



Snow Measurement Activities and Facilities in Turkey

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COST ES1404 Meeting

3-4 November 2015, Helsinki

Republic of Turkey



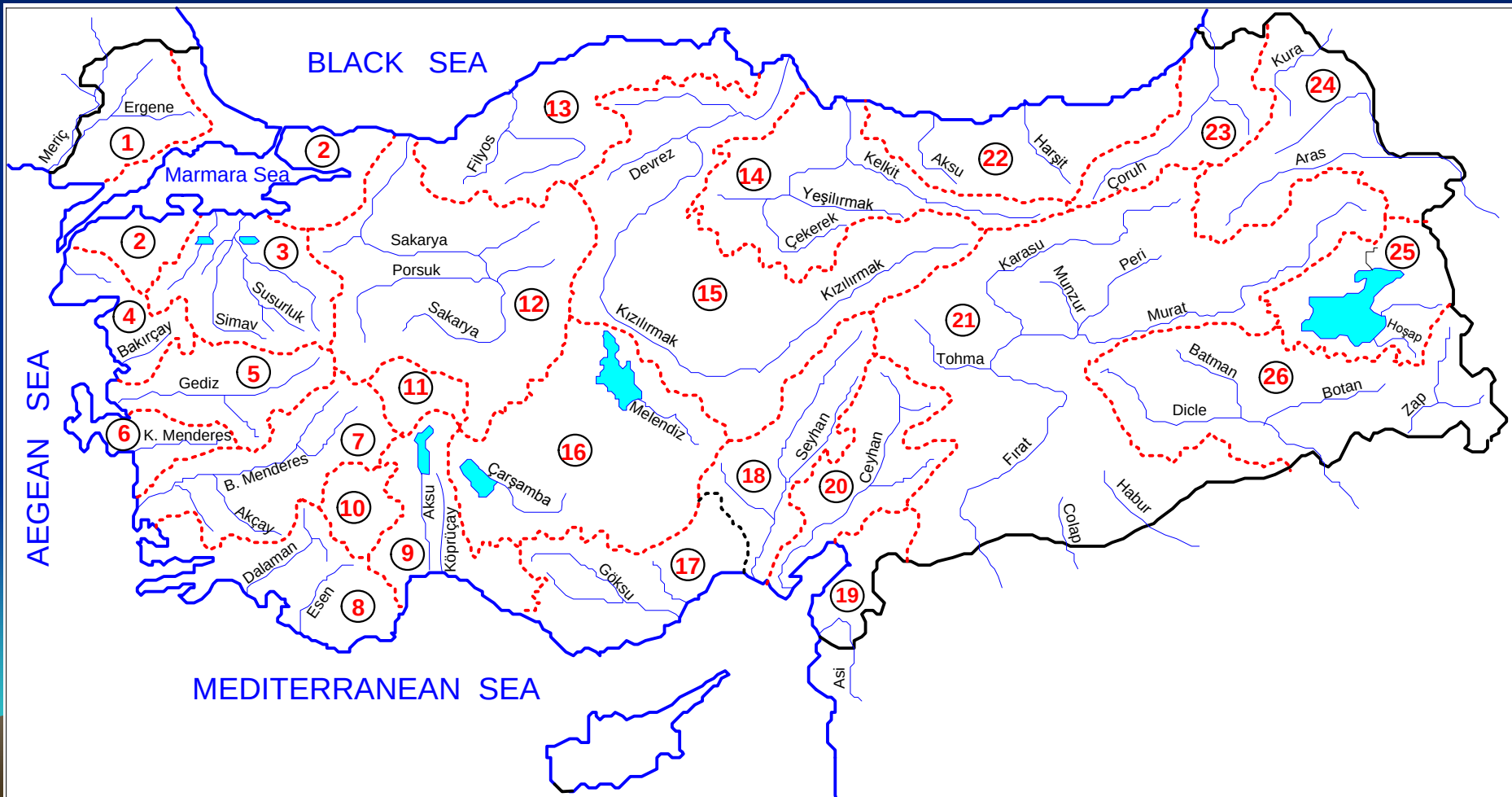
TURKEY bridges Europe and Asia continents

Area: 770,000 km²

Population: 77 million

Catchments in Turkey

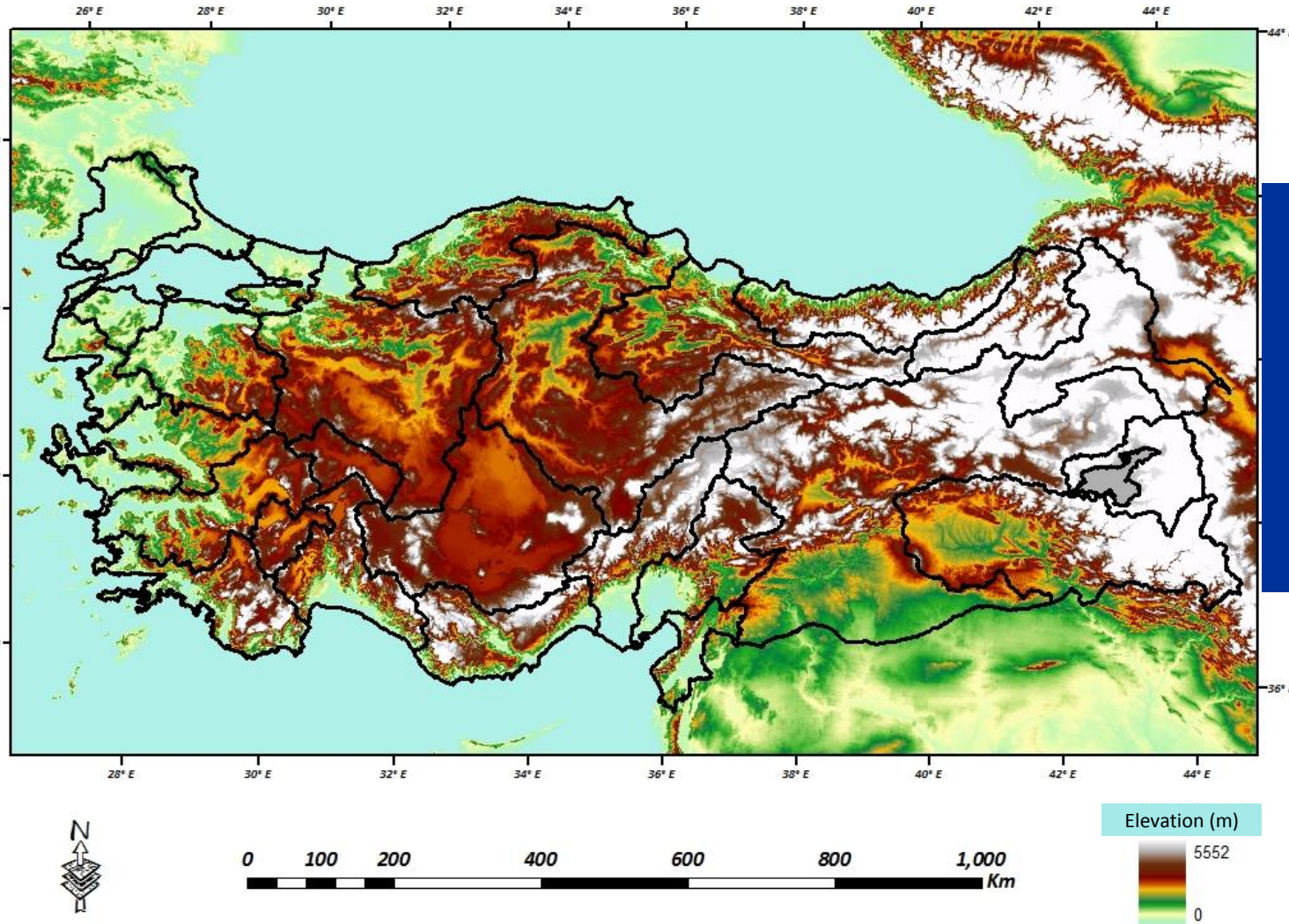
26 catchments in Turkey



Distribution of Annual Precipitation in Turkey



Topography of Turkey



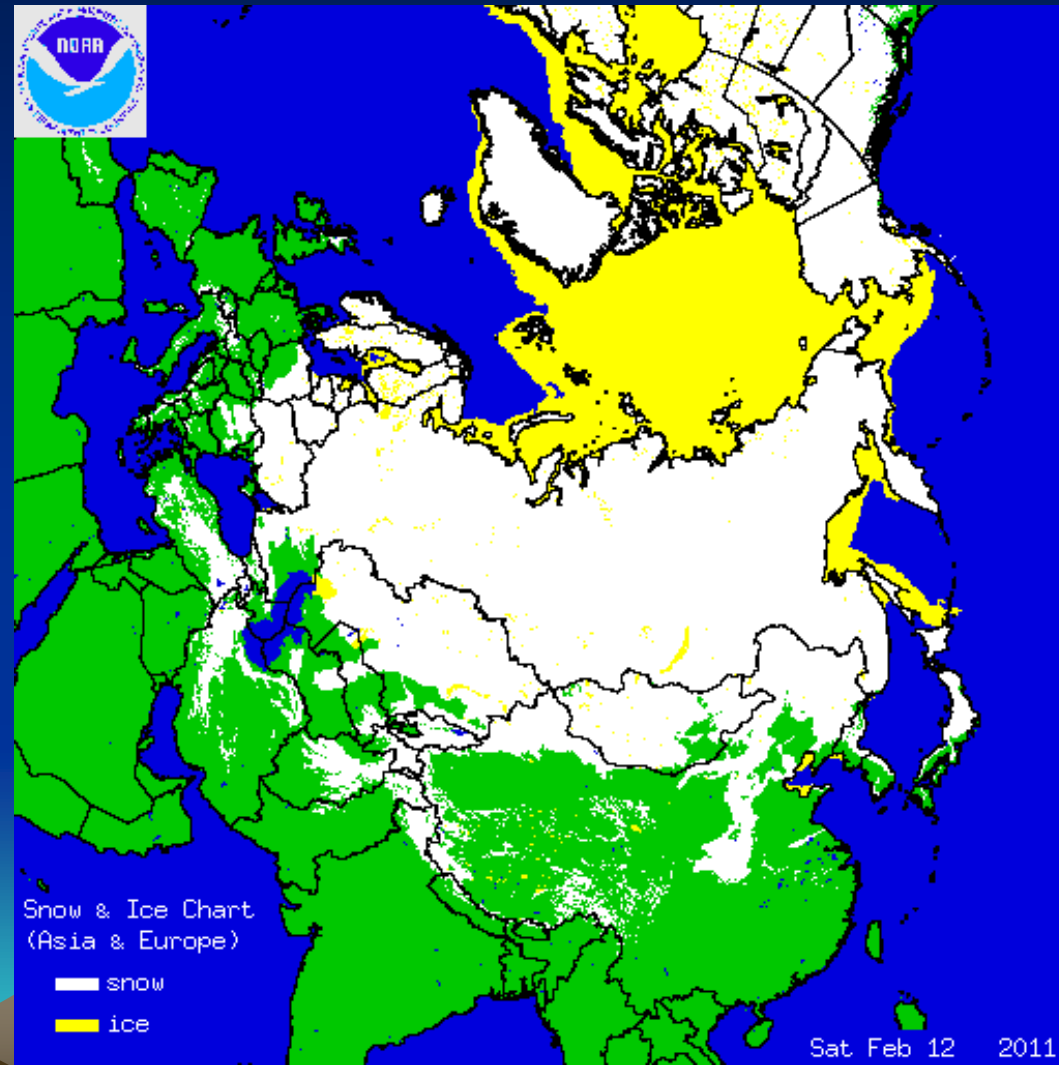
Mean Elevation
1140 m

Mean Slope
17.3%

Snow in Turkey

❄ Average elevation of Turkey > 1100 m, snow is seen frequently

❄ Snow stays on ground in
Eastern Anatolia
Northeast Anatolia
Central Anatolia



Data Collection in Turkey

❄ State Meteorological Service (MGM)

(meteorological, snow data)



❄ State Hydraulic Works (DSİ)

(discharge, snow data)



❄ Universities

(meteorological, snow, discharge data)

❄ Private Companies

(meteorological, snow, discharge data)

Snow Measurements

❄ Late 1960 s by manual snow courses



~ 175 stations

❄ Early 2000 s automatic SnoTel



~ 35 stations

Projects Conducted

- ❄ NATO Science for Stability (SfS), 1999-2003
- ❄ Turkish State Planning Organization (DPT), 2003-2005
- ❄ Turkish Scientific and Technological Research Council (TÜBİTAK), 2008-2016
- ❄ Anadolu University Scientific Research Projects (BAP), 2007-2016
- ❄ EUMETSAT Satellite Application Facilities in Hydrology (H-SAF), 2005-2017
- ❄ COST Project, 2014-2018

Euphrates-Tigris Basins (Mesopotamia-Transboundary Rivers)



❄ Riparian countries:

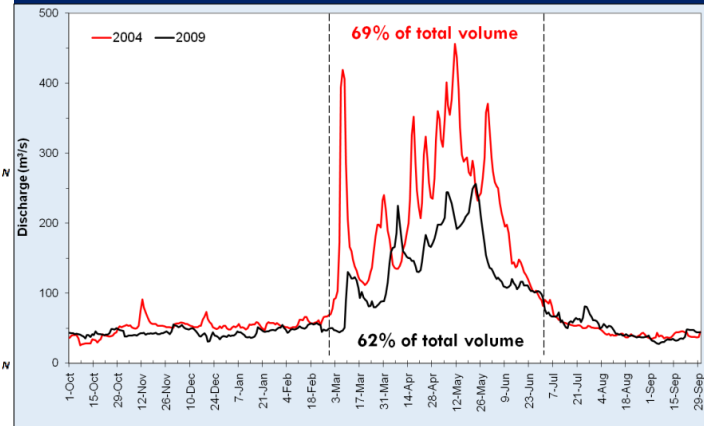
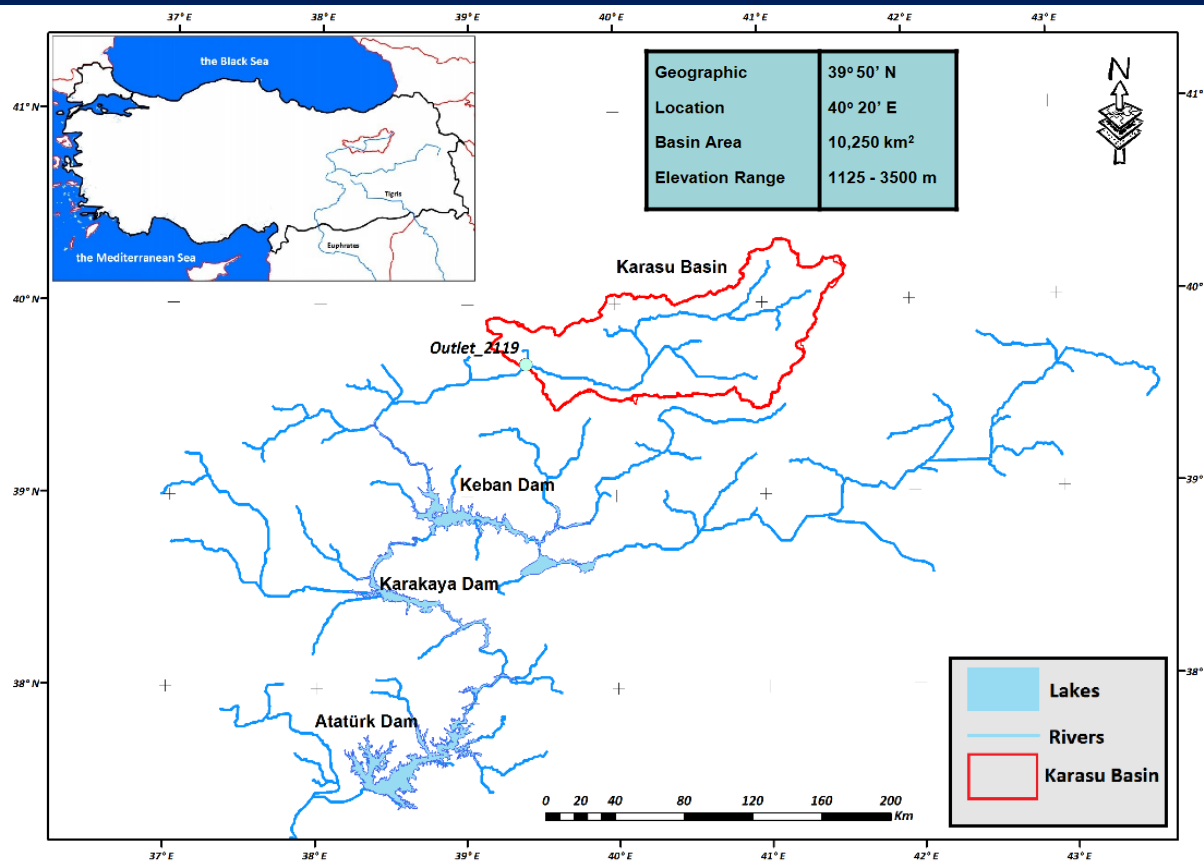
Turkey, Syria, Iran, Iraq,
Saudi Arabia

❄ Euphrates: 21% → 90%

❄ Tigris: 14% → 53%

❄ Euph.-Tigris: → 71%

Pilot Basin - Upper Euphrates



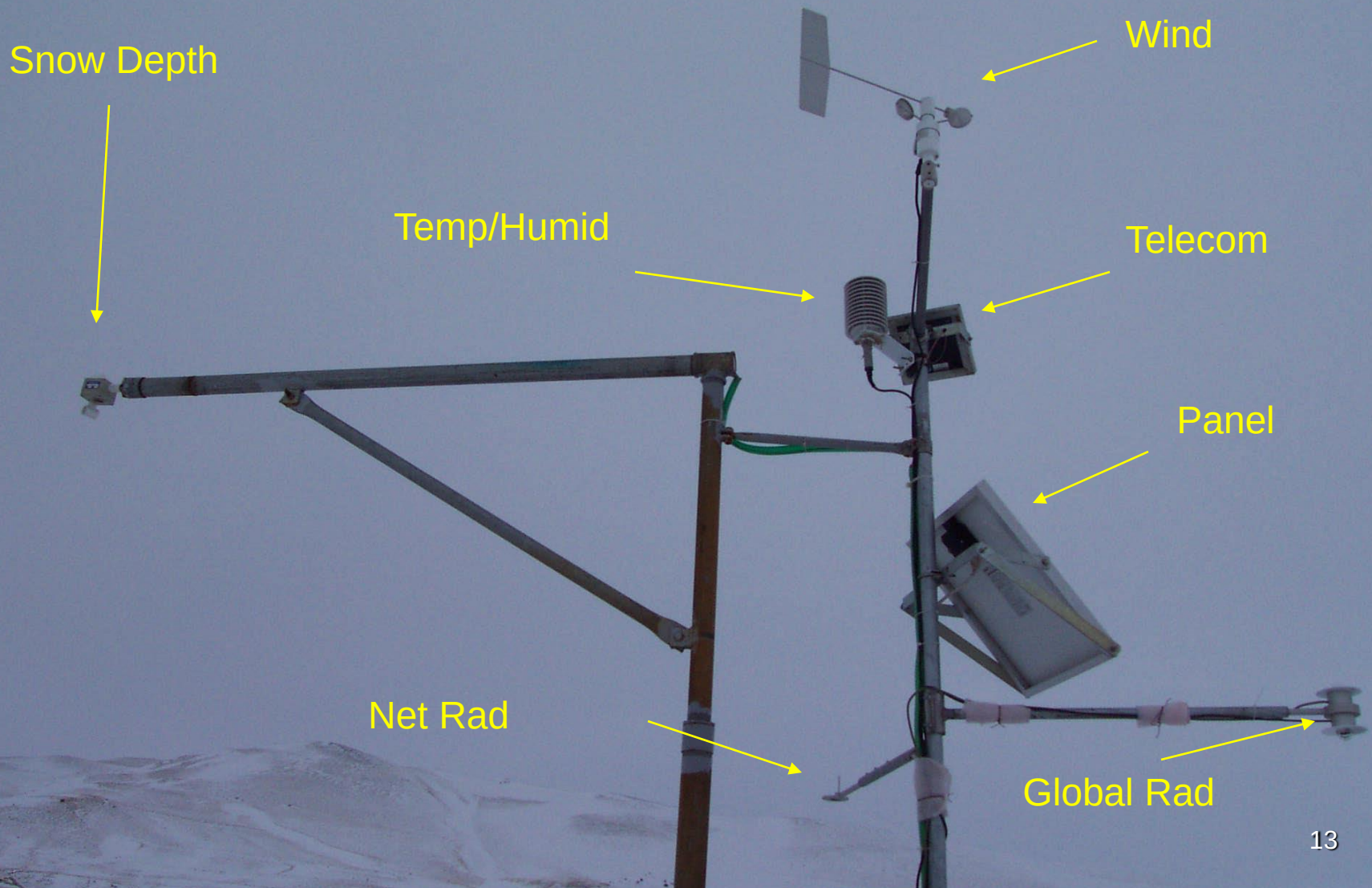
60–70% of the total runoff volume originate during snowmelt period....

Large dams downstream

Güzelyayla SnoTel (2065 m)



Sensors



Precipitation Gauge



30 cm dia. tipping bucket

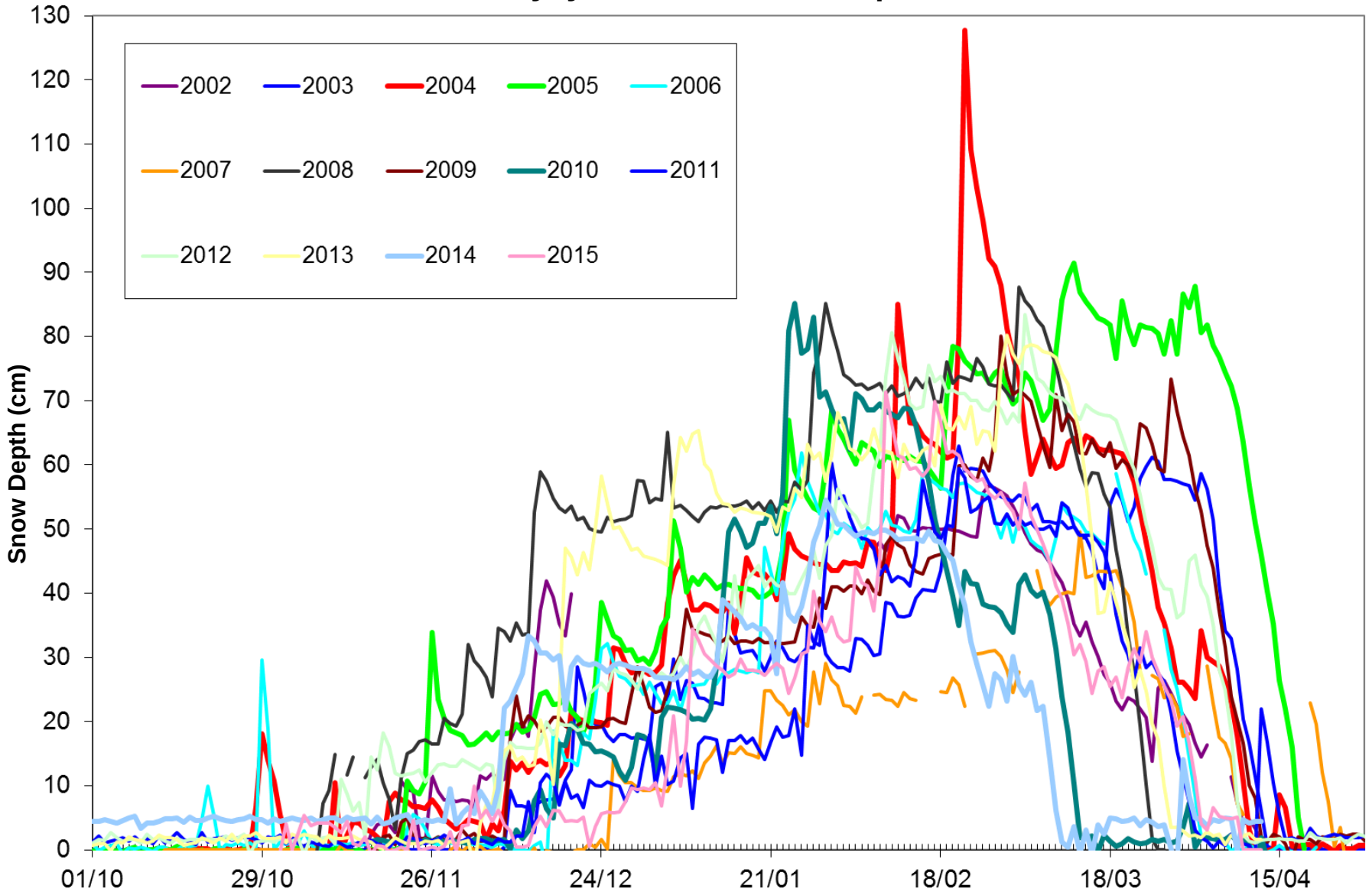
Snow Pillow

~ 3 m diameter



Güzelyayla (2065 m)

Güzelyayla SnoTel Snow Depth



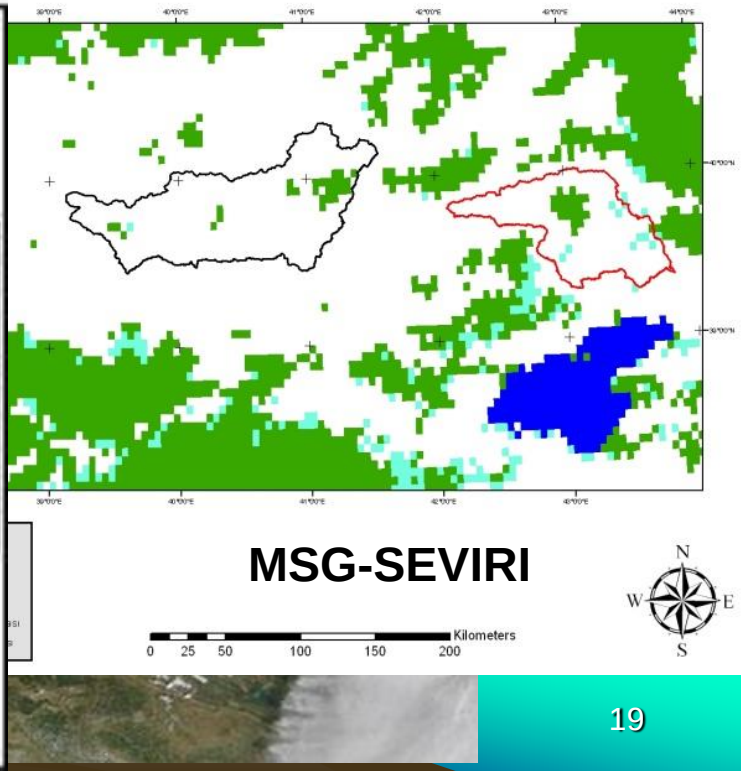
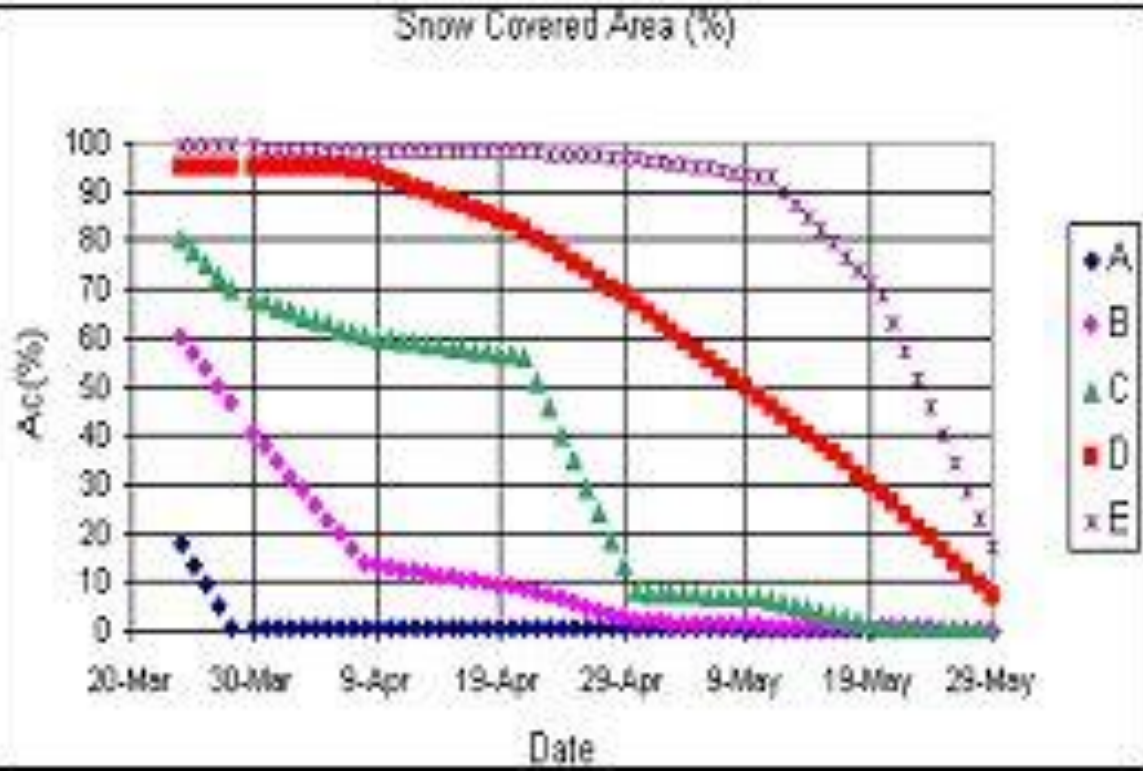
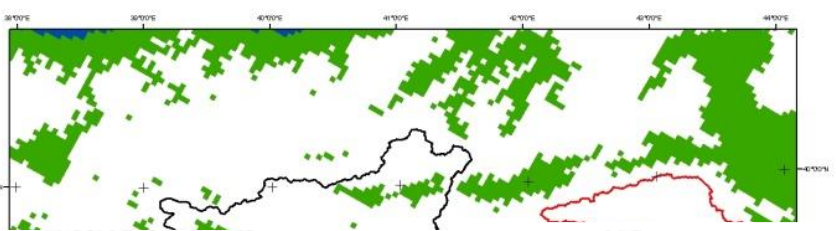
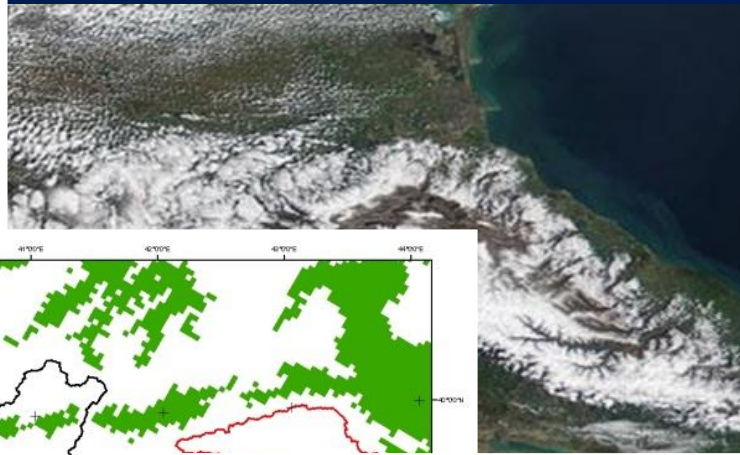
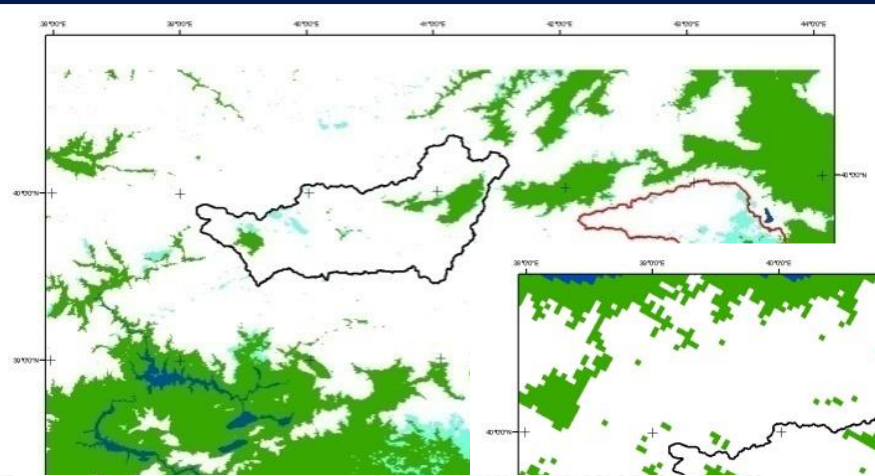
Palandöken SnoTel (2610 m)



Palandöken SnoTel (2610 m)

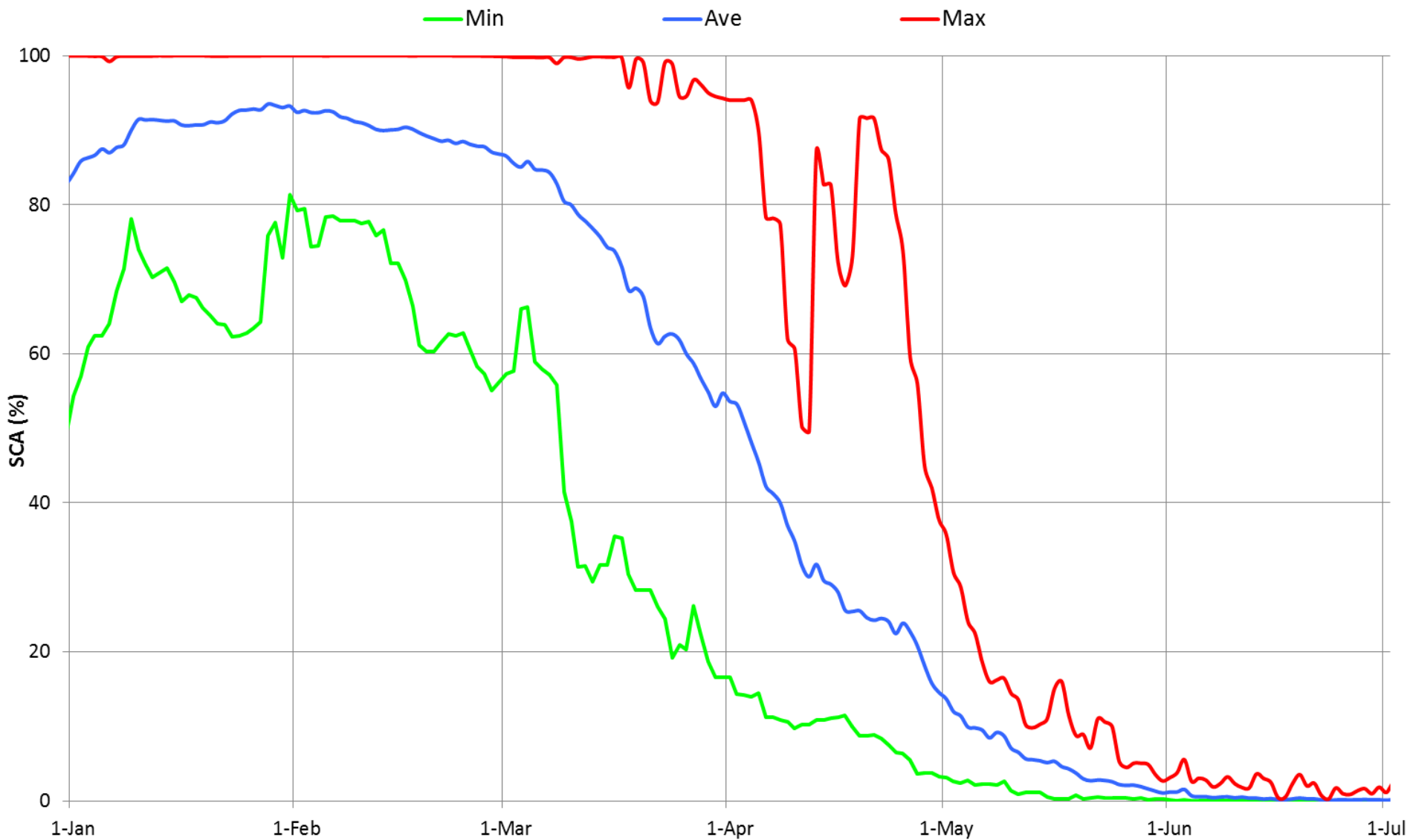


Satellite Monitoring

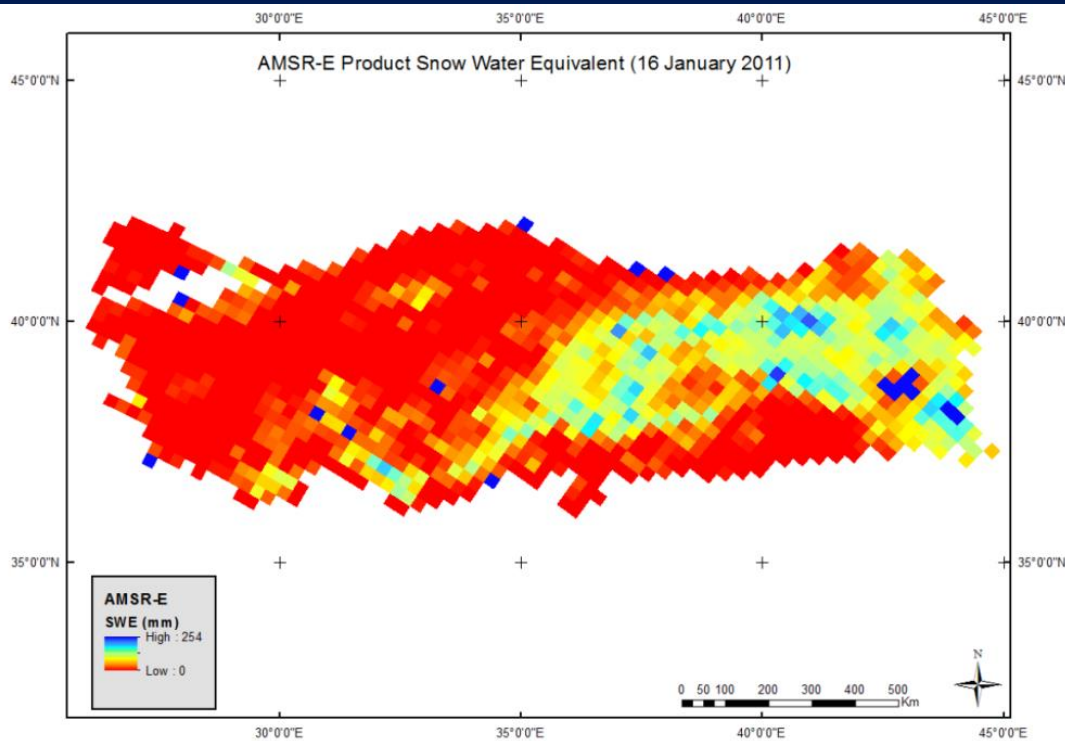


Snow Covered Area

Snow Depletion Curves 2000-2015



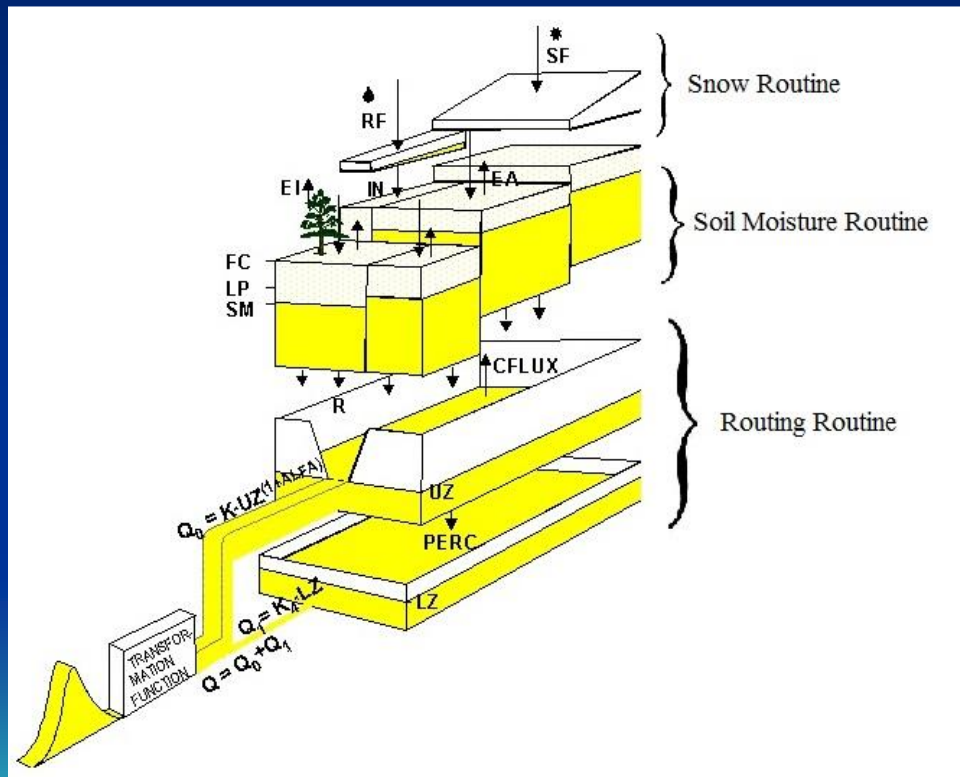
Snow Water Equivalent



Hydrological Modeling

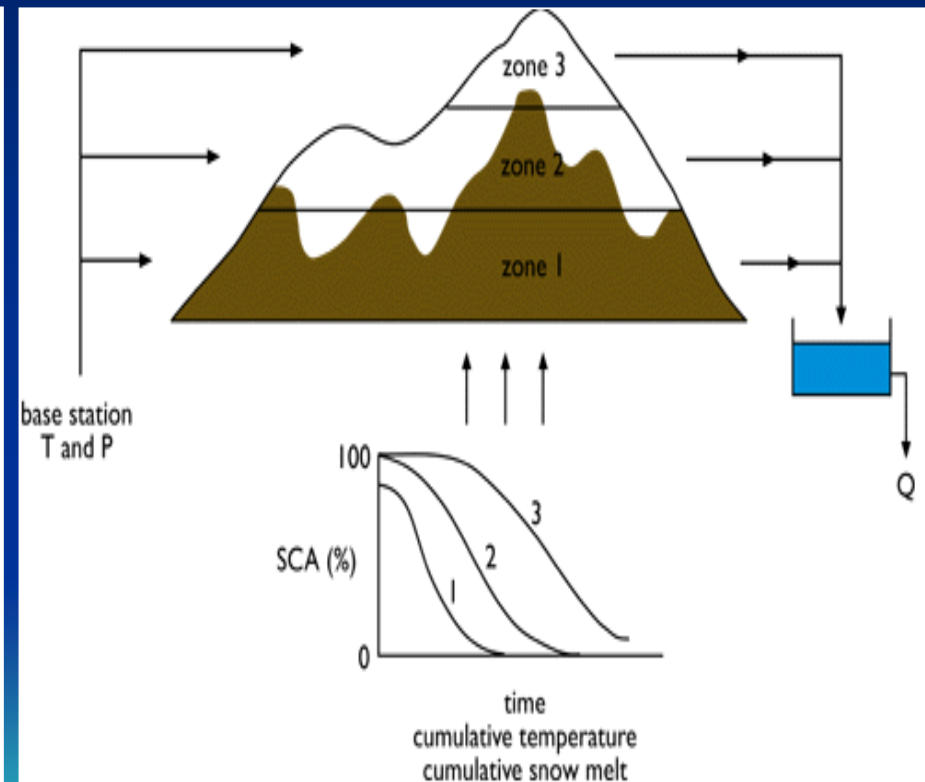
HBV

(Hydrologiska Byråns Vattenbalans)



SRM

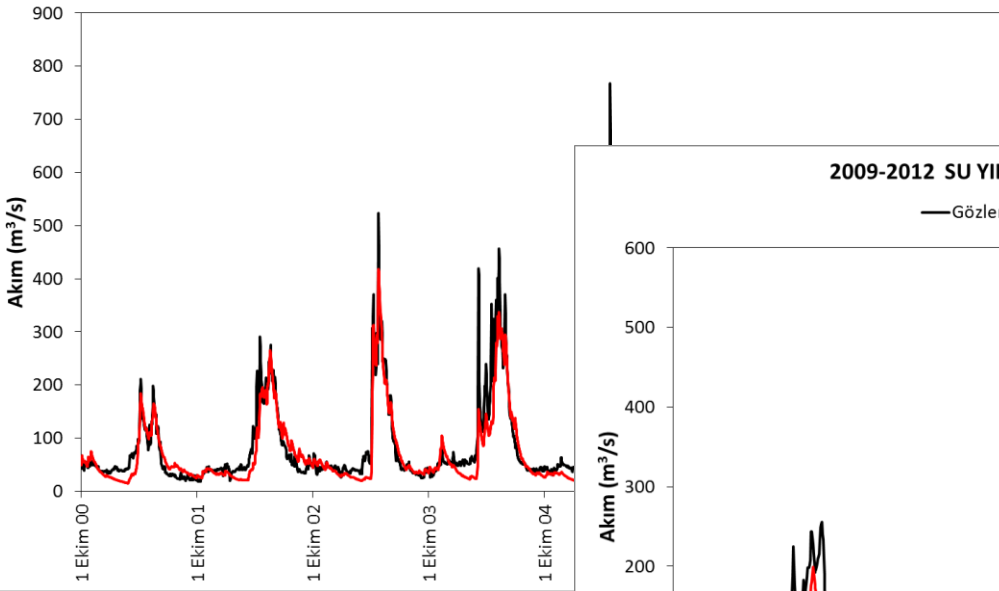
(Snowmelt-Runoff Model)



Two different conceptual models using temperature-index method

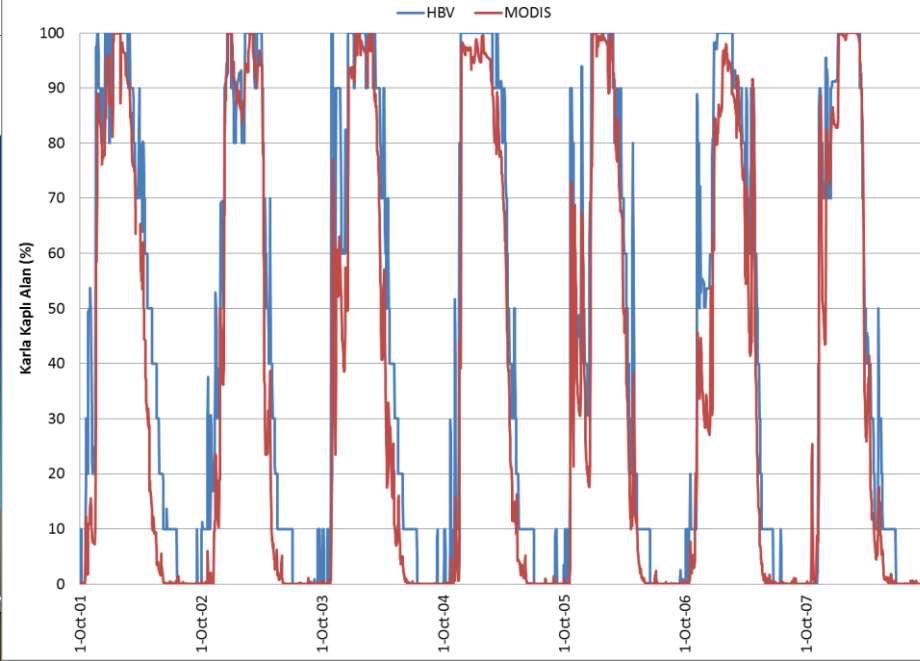
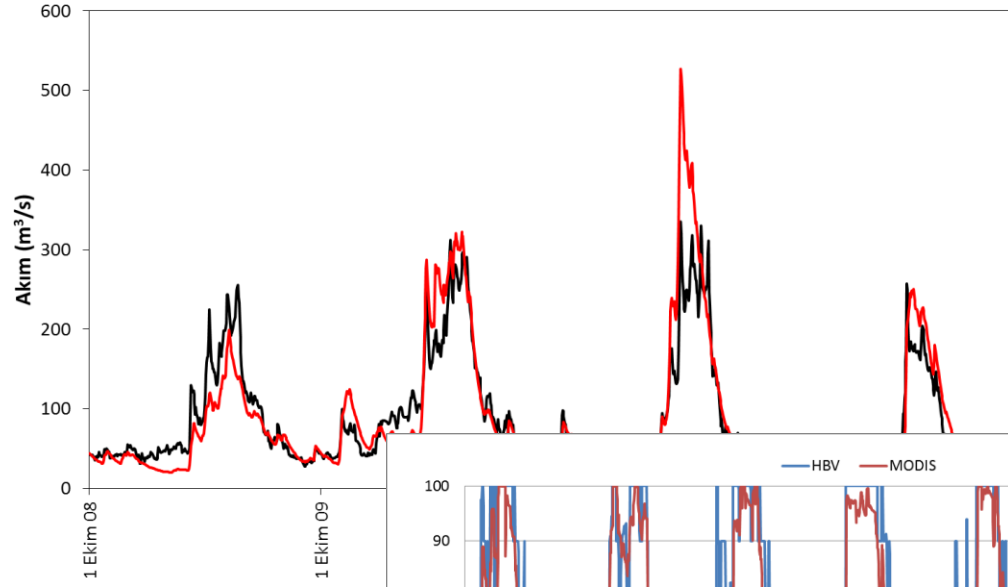
2001-2008 SU YILLARINA AİT KALİBRASYON (KARASU)

— Gözlenen Akım — Modellenen Akım



2009-2012 SU YILLARINA AİT DOĞRULAMA (KARASU)

— Gözlenen Akım — Modellenen Akım

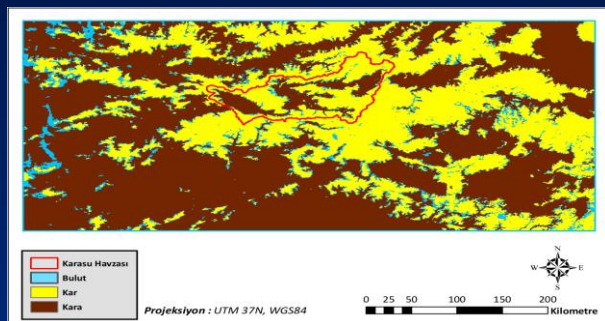


	BIAS (m ³ /s)	R ²
Kalibrasyon (2001 – 2008)	-9.03	0.86
Doğrulama (2009 – 2012)	-1.39	0.84

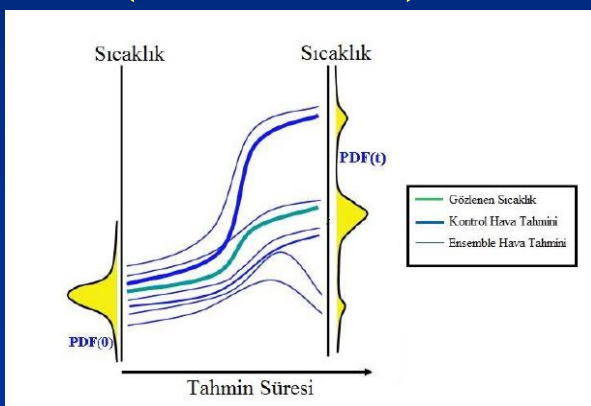
Forecasting

Satellite

SnoTel



EPS (Probabilistic)

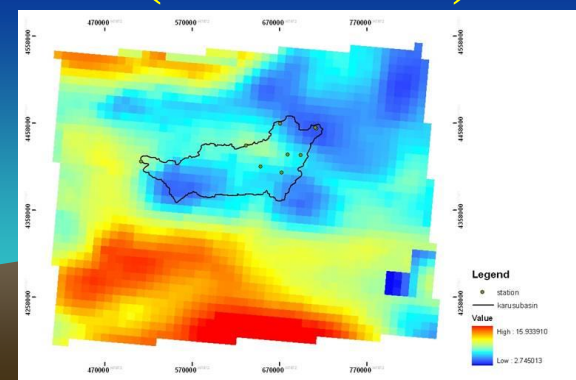


Hydrologic Model

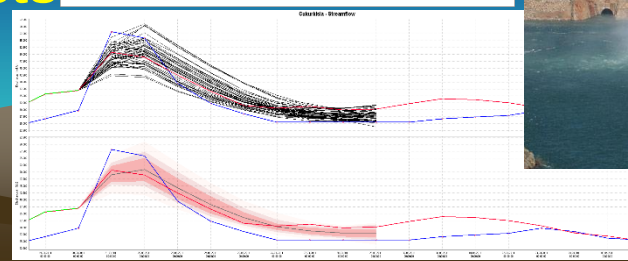
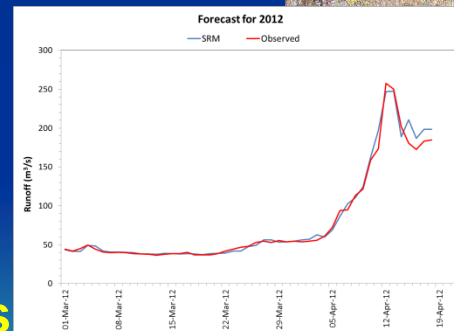


Stream Gage

WRF (Deterministic)



Daily Forecasts



COST, Helsinki, 2015

Erzurum (1850 m)



COST, Helsinki, 2015



THANK YOU

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