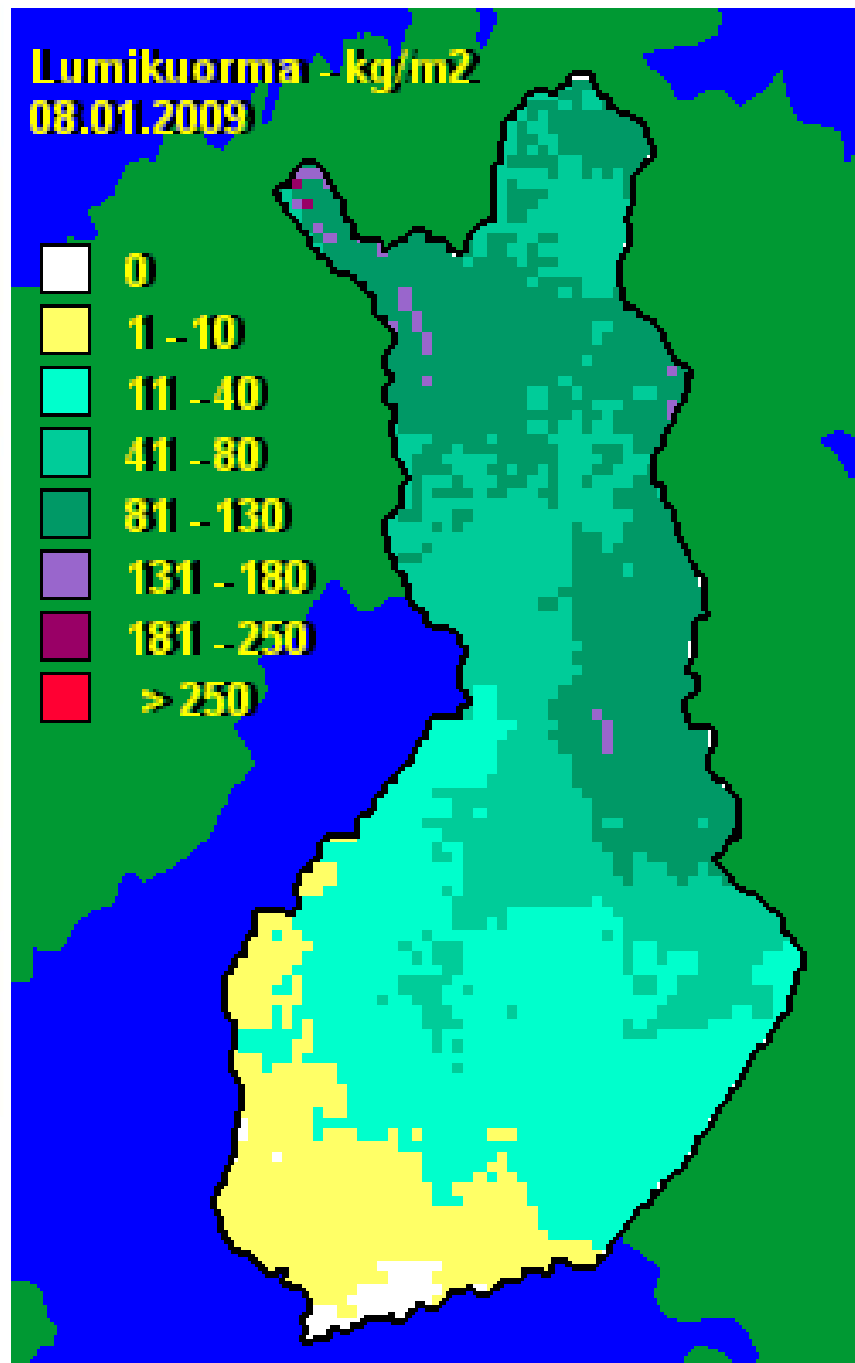
WSFS coverage and operational use:

- Watershed models cover the whole country
 - 5700 small subbasins
- Forecasts are made daily for 300 discharge and water level observation points
- Forecasts are used for regulation, flood damage prevention and general information

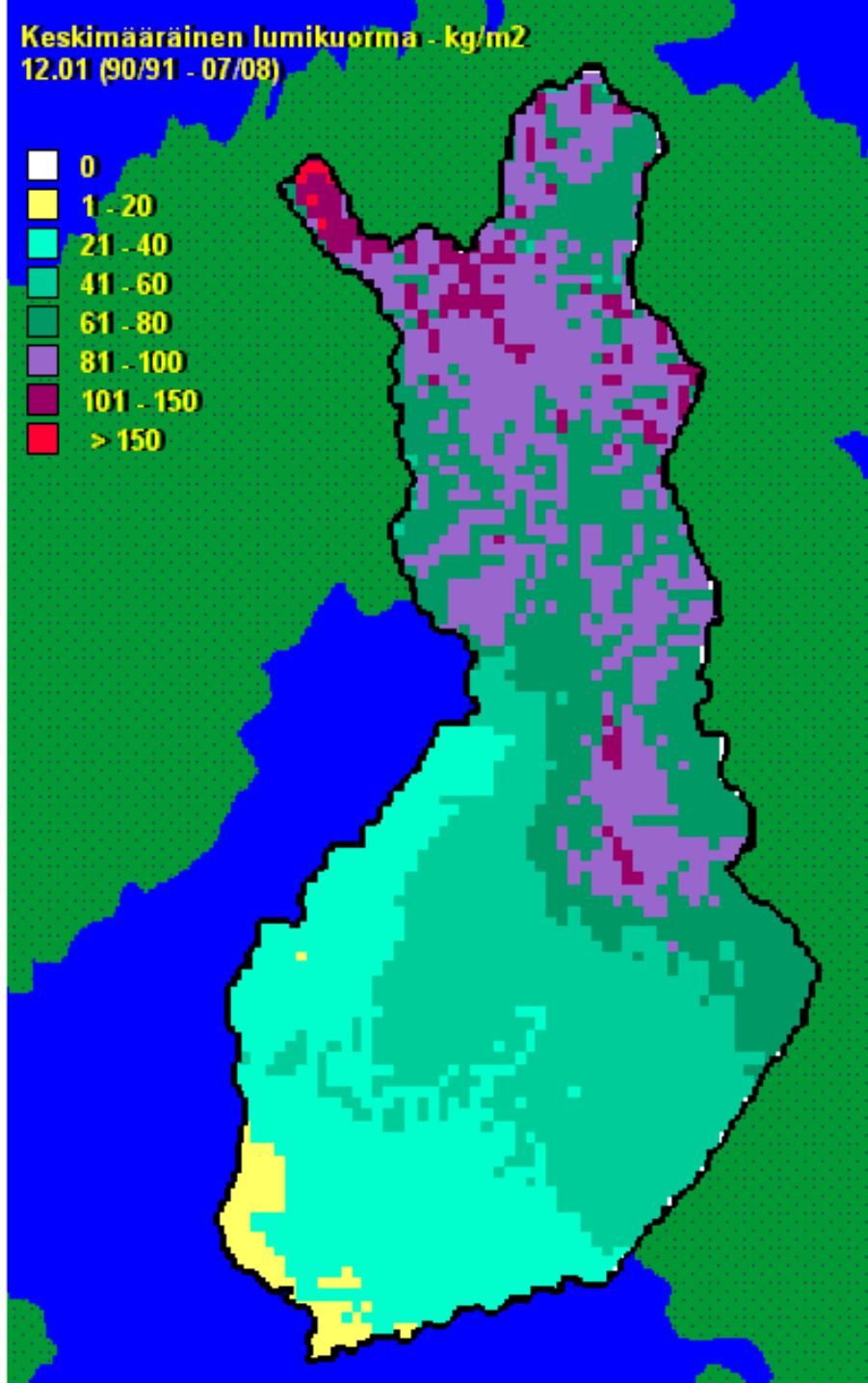
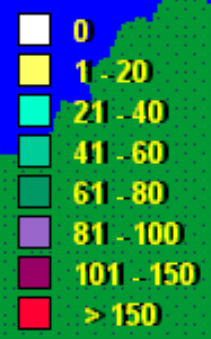




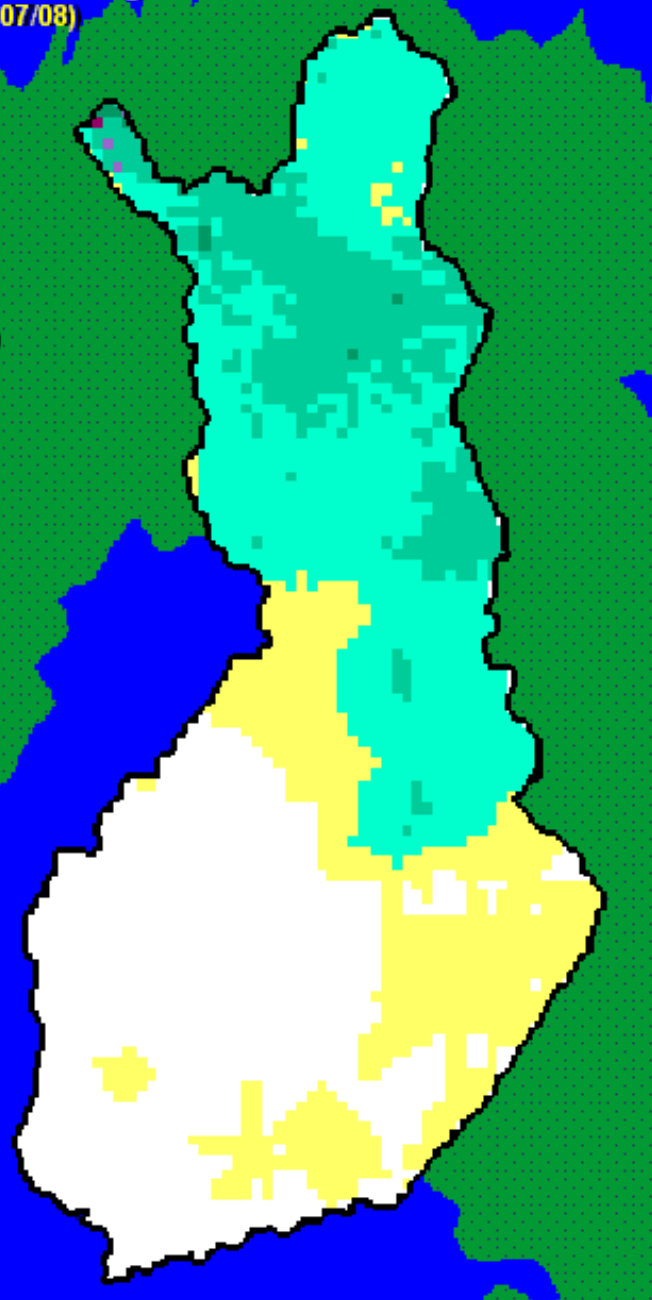
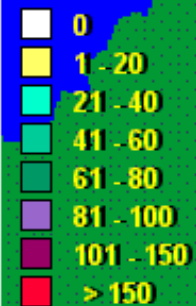
Lumen vesiarvo (mm eli kg/m^2) 8. 1.2009
 Forecast day 8. 1.
 Snow water equivalent (mm) 8. 1.2009



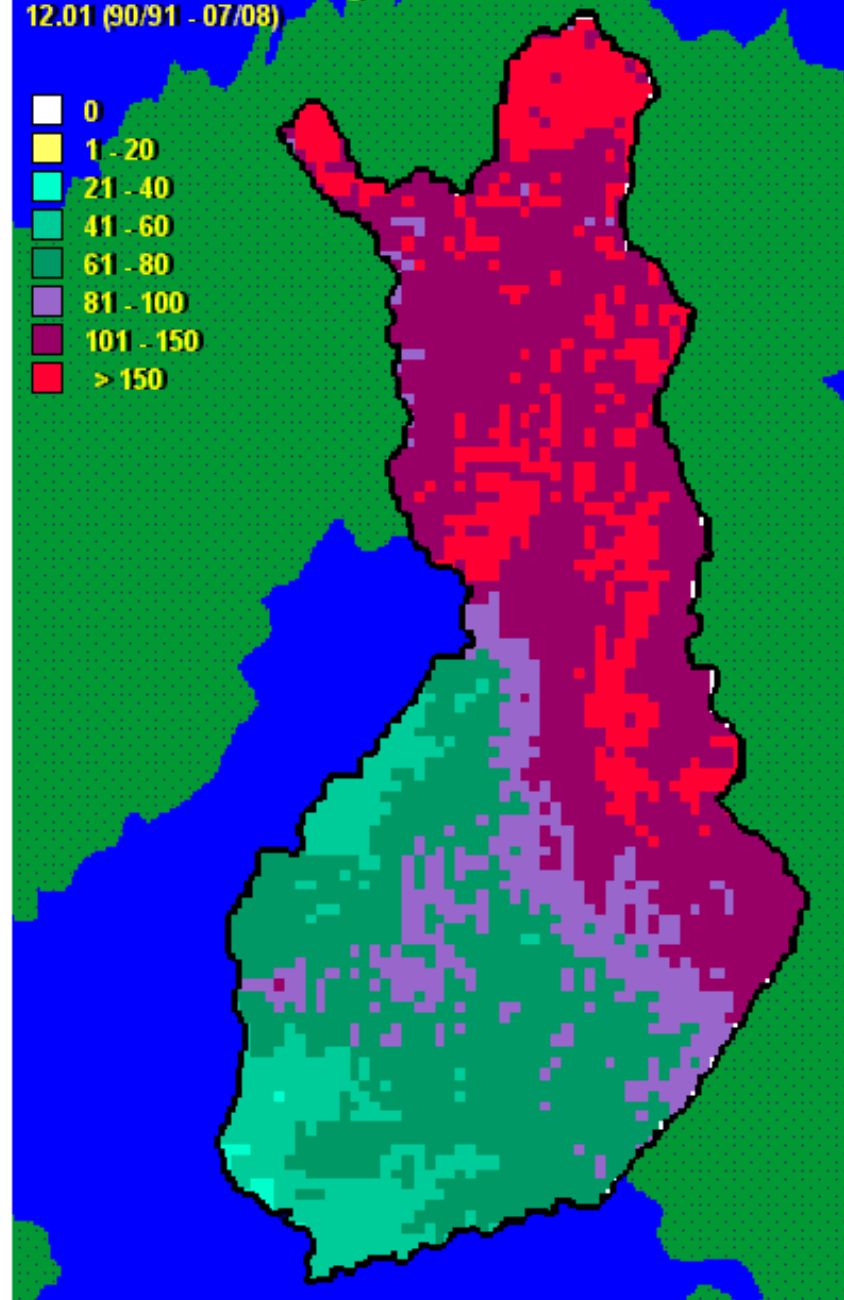
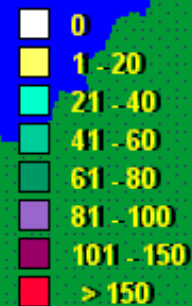
Keskimääräinen lumikuorma - kg/m²
12.01 (90/91 - 07/08)



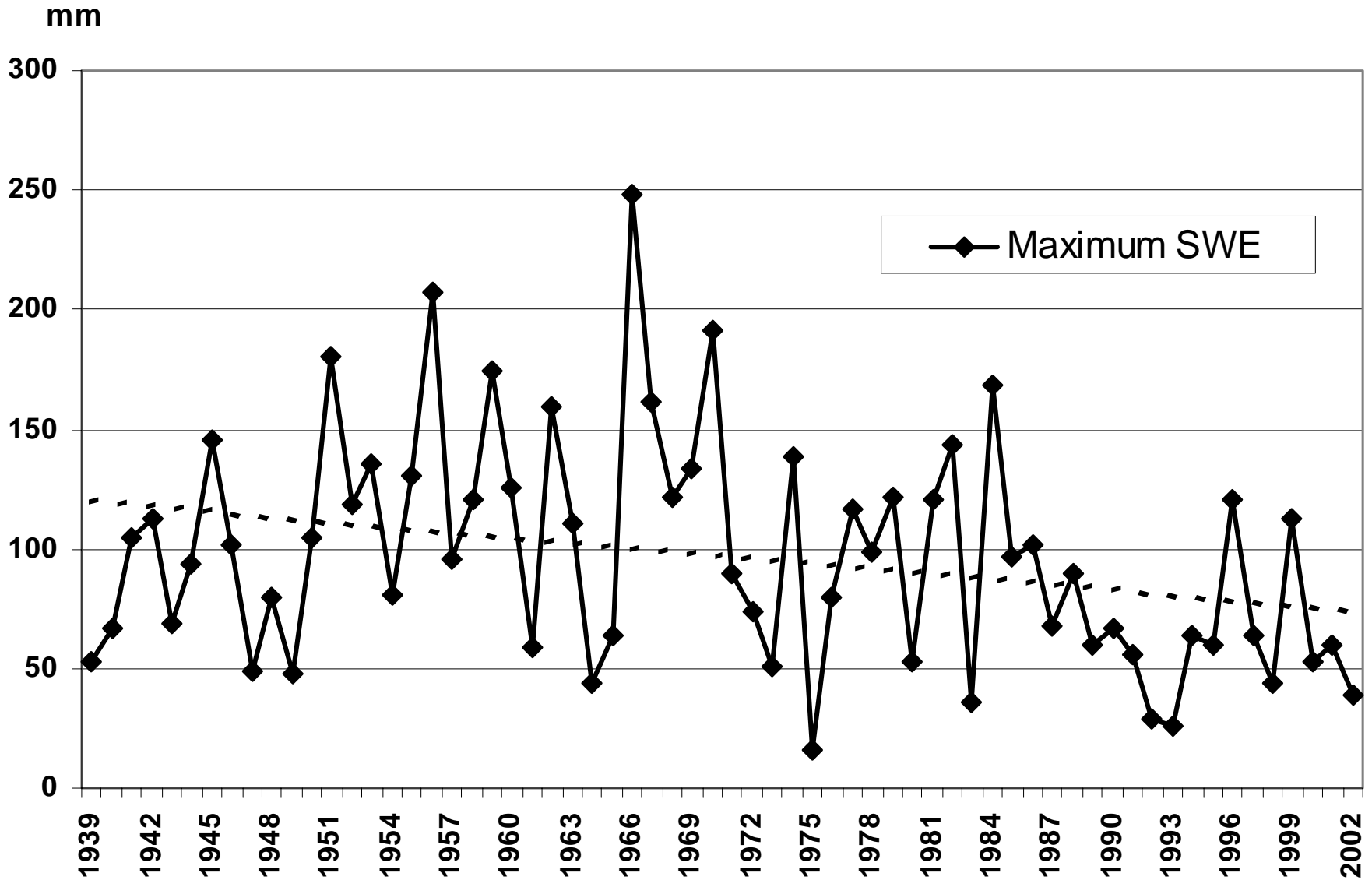
Minimi lumikuorma - kg/m²
12.01 (90/91 - 07/08)



Maksimi lumikuorma - kg/m²
12.01 (90/91 - 07/08)

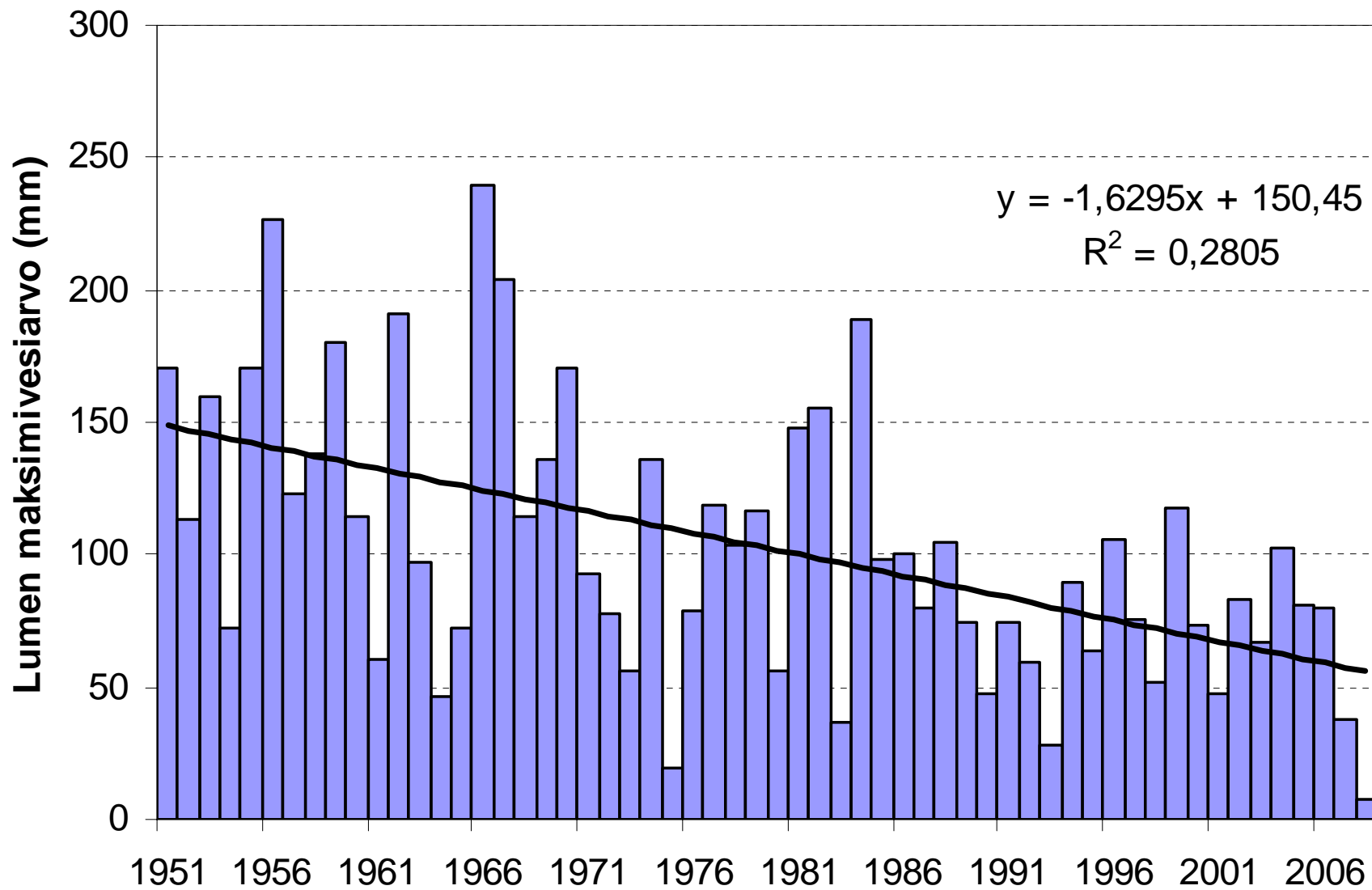


Hovi snow course, Vihti, Southern Finland:



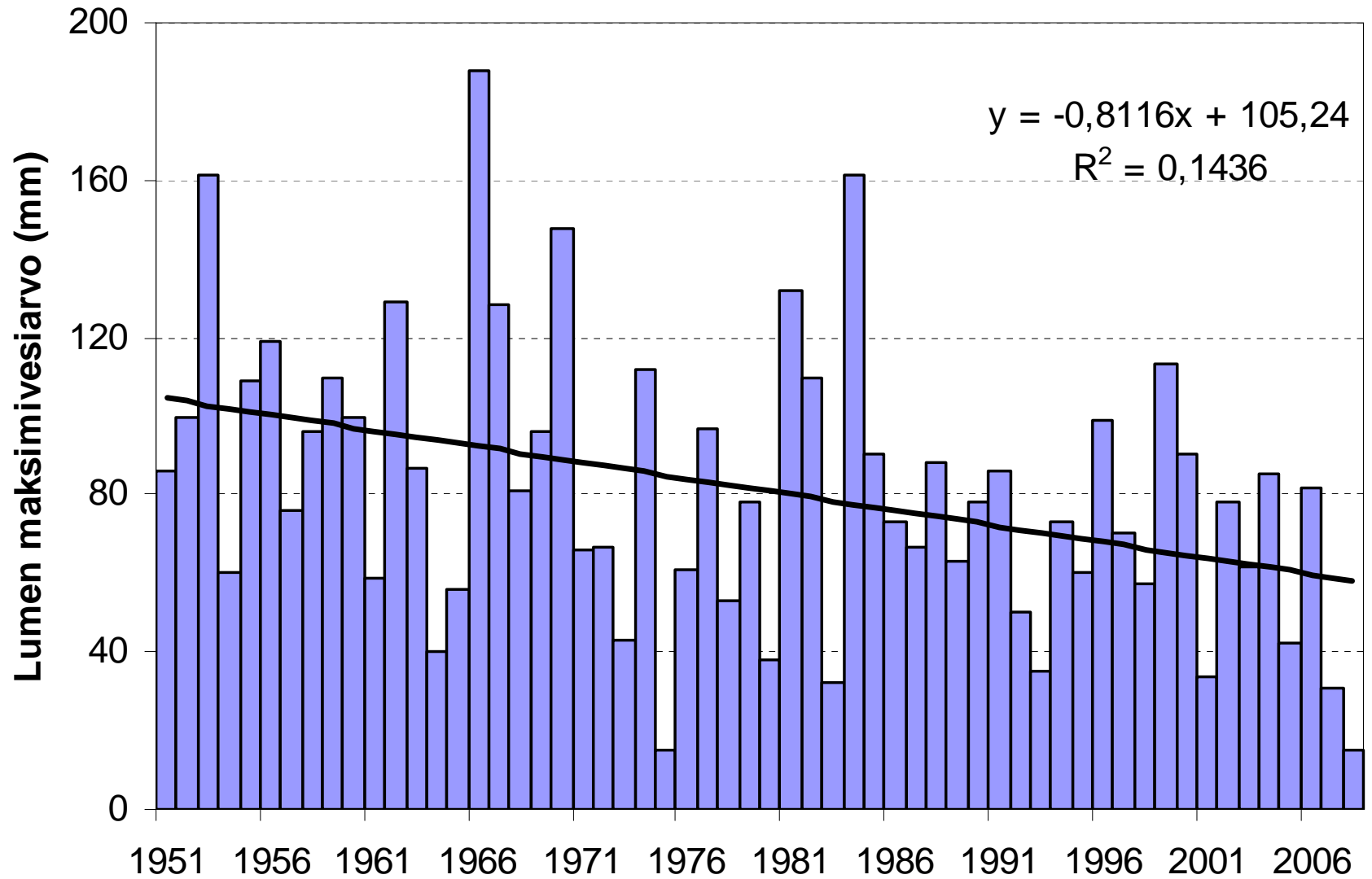
Vantaanjoki

99.9%



Loimijoki

99%

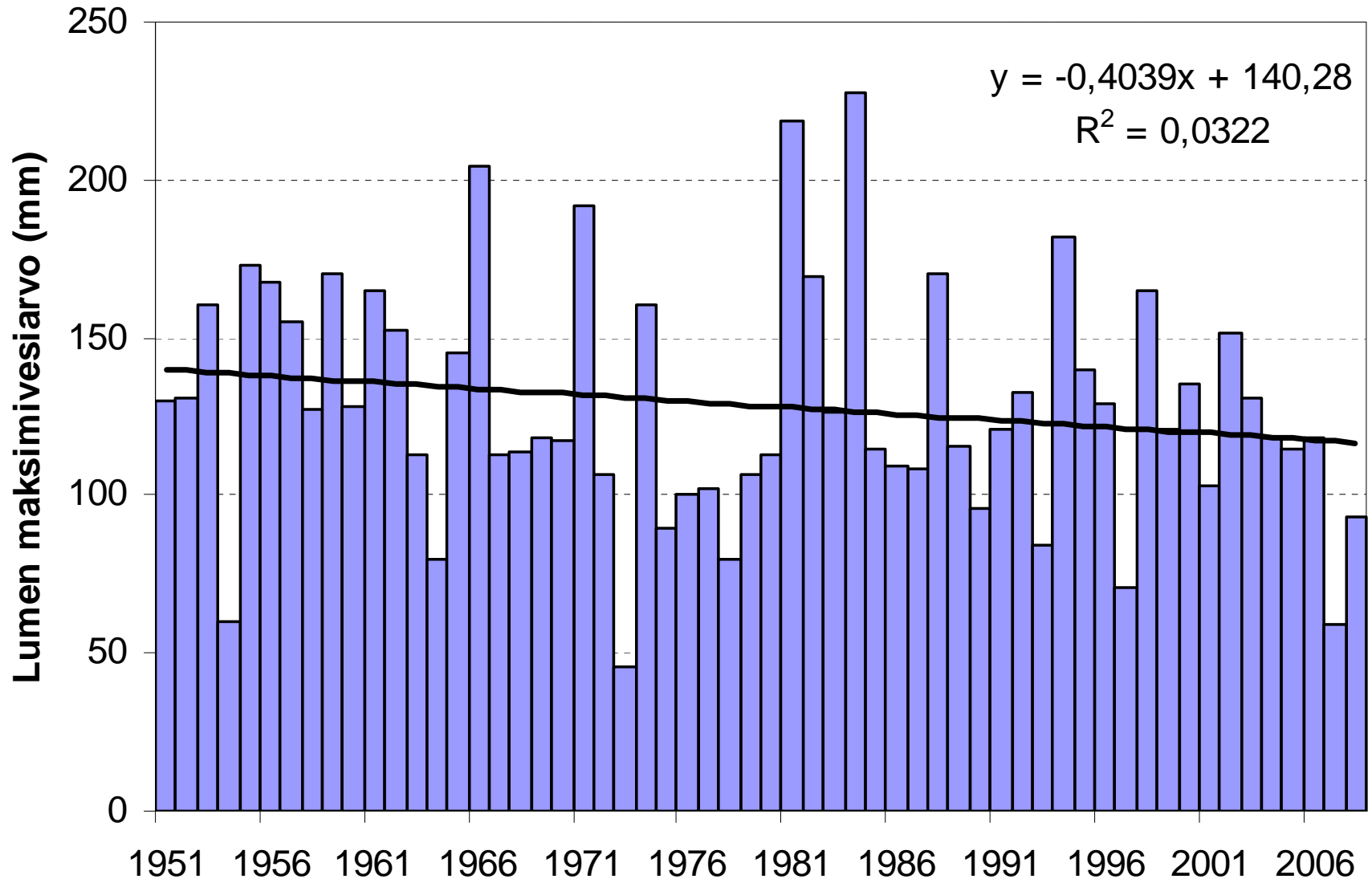


Southern Finland:

Drainage basin	1961- 1990	1991- 2000	Δ (%)	2001- 2008	Δ (%)
Luumäki, Jyrääkoski	123	123	-0	104	-16
Vantaanjoki	109	74	-22	63	-42
Aurajoki	86	69	-20	47	-30
Ahvenanmaa, (model)	80	51	-36	55	-31
Loimijoki	85	68	-20	54	-37
Vanajavesi	100	77	-23	65	-35

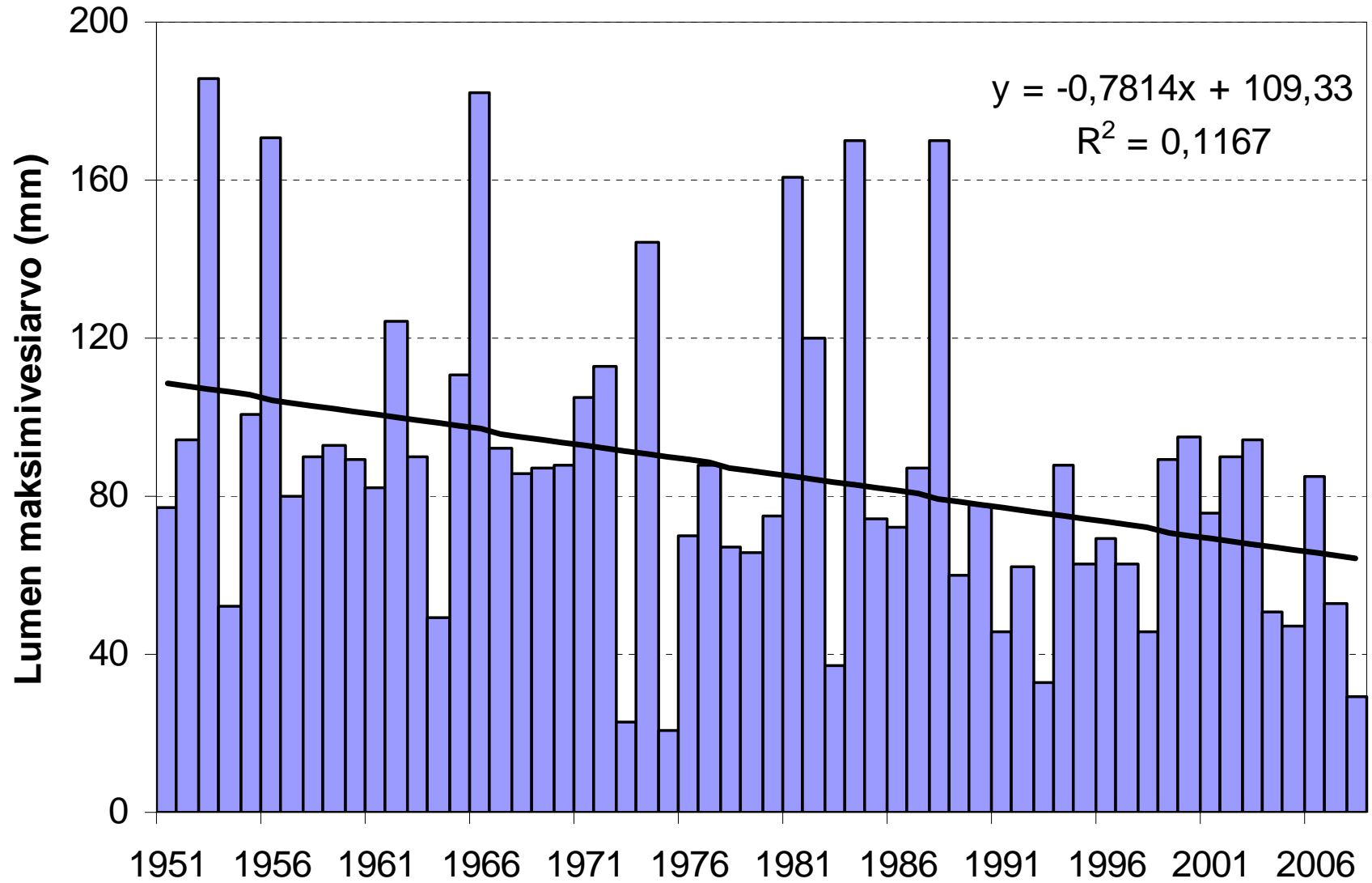
6.2.2009

Saimaa lähialueineen



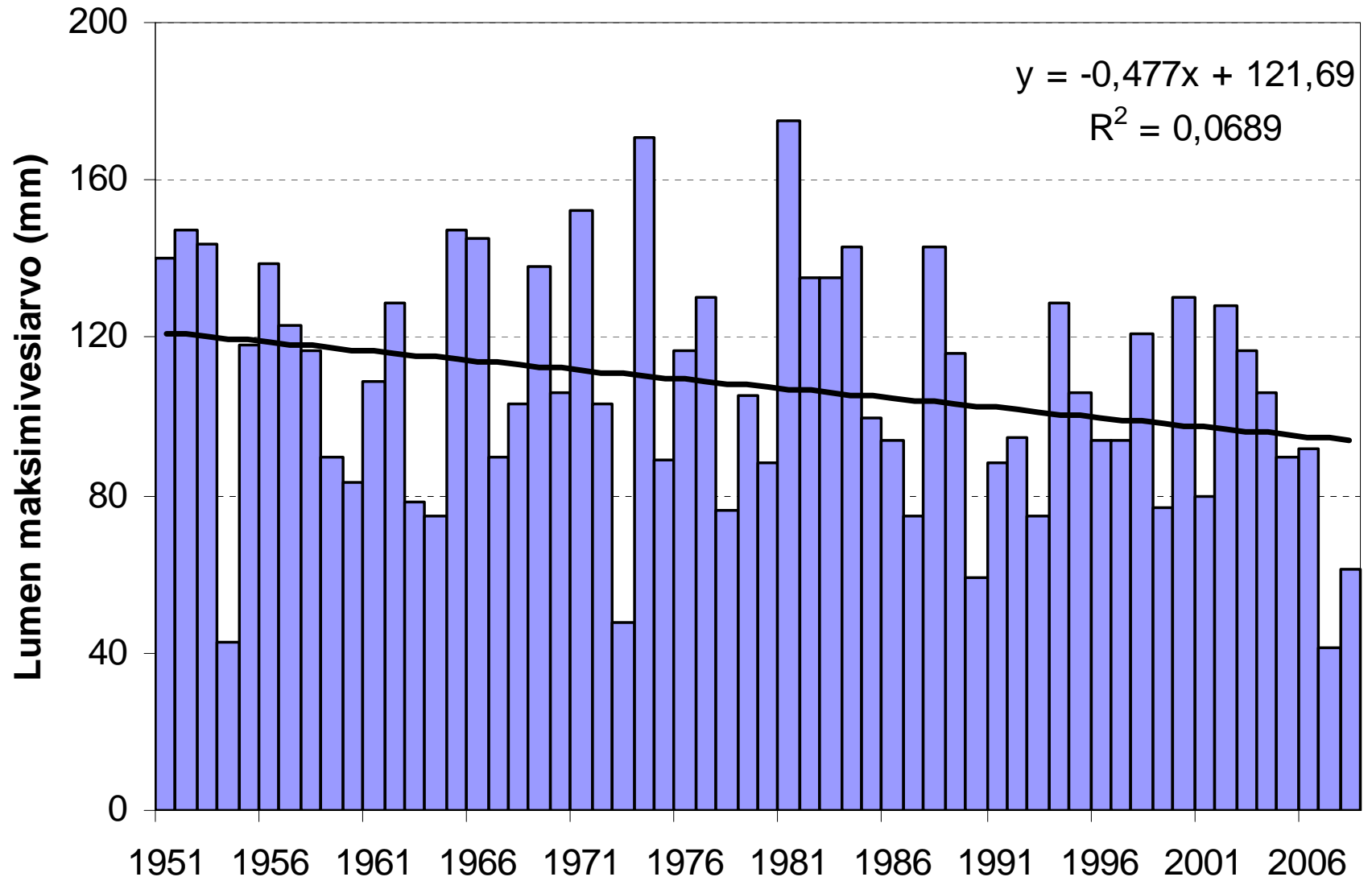
Kyrönjoki

99%



Kalajoki

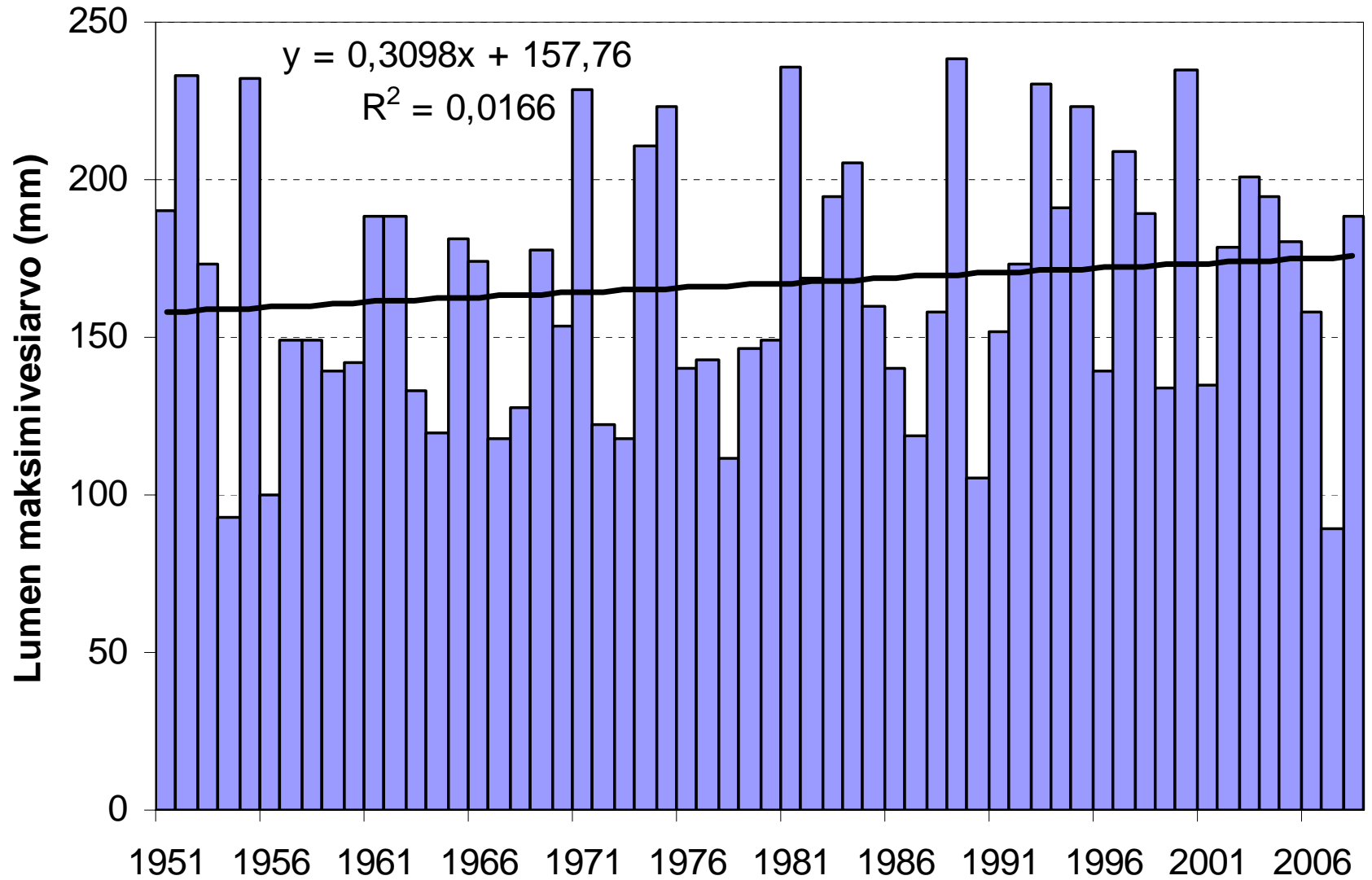
95%



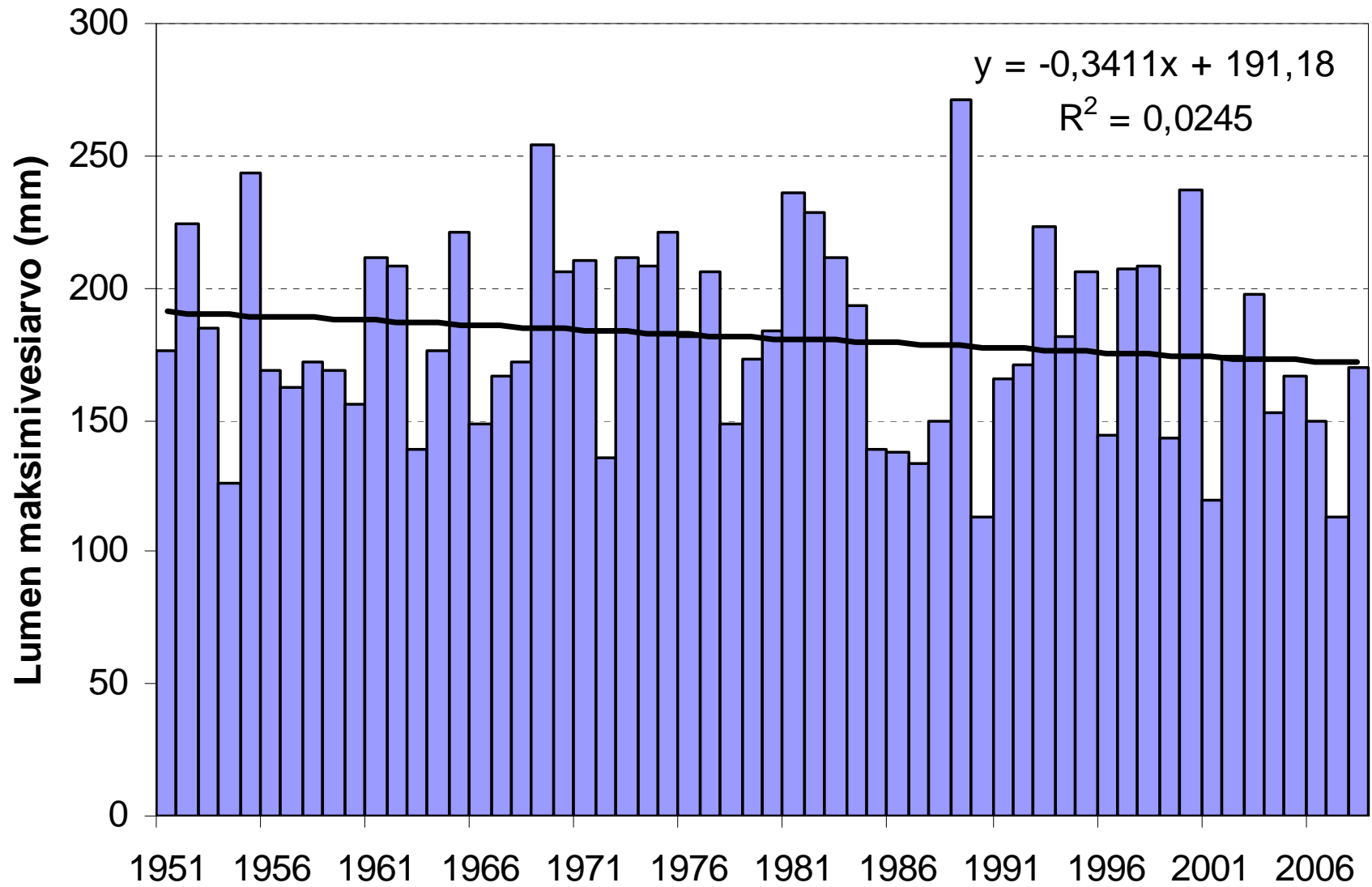
Central Finland:

Drainage basin	1961- 1990	1991- 2000	Δ (%)	2001- 2008	Δ (%)
Saimaan lähialue	129	129	-0	111	-14
Pielisen lähialue	164	179	+9	160	-3
Kallaveden reitti	146	155	+6	136	-7
Päijänteiden lähialue	119	103	-13	90	-24
Kyrönjoki	92	74	-20	66	-29
Kalajoki	113	97	-14	89	-21

Sotkamon reitti



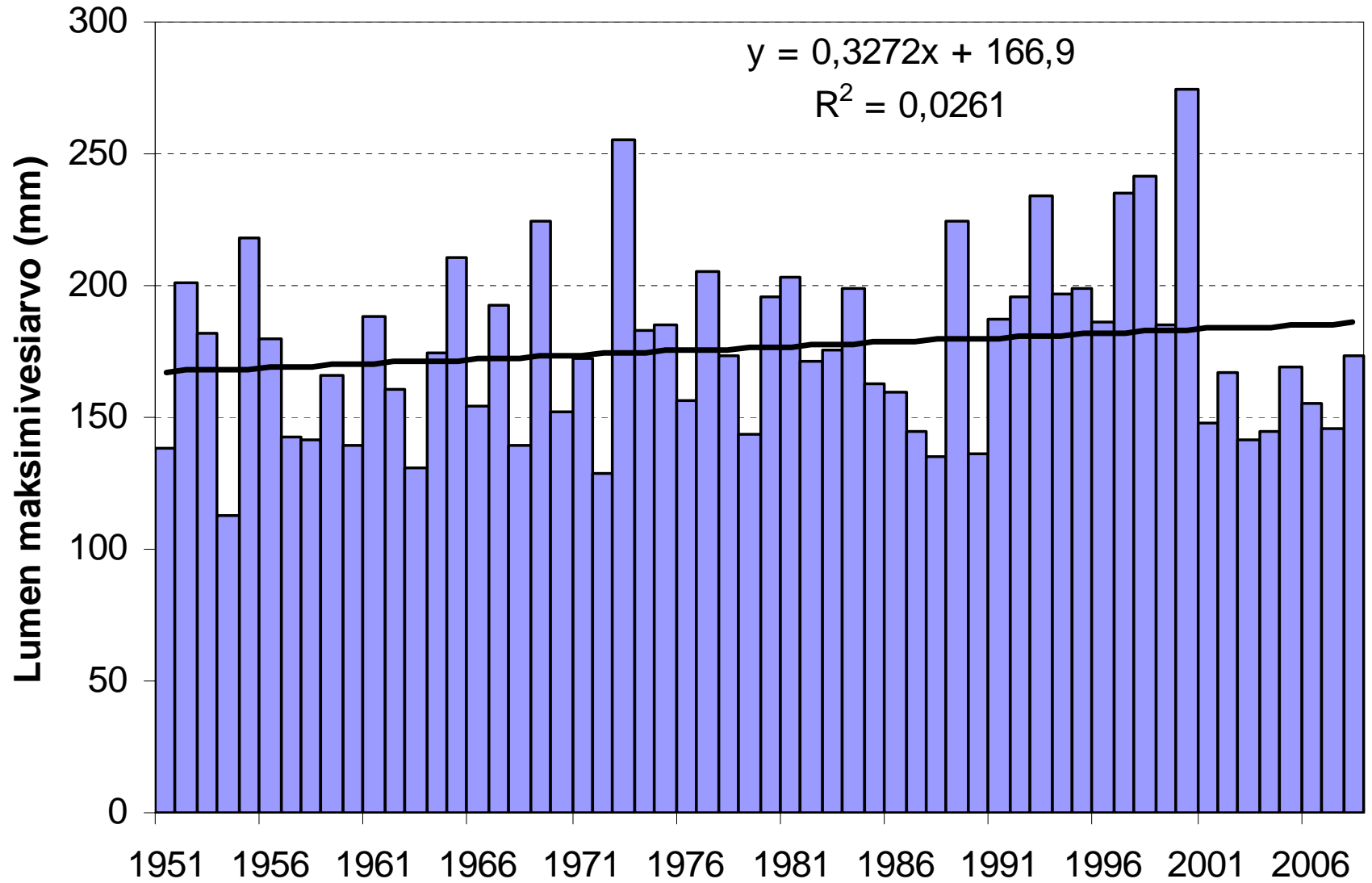
Iijoki



Oulu province:

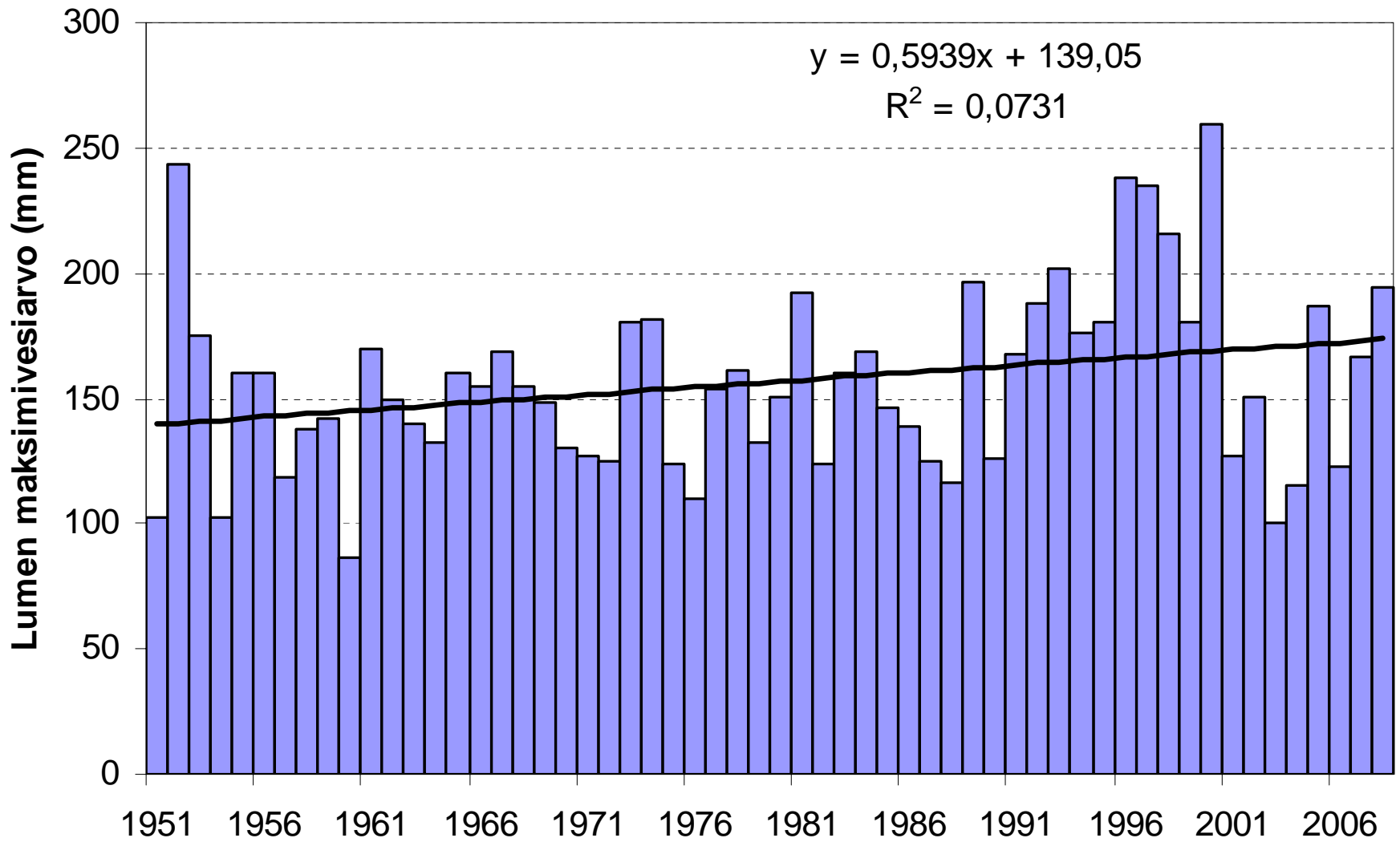
Drainage basin	1961- 1990	1991- 2000	Δ (%)	2001- 2008	Δ (%)
Sotkamon reitti	158	183	+16	176	+11
Hyrynsalmen reitti	177	206	+16	173	-2
Siikajoki	132	130	-1	102	-23
Oulujokivarsi	143	132	-8	110	-23
Iijoki	186	190	+2	155	-17
Kuusamo, Muojärven alue	181	192	+6	147	-19

Kemijoki



Inari

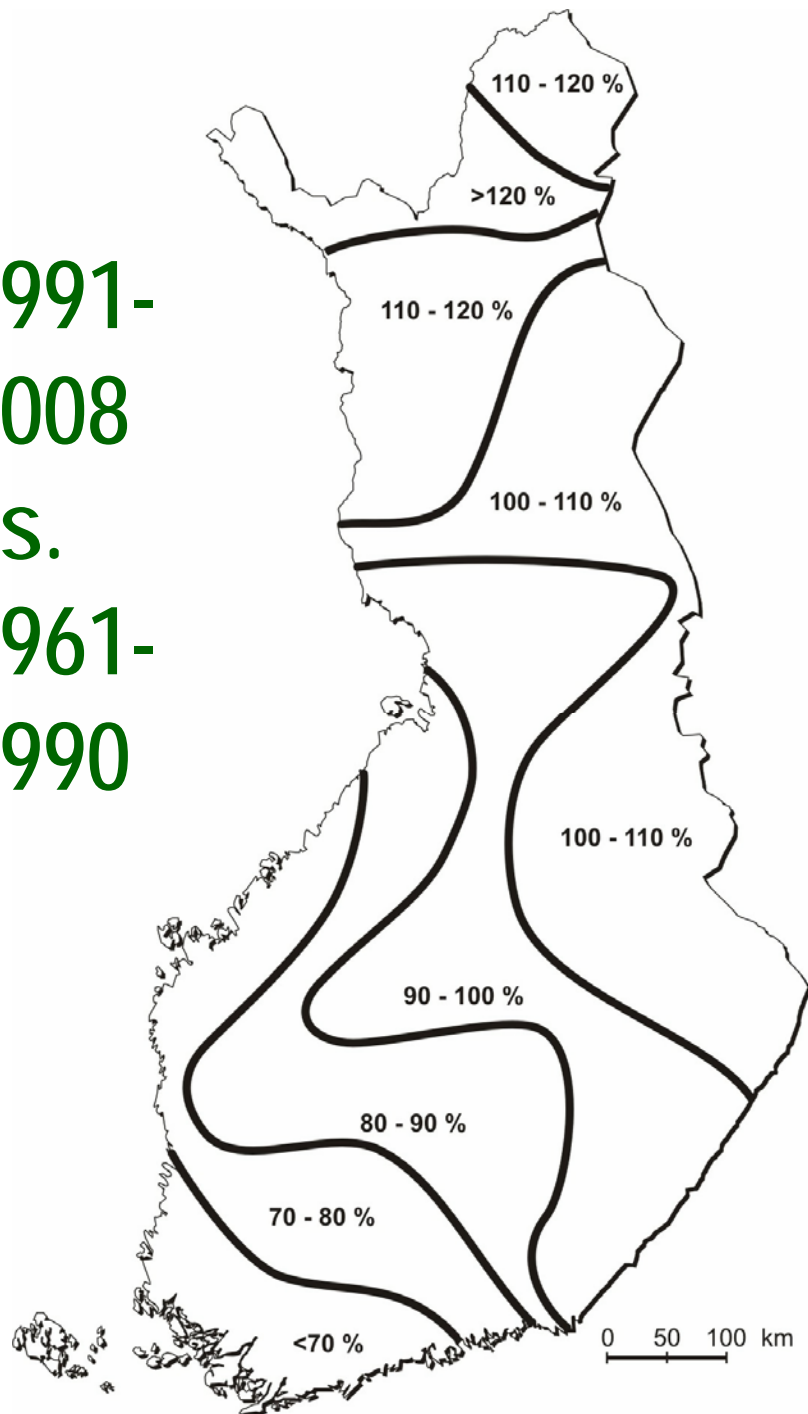
95%



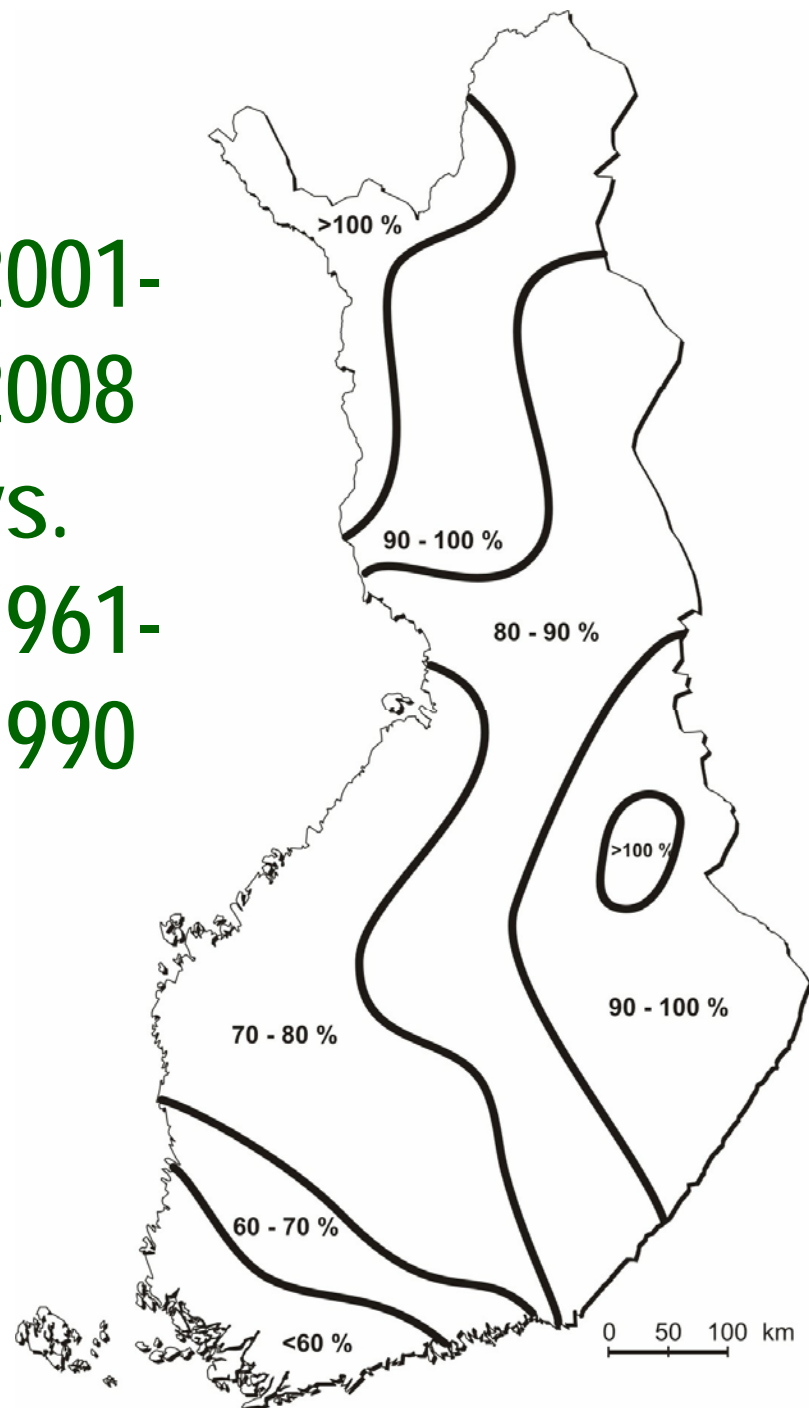
Lappi province:

Drainage basin	1961- 1990	1991- 2000	Δ (%)	2001- 2008	Δ (%)
Kemijoki, Itä-Lappi	183	226	+24	158	-14
Kemijoki, suuosa	184	193	+5	173	-17
Tornionjoki, Tengeliönjoki	155	179	+15	158	+2
Ounasjoki, yläosa	168	201	+19	165	-2
Inarin lähialueet	139	189	+36	134	-4
Kilpisjärven alue (model)	185	270	+46	188	+1

1991-
2008
VS.
1961-
1990



2001-
2008
VS.
1961-
1990



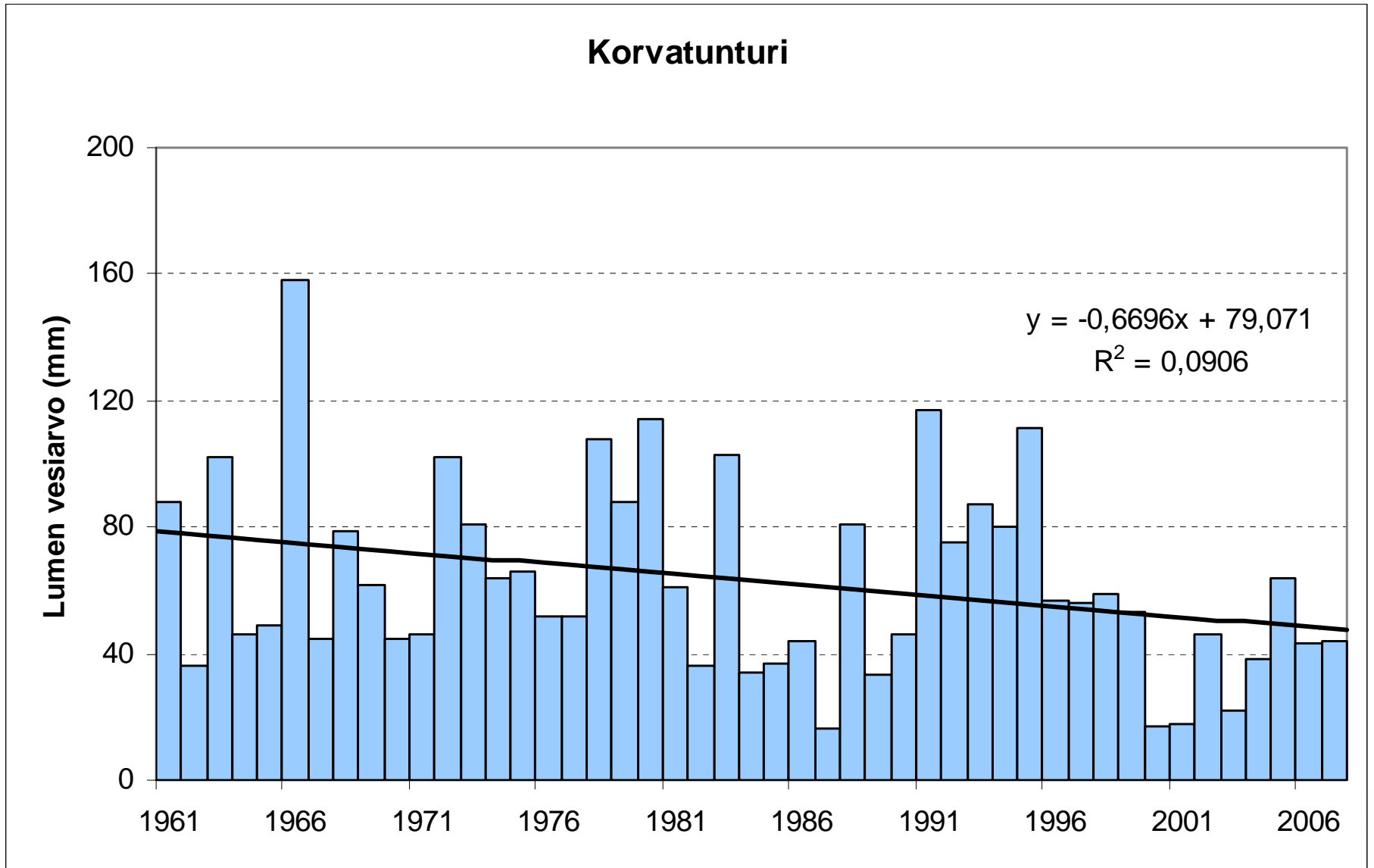
Average date of max. water equivalent:

	1962- 1990	1991- 2008
Åland	March 13	March 2
Kilpisjärvi	May 5	April 26

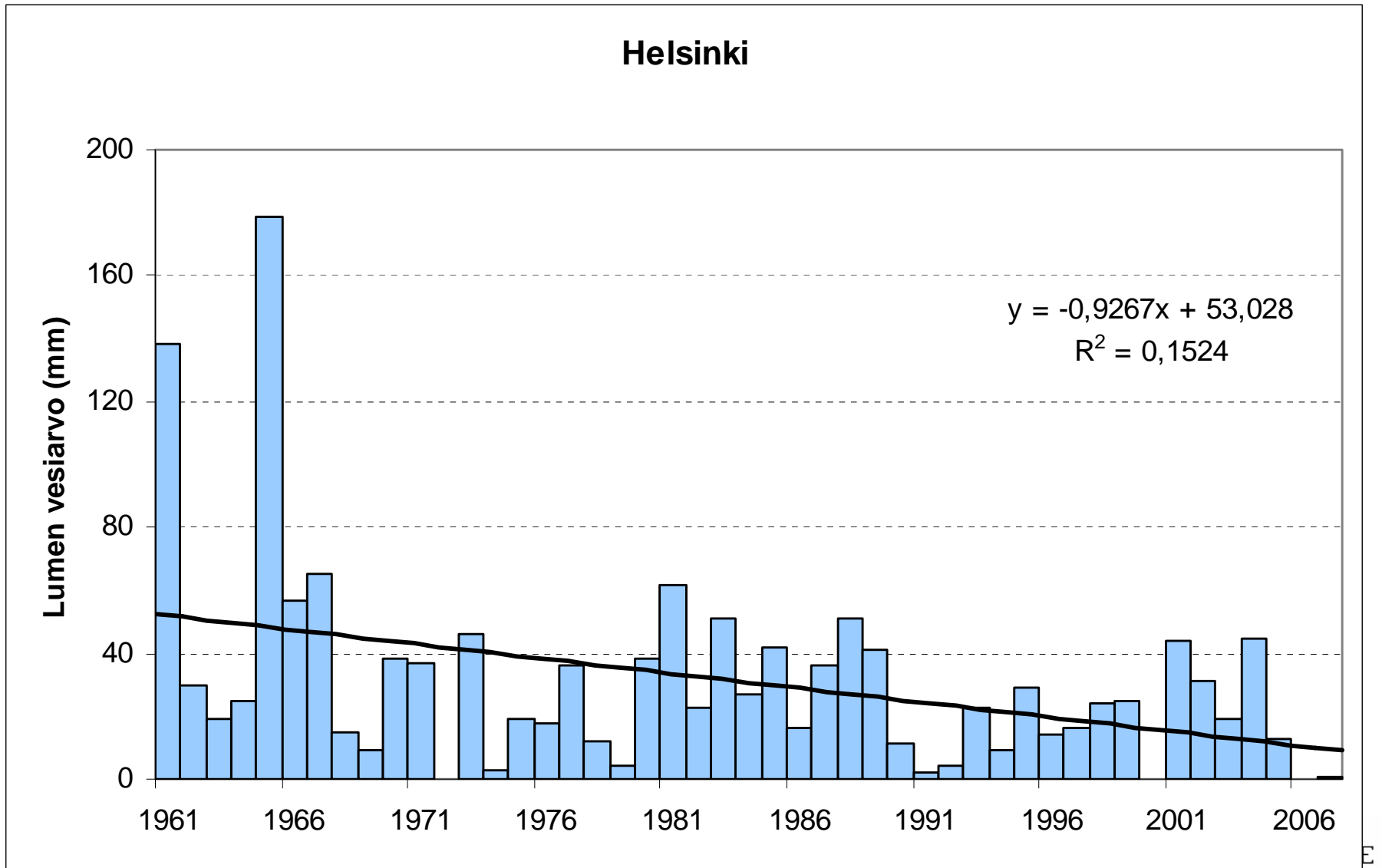


Typical winter
in southern Finland???

Water equivalent on Christmas Eve, Lapland:



Water equivalent on Christmas Eve, Helsinki:



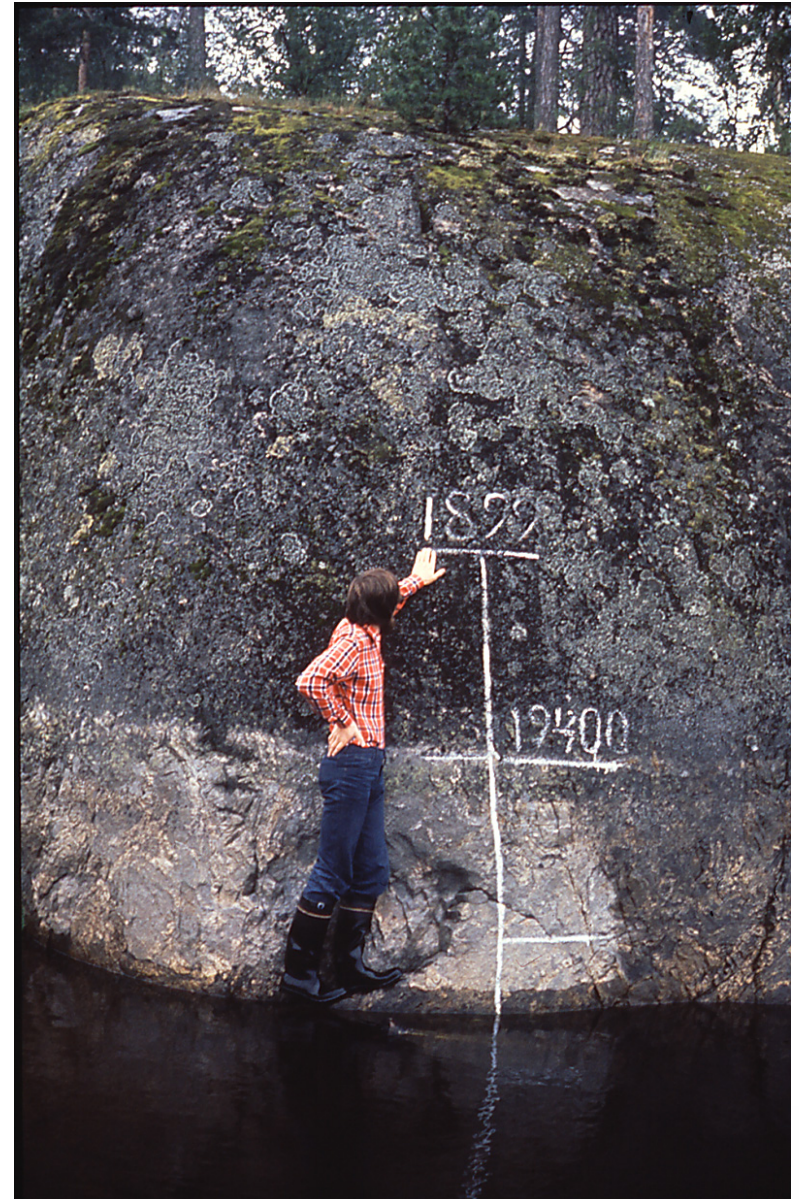
Average dates of the arrival of the 'permanent' snow cover:

	1962- 2000	2001- 2008
Helsinki	Nov 22	Dec 8
Korvatunturi	Oct 18	Nov 4



The flood of the Broken Oath, 1899

- particularly in Vuoksi, Kymijoki and Kokemäenjoki basins
- up to two meters of snow in winter; late melting season
- high rainfall in May
- water level in many lakes 1.5-2.5 metres above normal



Positive proof of global warming.



**18th
Century**

1900

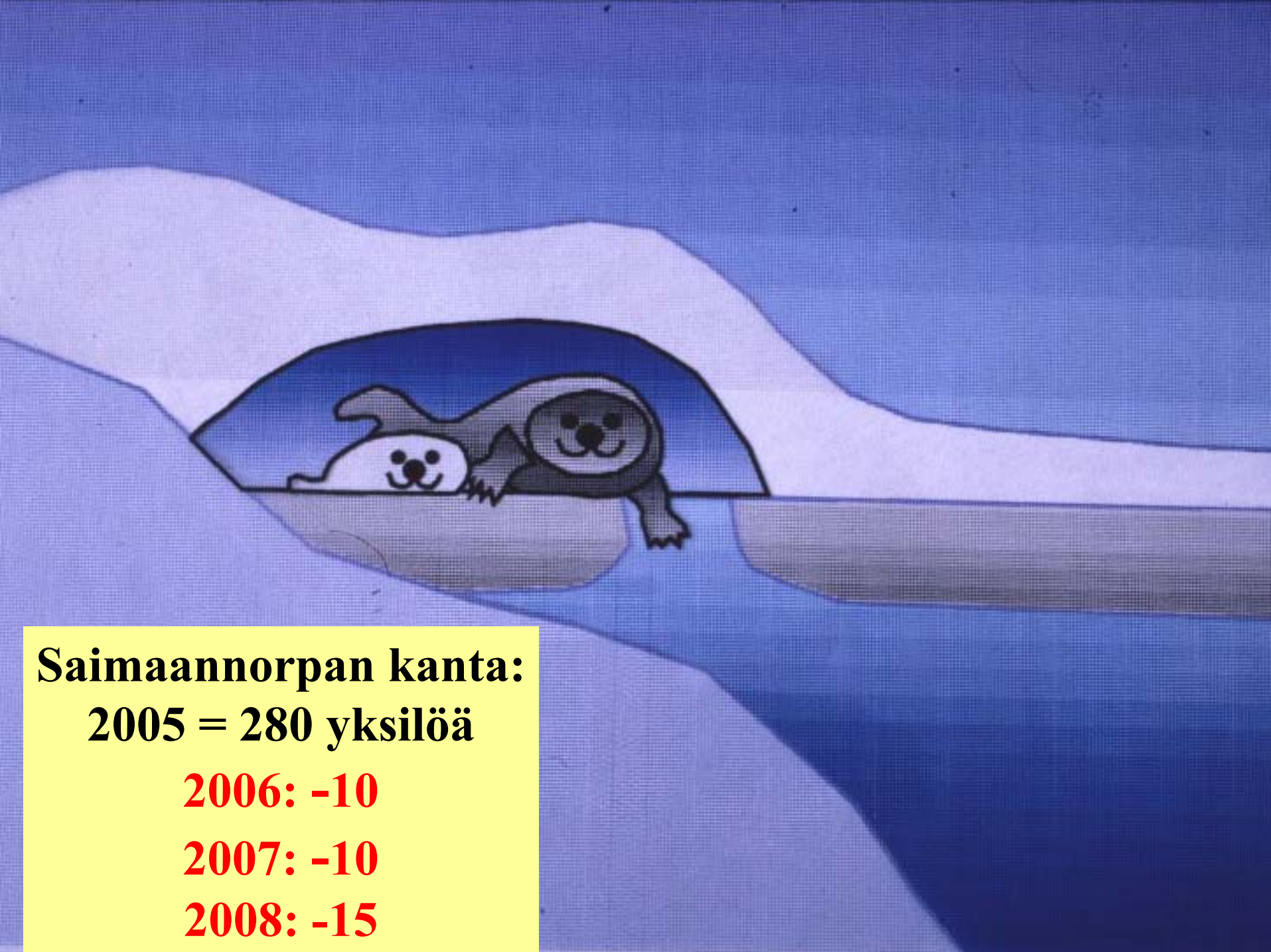
1950

1970

1980

1990





Saimaannorpan kanta:

2005 = 280 yksilöä

2006: -10

2007: -10

2008: -15





KIITOS!

