Some Geothermal Data for Southern Arizona

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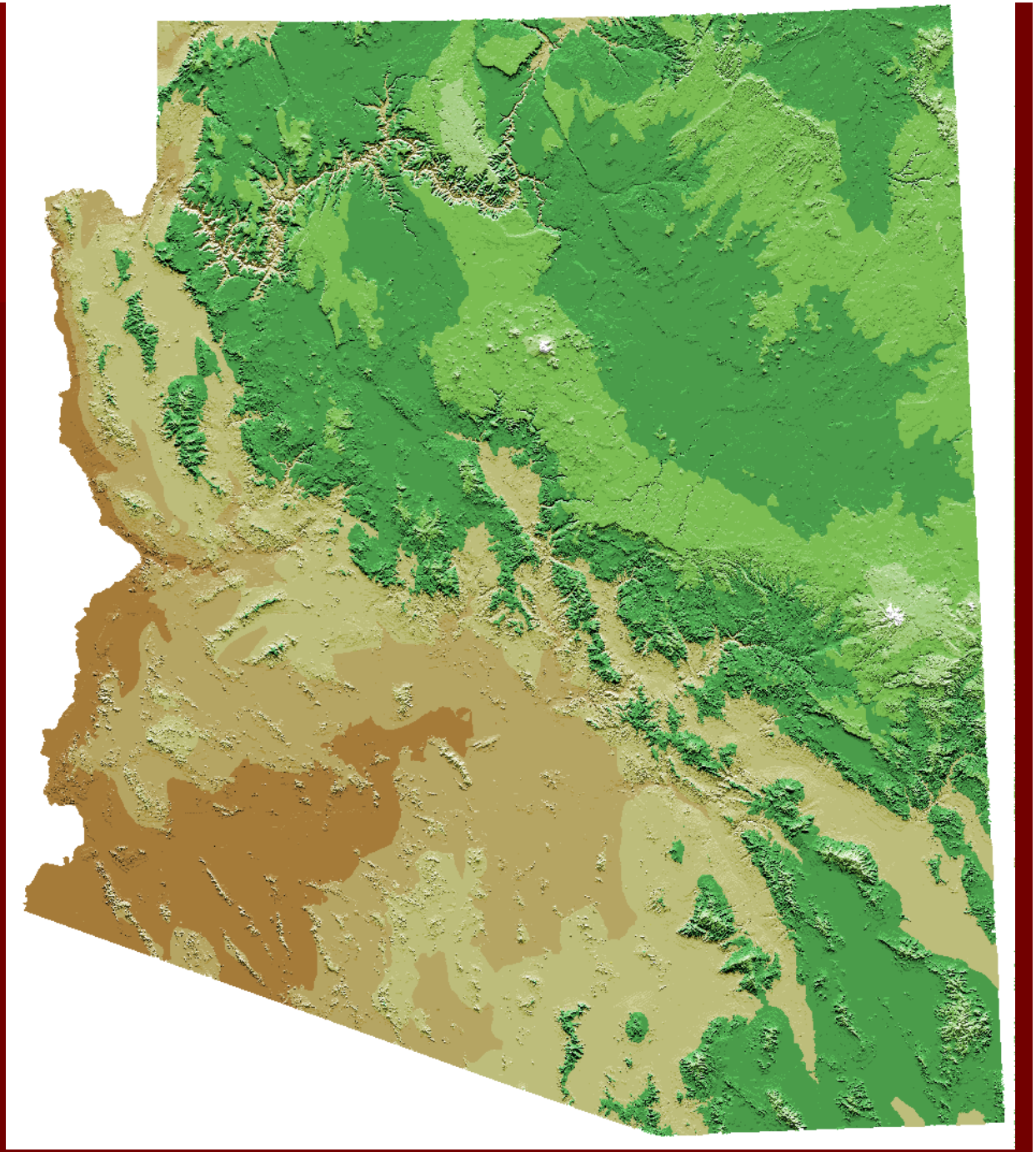
Arizona Geothermal Working Group – March 23, 2007

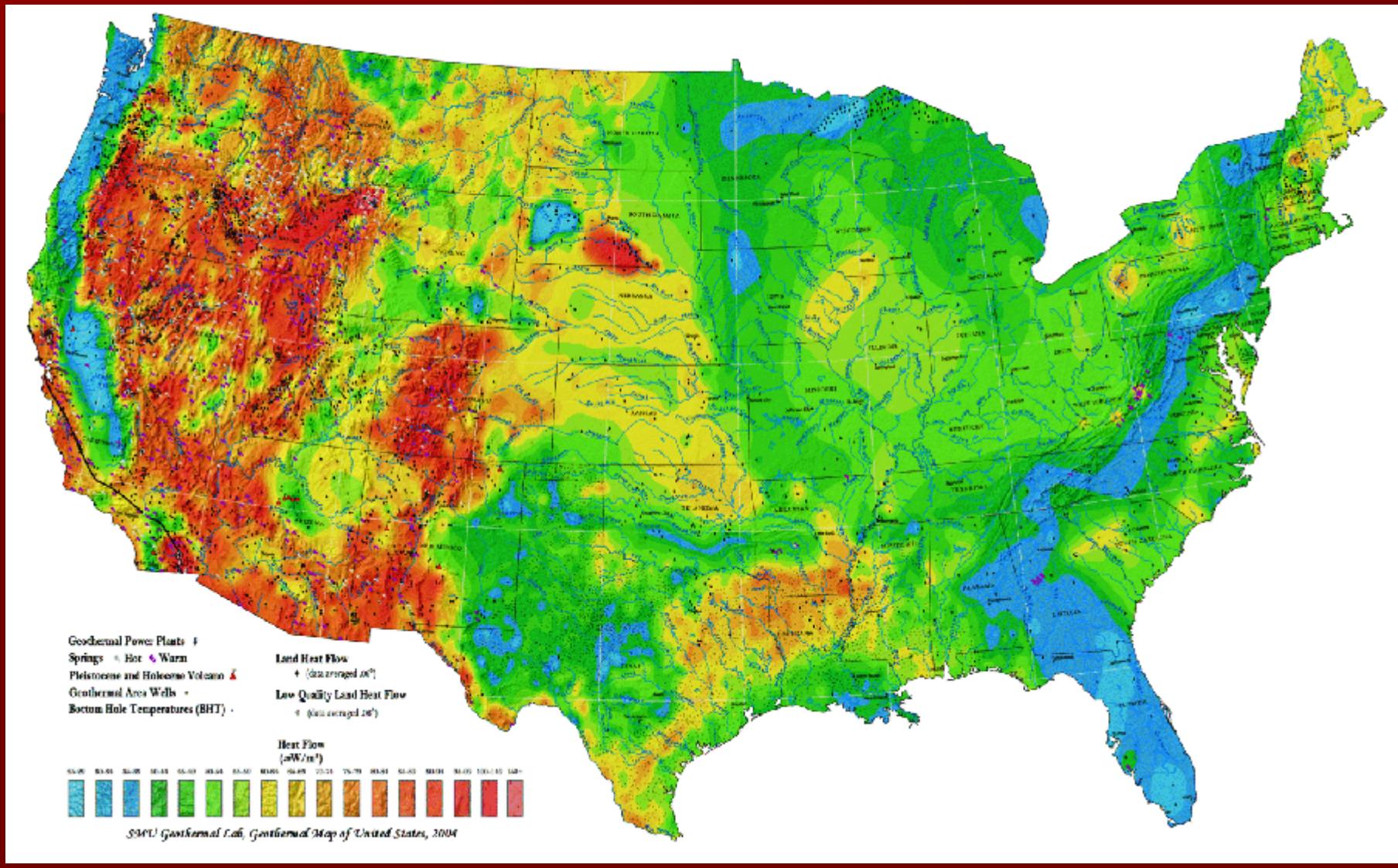
Outline

- Introduction for Jim Witcher's talk
- Physiographic & Geothermal Setting
- Selected data sets that indicate likely geothermal resources in southern Arizona (south of 34^{o} north)
- Prospects for use of geothermal heat pumps in southern Arizona (energy conservation)

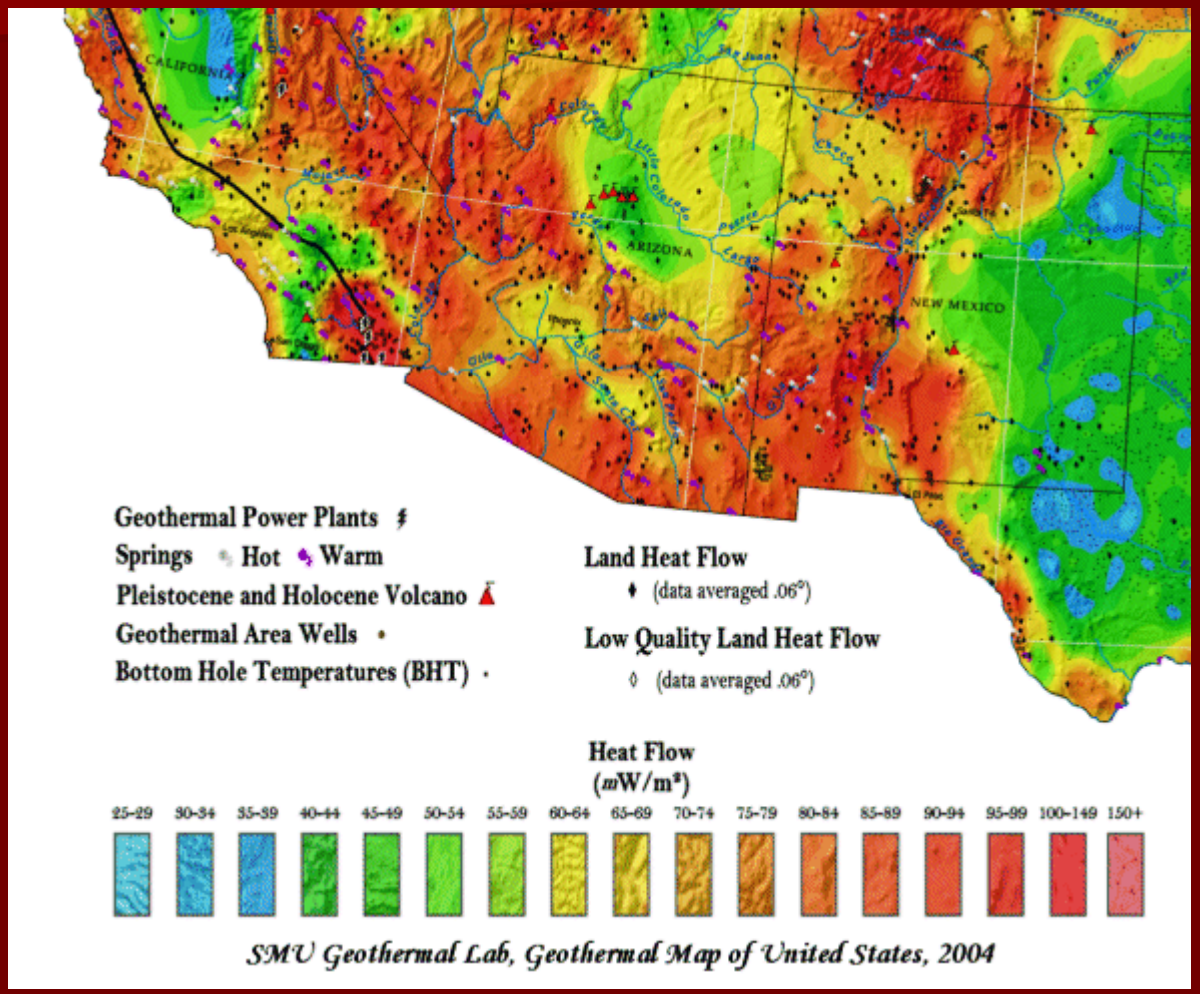
Arizona Topography

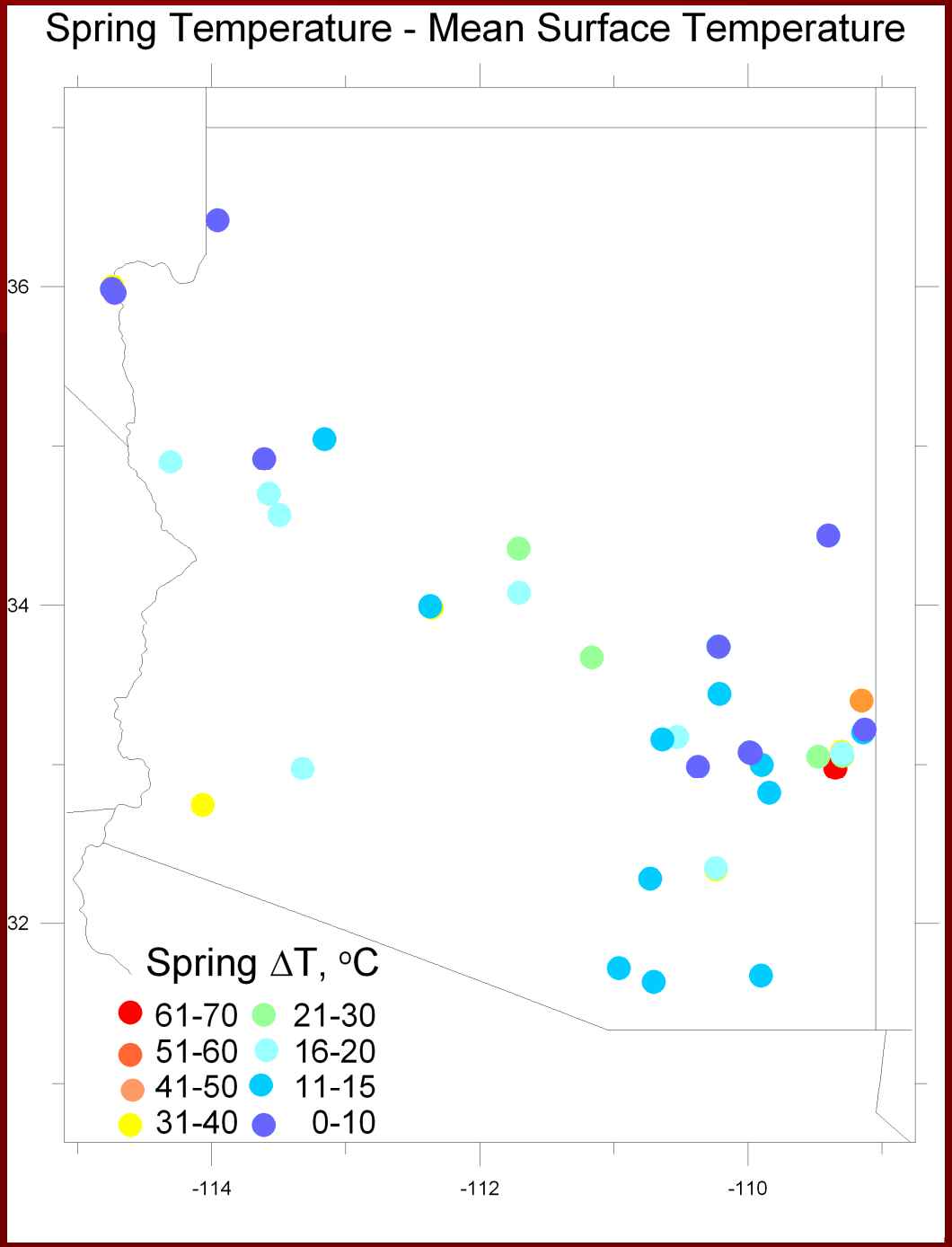


US Heat Flow


Geothermal Power Plants
Springs
Hot
Warm
Pleistocene and Holocene Volcano
Geothermal Area Wells
Bottom Hole Temperatures (BHT)
Land Heat Flow
Low Quality Land Heat Flow
Heat Flow
(mW/m²)
SMU Geothermal Lab, Geothermal Map of United States, 2004

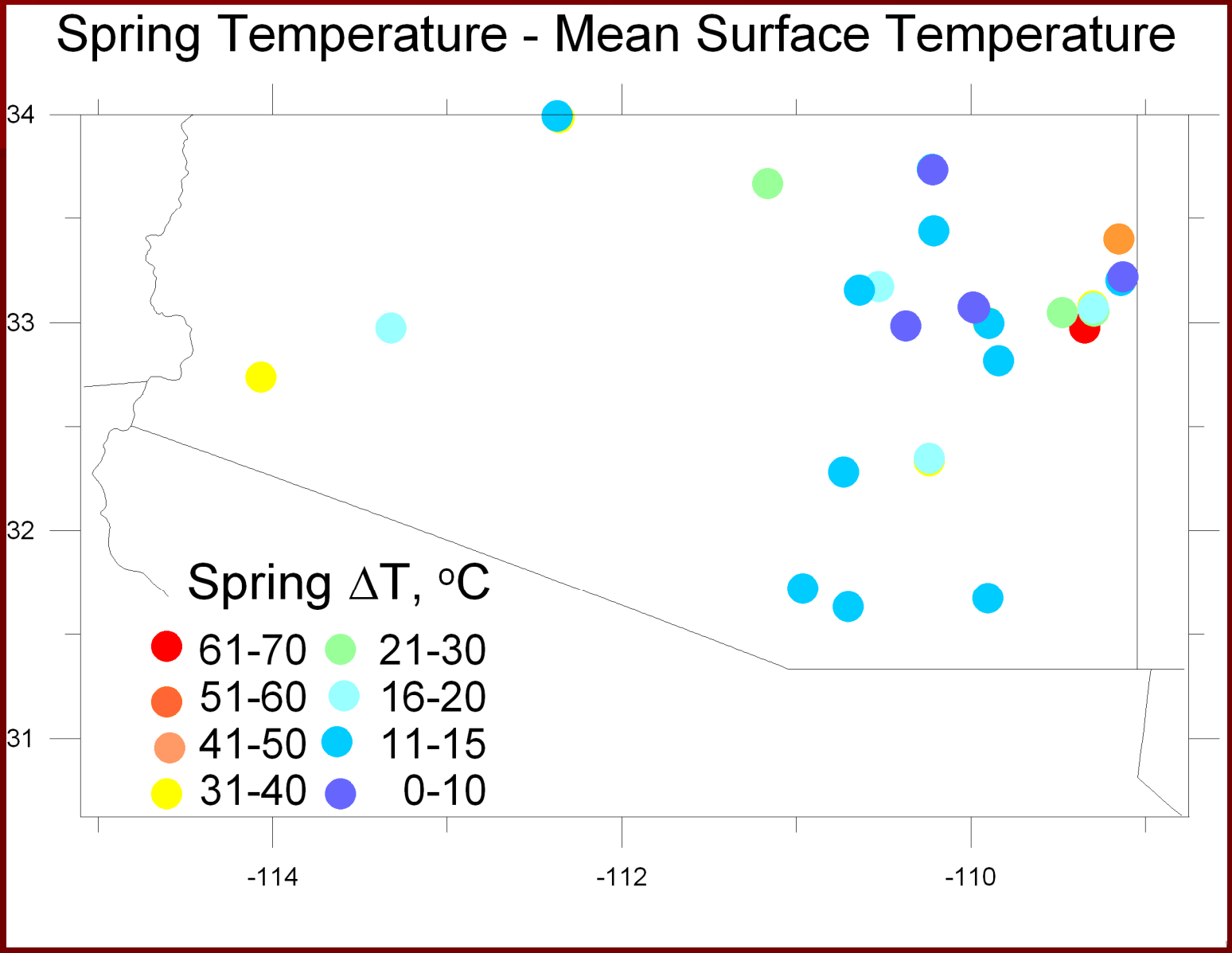
US Heat Flow – Arizona-New Mexico



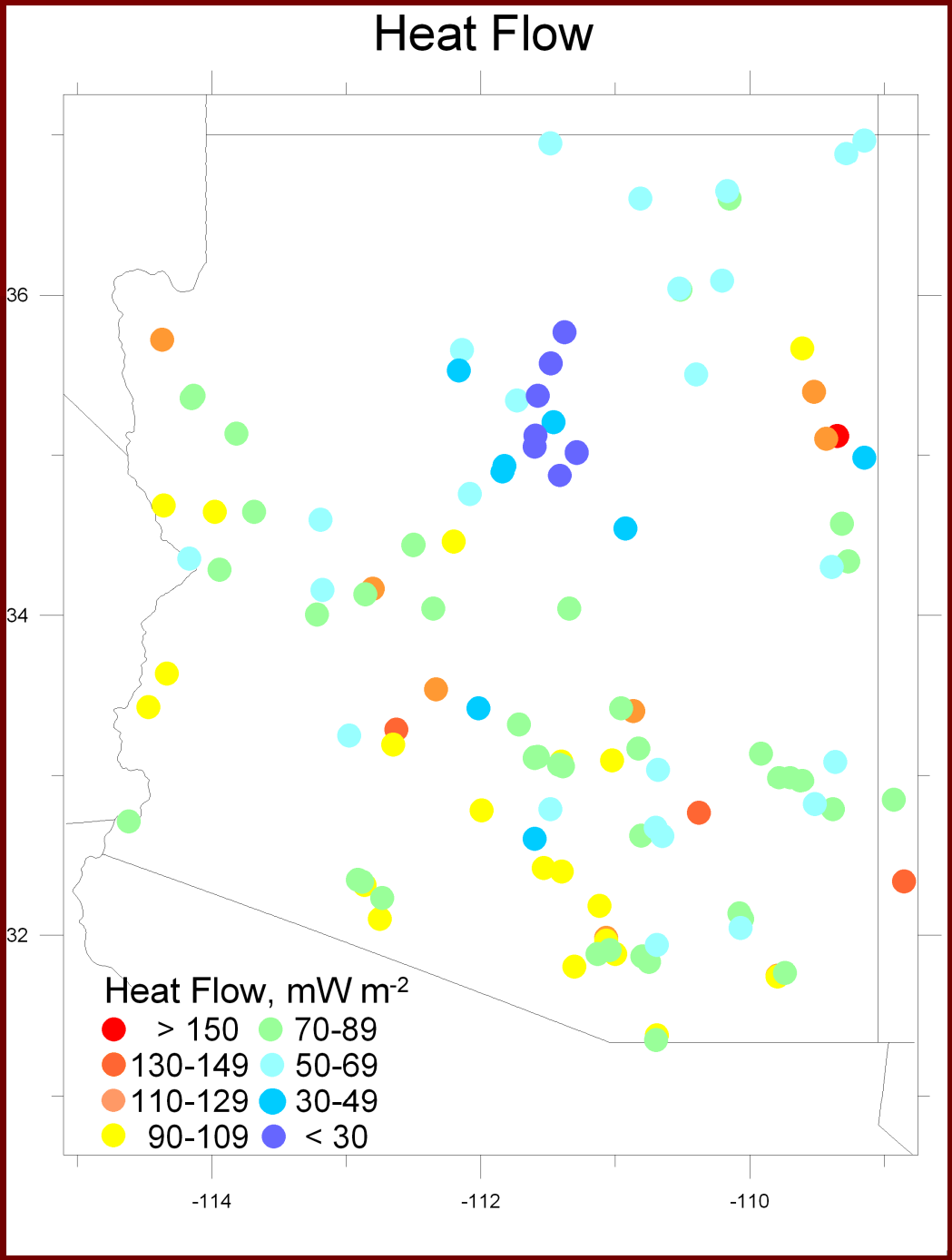


Arizona Hot Springs – Above Ambient Temperature

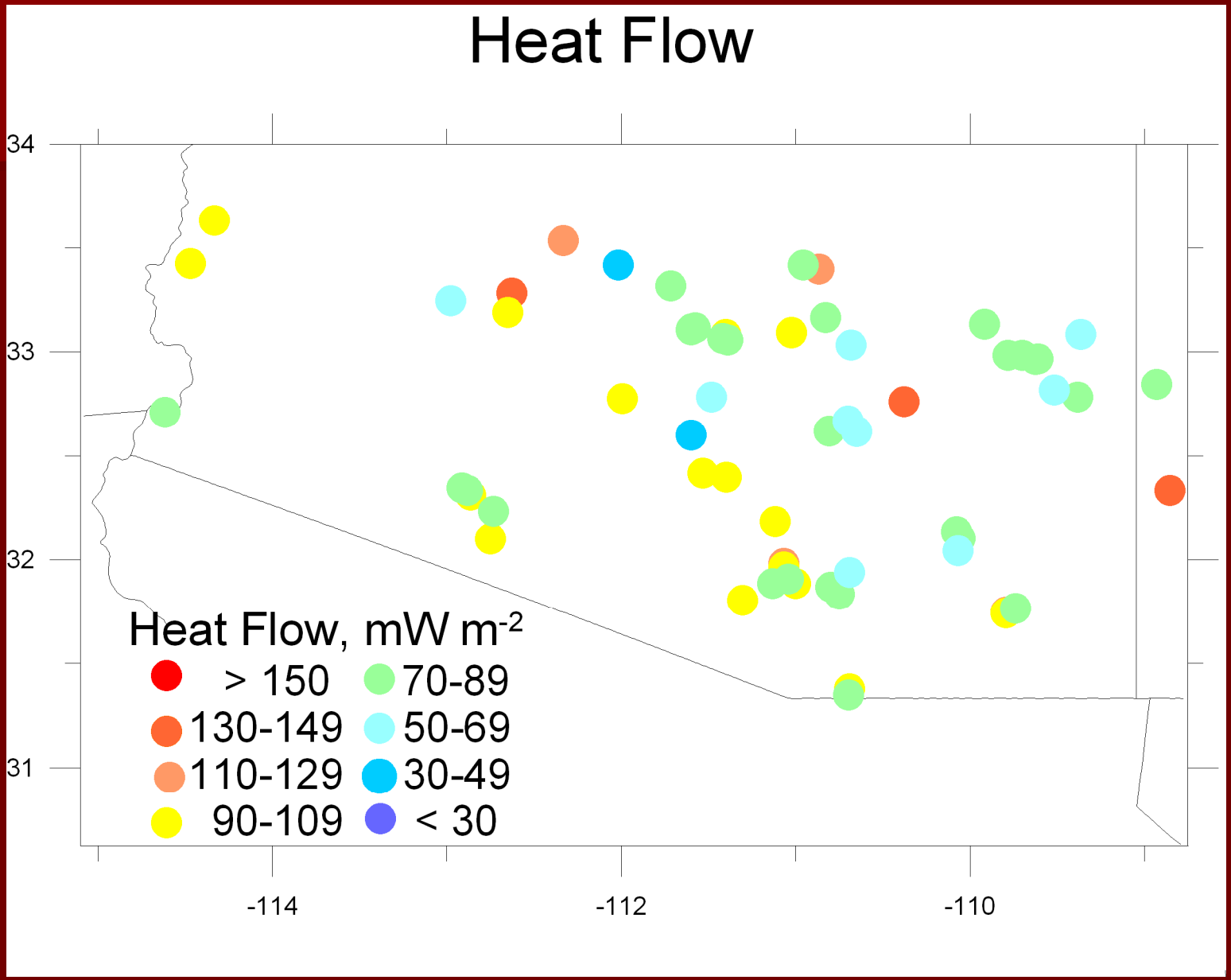
Southern Arizona Hot Springs

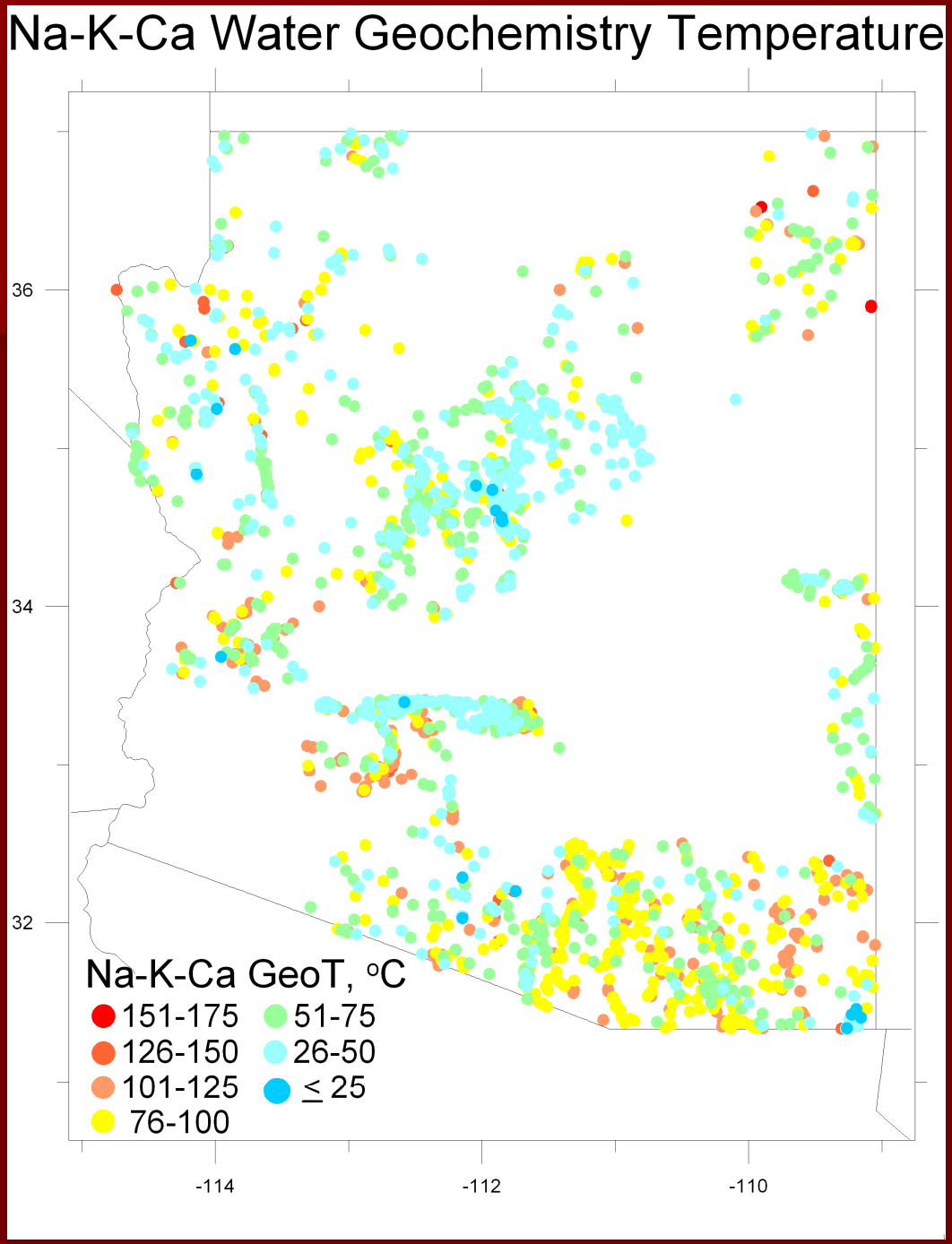


Arizona Heat Flow



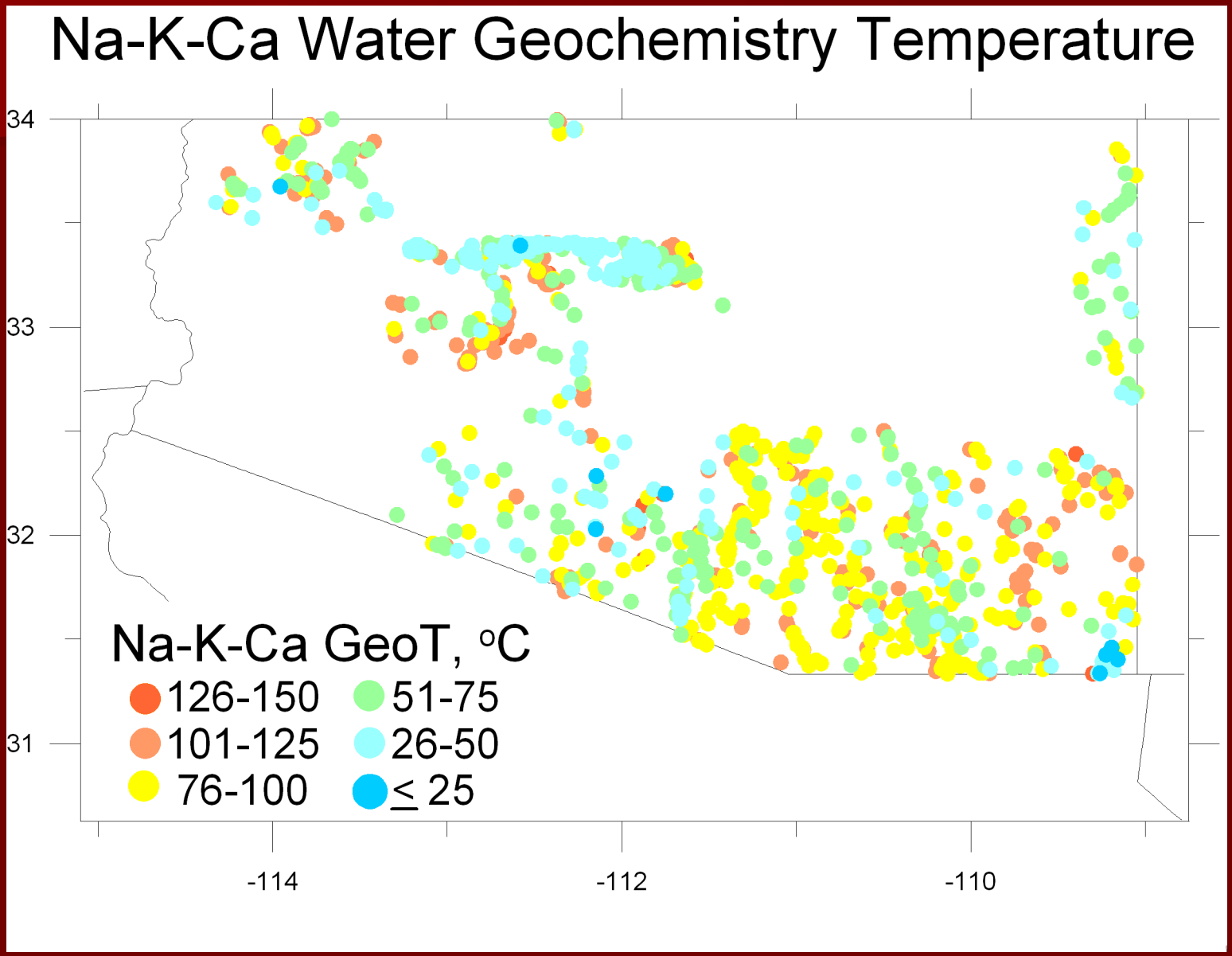
Southern Arizona Heat Flow





Na-K-Ca Water Geochemistry Temperature Data

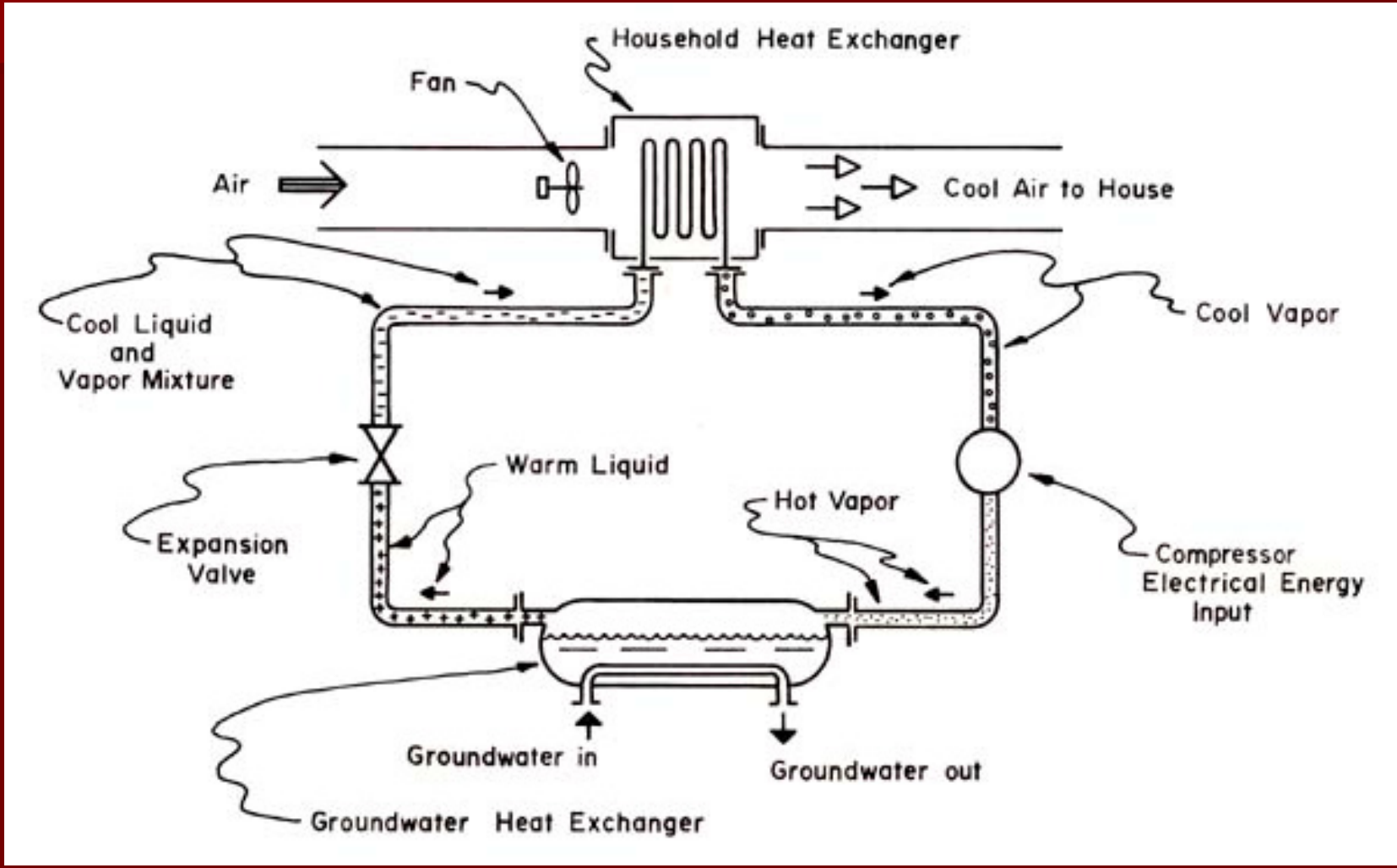
Southern Arizona Na-K-Ca GeoT Data



Summary

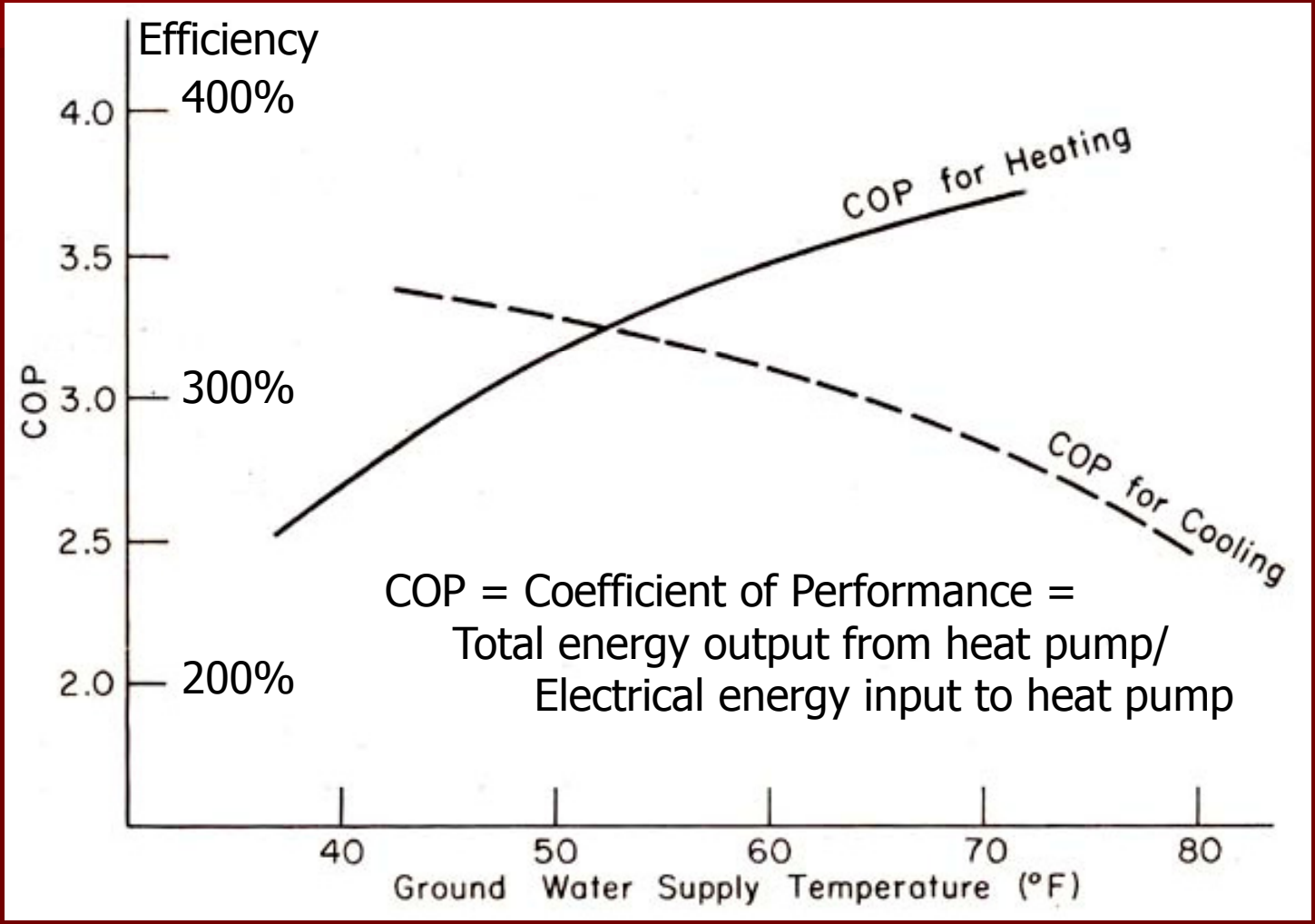
- US Heat Flow map shows potential for low-temperature geothermal resources for most of southern Arizona
- Major hot springs on near Mogollon Rim
- High heat flow (typical of Basin and Range) for most of southern Arizona
- Na-K-Ca Water Geochemistry Data indicate widespread resources up to 100°C (212°F), locally hotter

Geothermal Heat Pump Cooling Mode



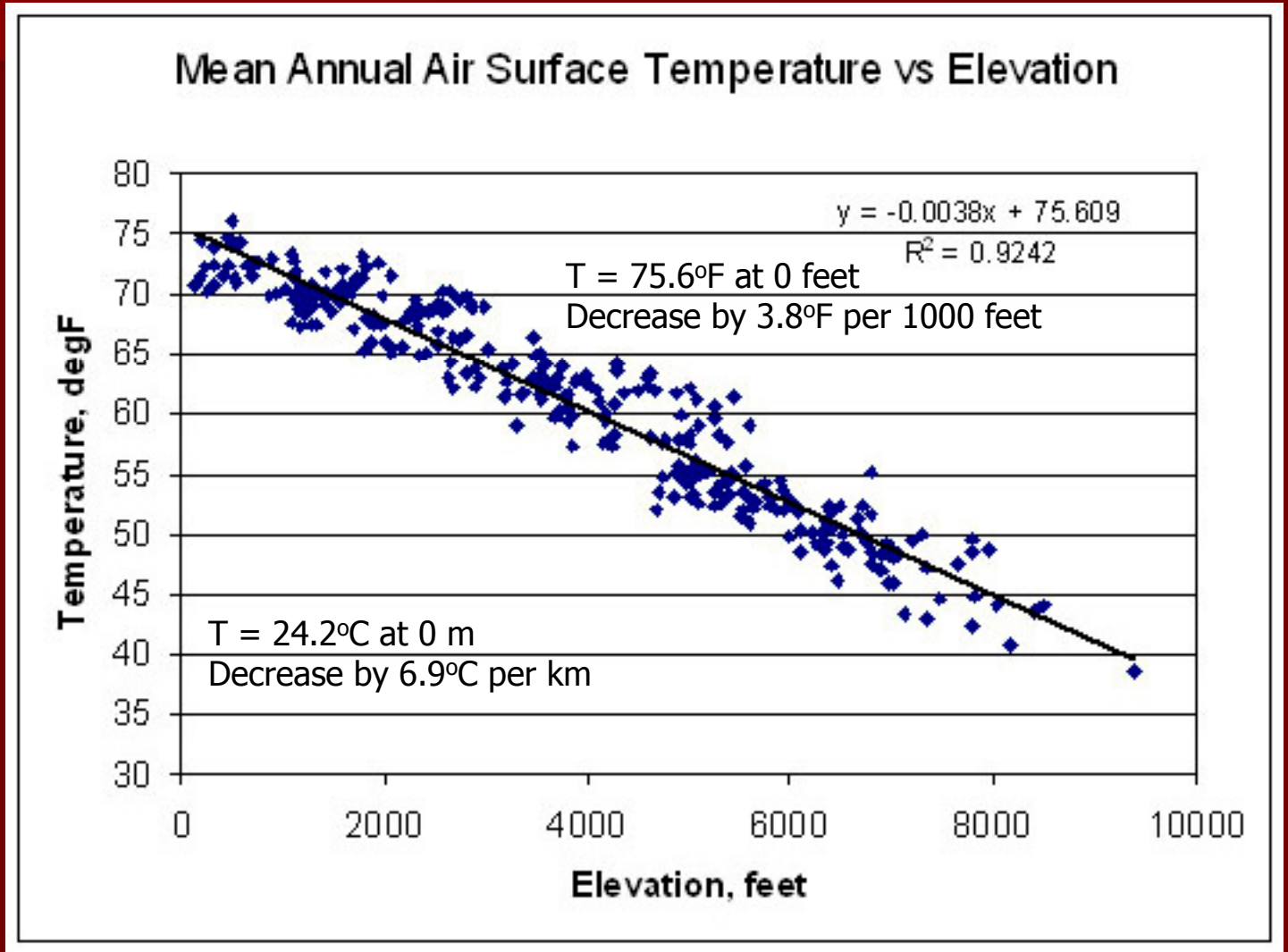
Source: Garing, K. L., & F. R. Connor, 1981, Groundwater Heat Pumps in Colorado, Colorado Geol. Surv., Spec. Pub. 18. 32 pp.

Geothermal Heat Pump Efficiency vs. Ground Temperature

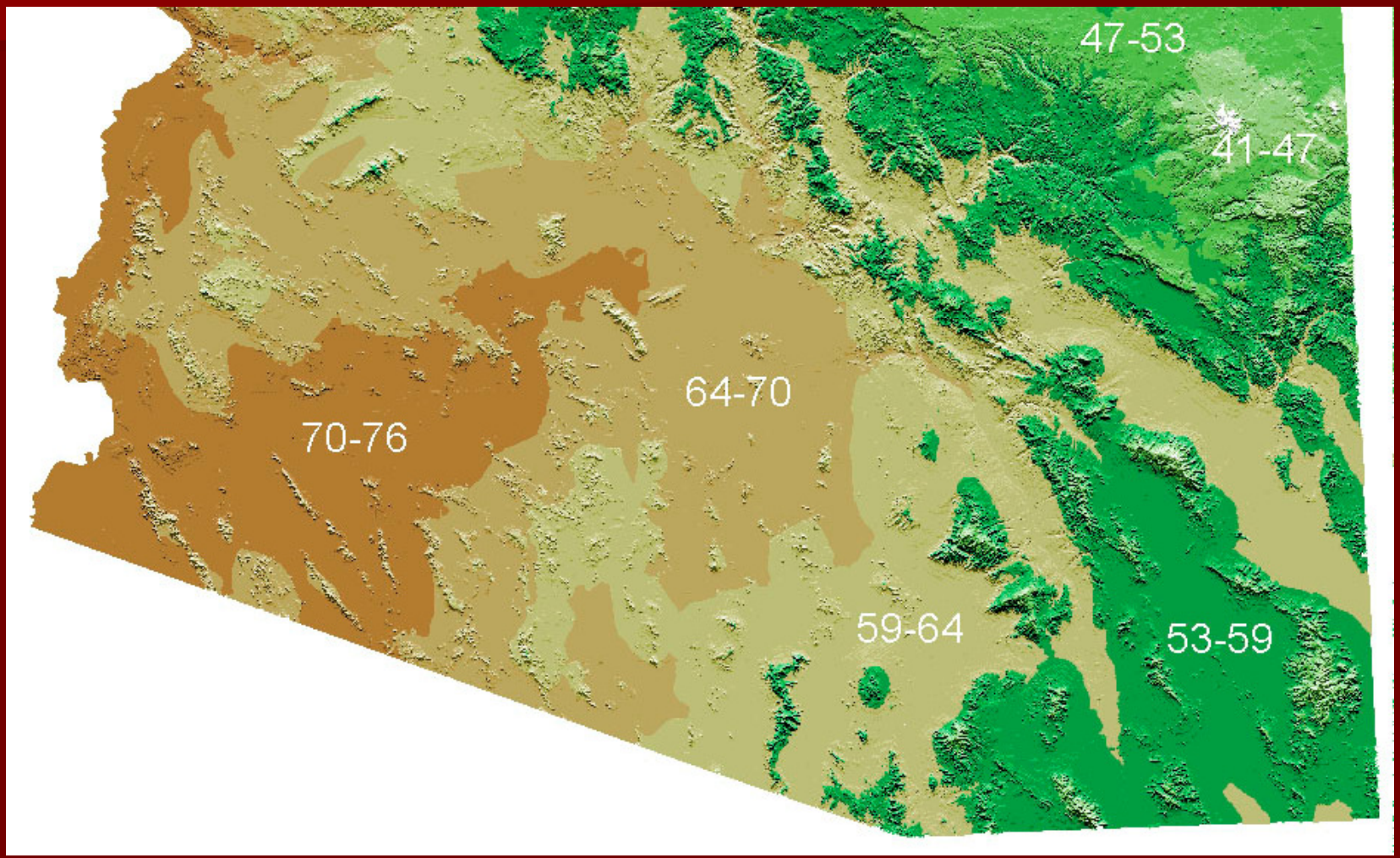


Source: Modified from Garing, K. L., & F. R. Connor, 1981, Groundwater Heat Pumps in Colorado, Colorado Geol. Surv., Spec. Pub. 18. 32 pp.

Mean Annual Surface Temperature in Arizona



Southern Arizona Mean Annual Air Surface Temperatures



Summary of Geothermal Potential for Use of Geothermal Heat Pumps in Southern Arizona

- Widespread use of compressor-type air-conditioner units in southern Arizona suggests potential increased efficiency (energy conservation) through the use of geothermal heat pumps (GHP)
- Range of surface air temperatures in southern Arizona indicates efficiencies of $\geq$250% for GHP neglecting energy used for ground heat exchange
- The challenge for the use of GHP in southern Arizona will probably be in efficient ground heat exchange because the water table is often relatively deep in this region.