

# Accounting for the spatial support-effect on modelling a temperature field from different sources of experimental data

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## Case study

Rocky Mountain National Park (RMNP)

## Data

21 SNOTEL stations

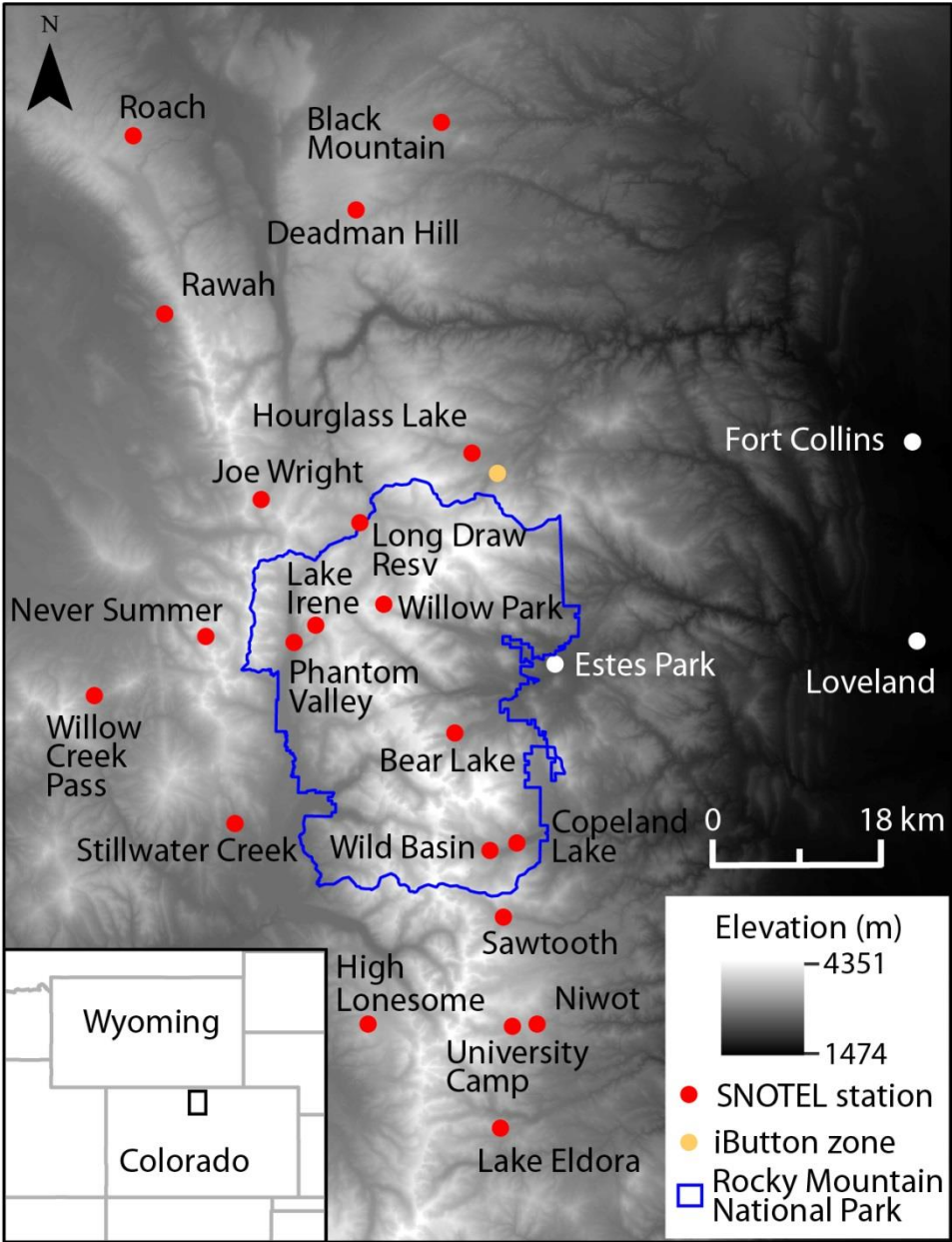
17 iButton sensors

MODIS LST (spatial resolution 1 km)

DEM 10m USGS

## Objectives

Comparison of the spatial variability of temperature for SNOTEL stations, iButton sensors and MODIS LST by using geostatistical techniques.



## Methodology

To obtain temperature fields from SNOTEL and iButton data using the same areal support of MODIS LST by using different geostatistical techniques: Ordinary Kriging (OK) and Kriging with External Drift (KED).

OK take into account the spatial correlation between experimental data.

In KED, a secondary variable is also used to interpolate the target variable. Normally, in calculating climatic variables the explicative variable with greatest influence is elevation.

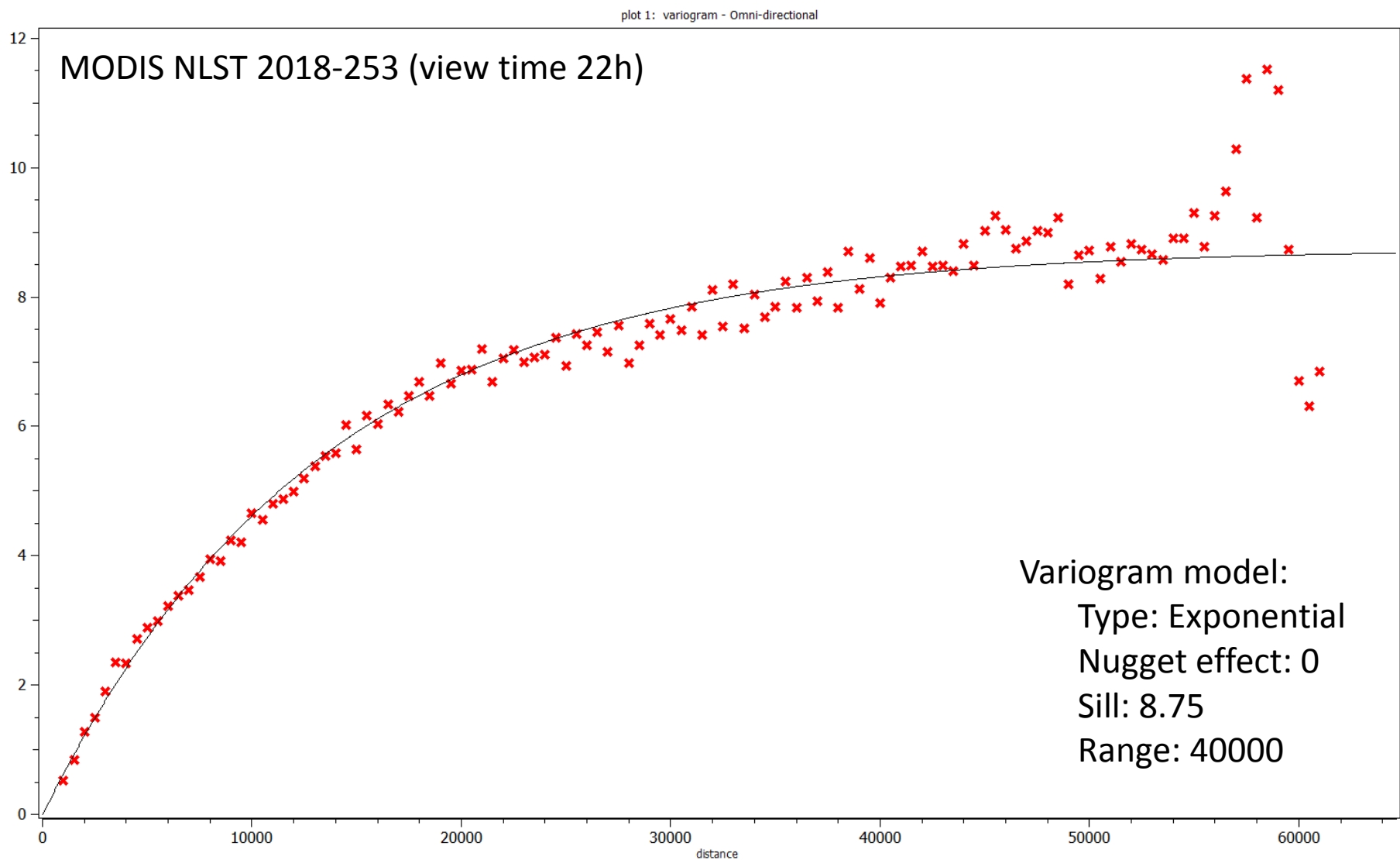
Geostatistical methods:

take spatial correlation of experimental data into account using the variogram function.

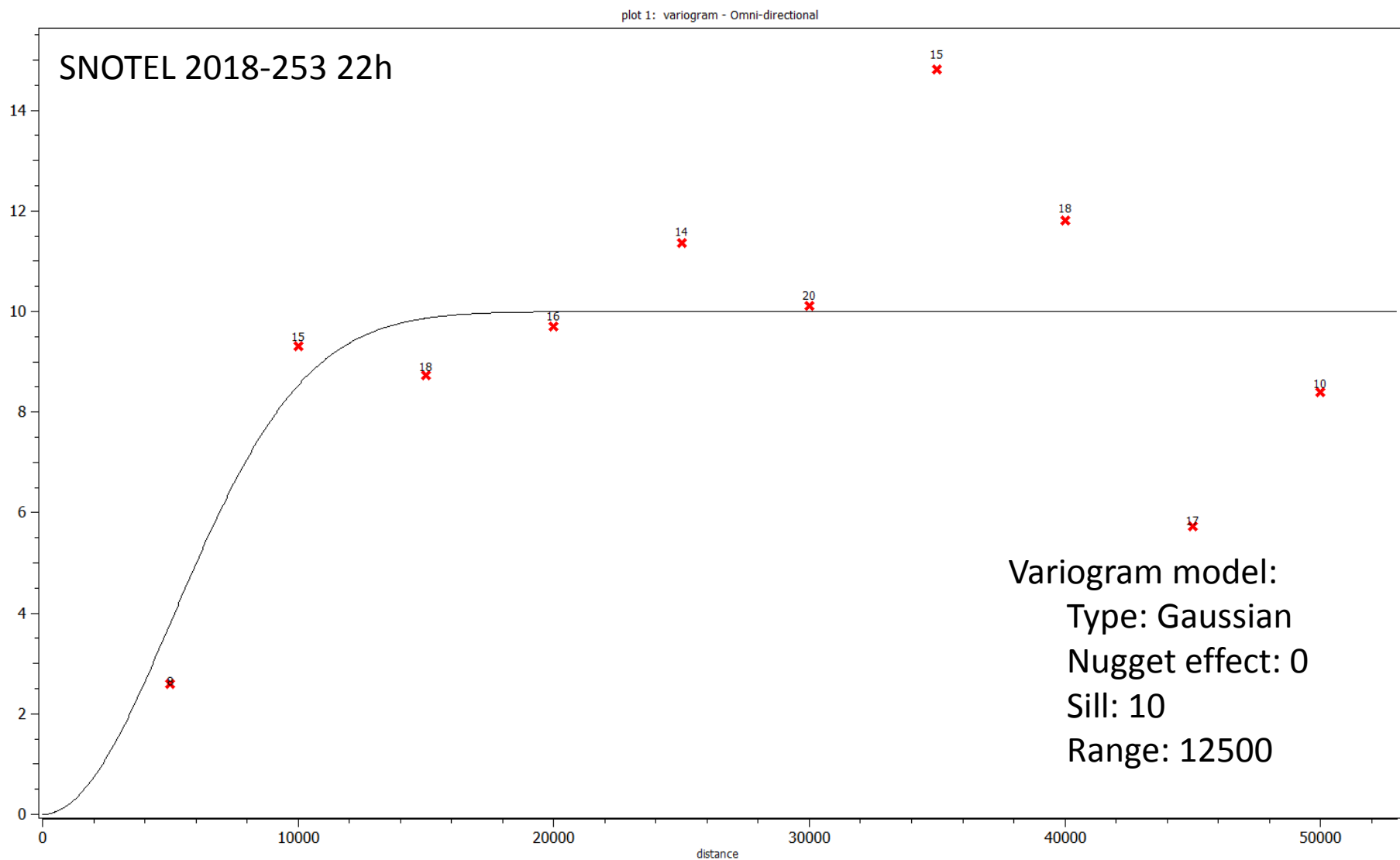
quantify the uncertainty of the estimation through the kriging variance.

Results

Variograms

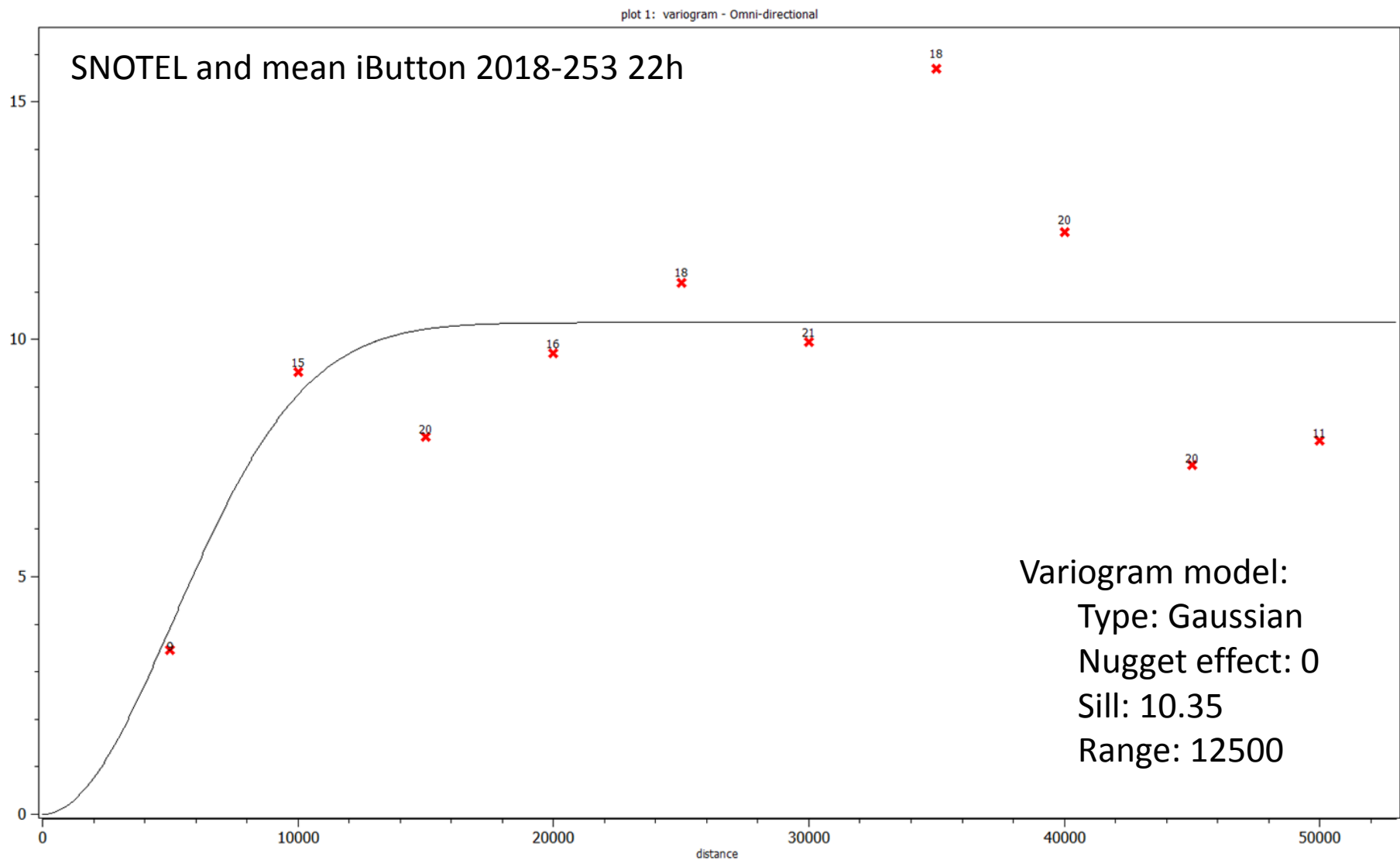


Results Variograms



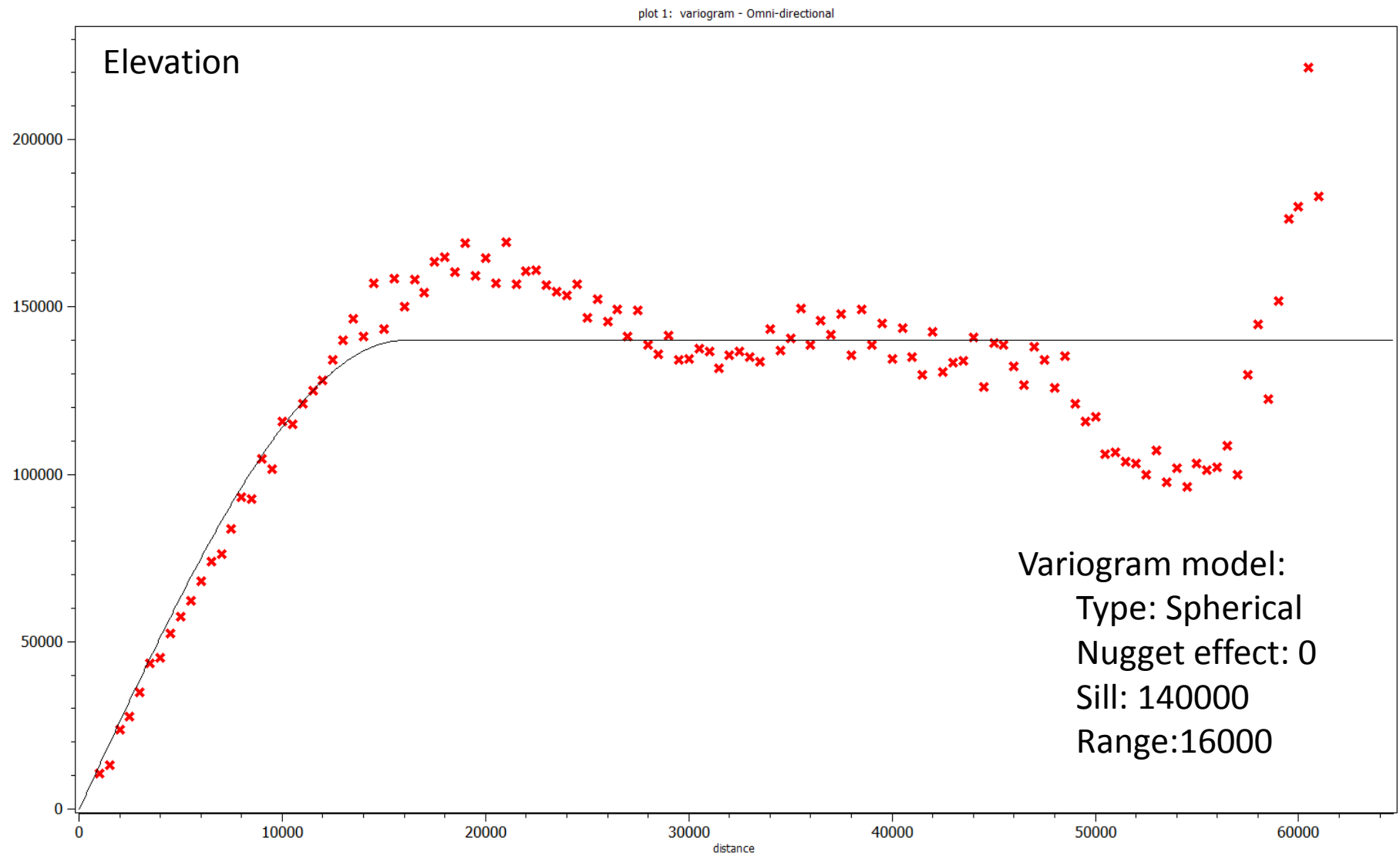
Results

Variograms



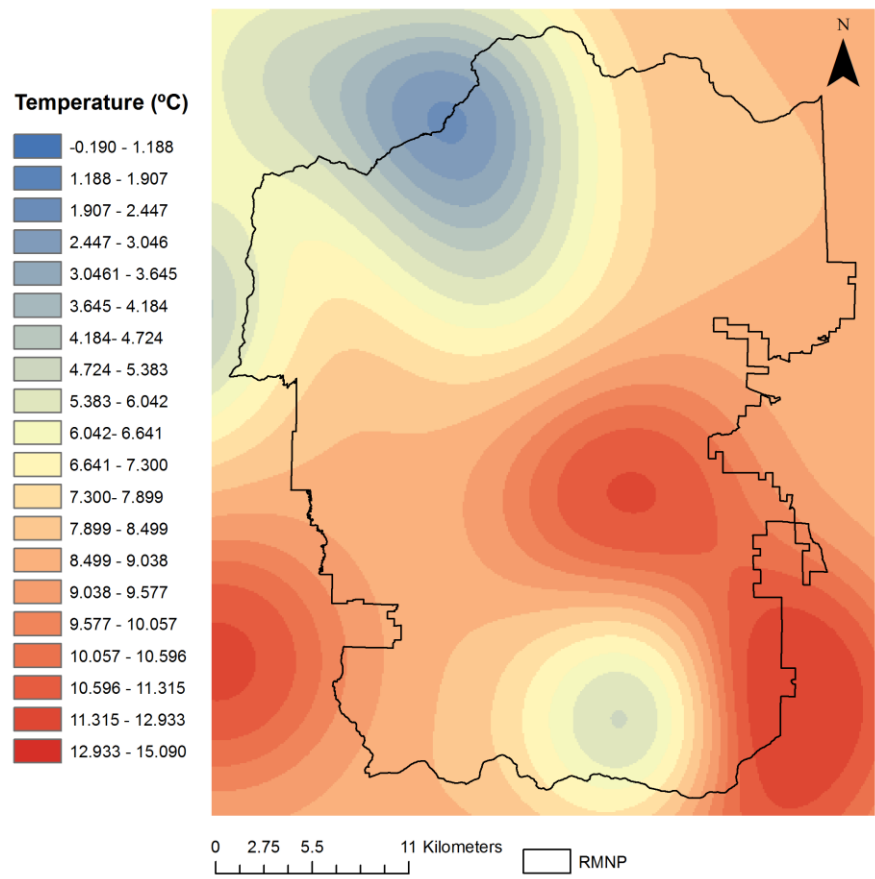
Results

Variograms

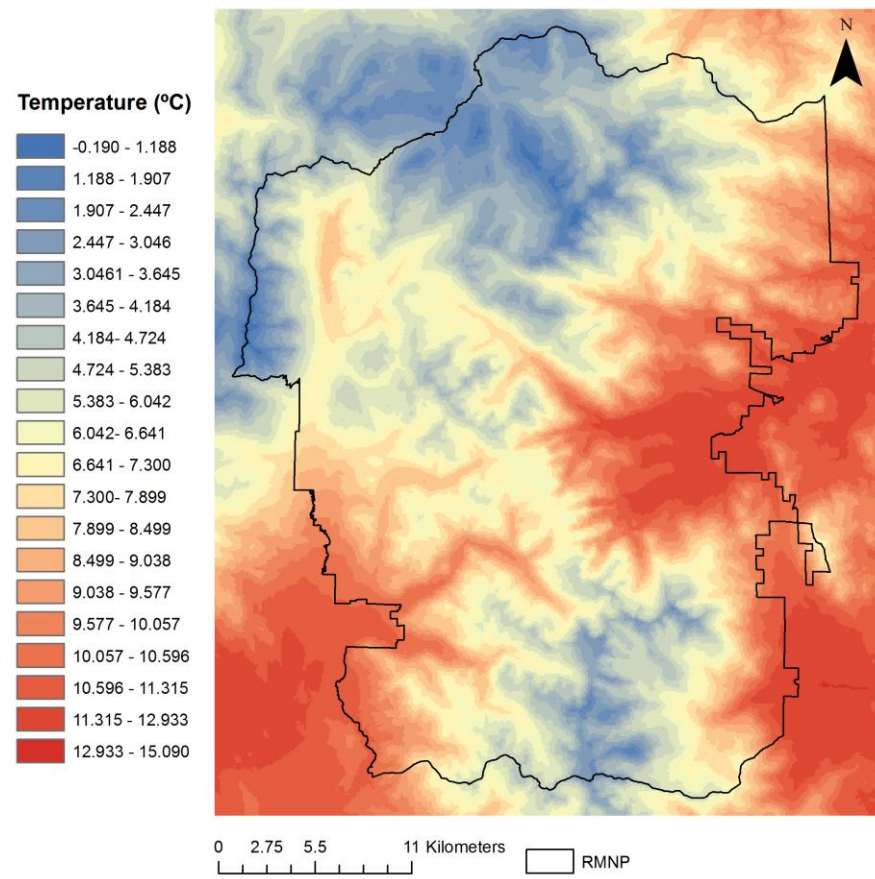


Results

Estimation using SNOTEL data (100m spatial resolution)



Ordinary Kriging (OK)  
SNOTEL 2018-253 22h

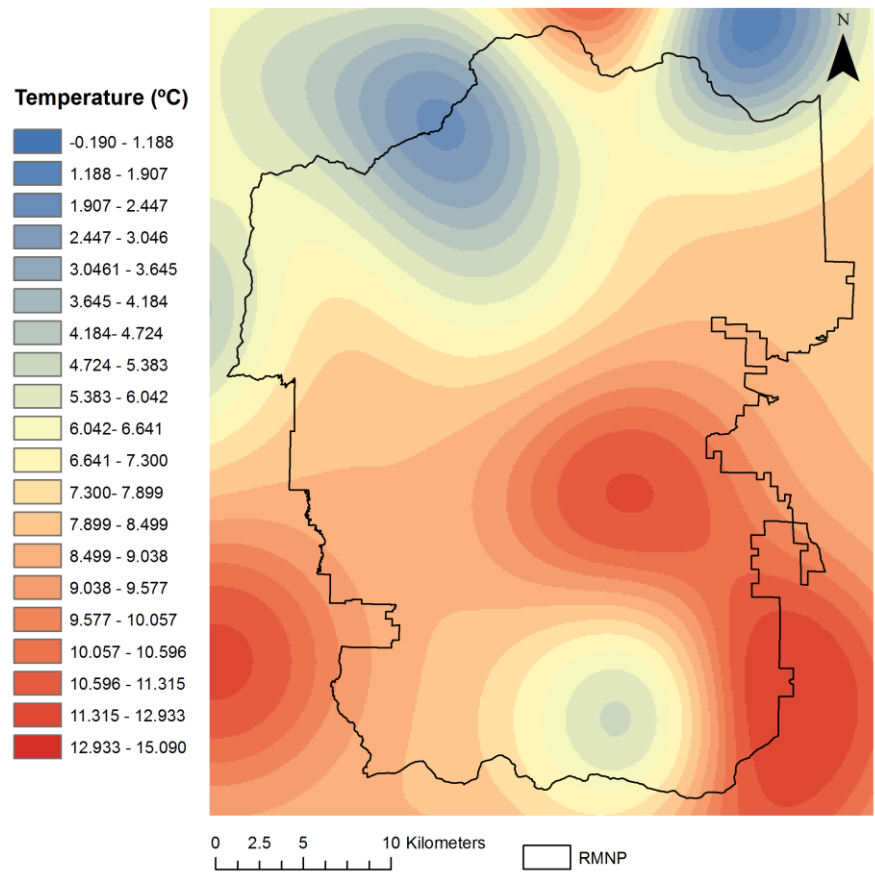


Kriging with External drift (KED)  
SNOTEL 2018-253 22h

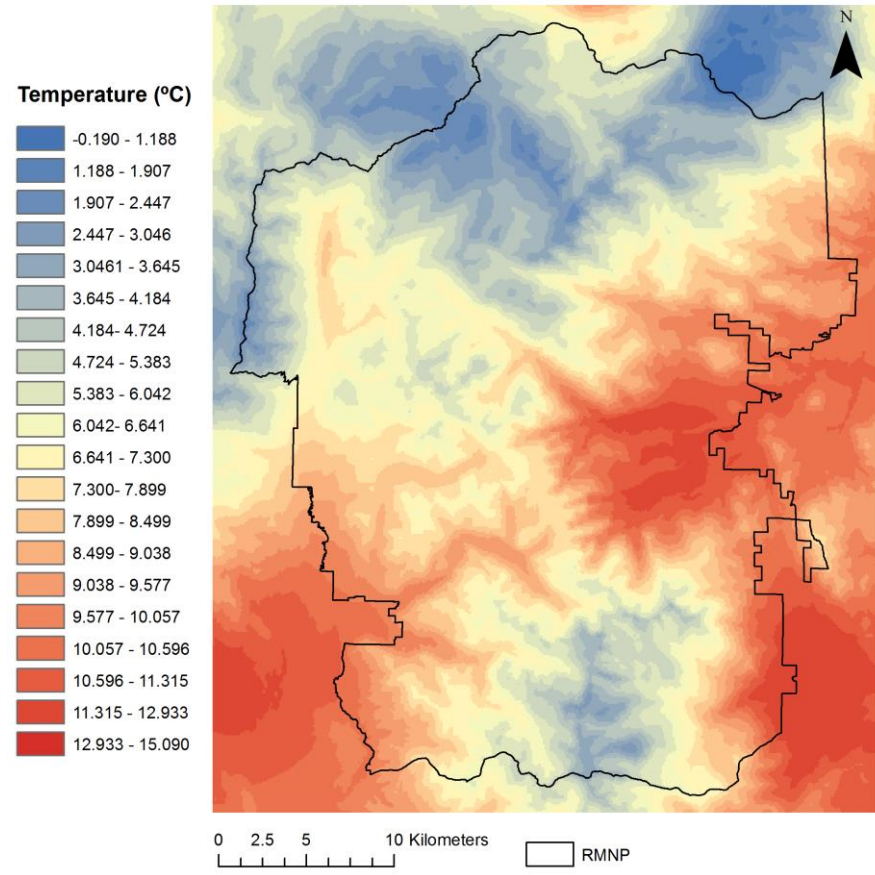


Results

Estimation using SNOTEL data and mean iButton (100m spatial resolution)



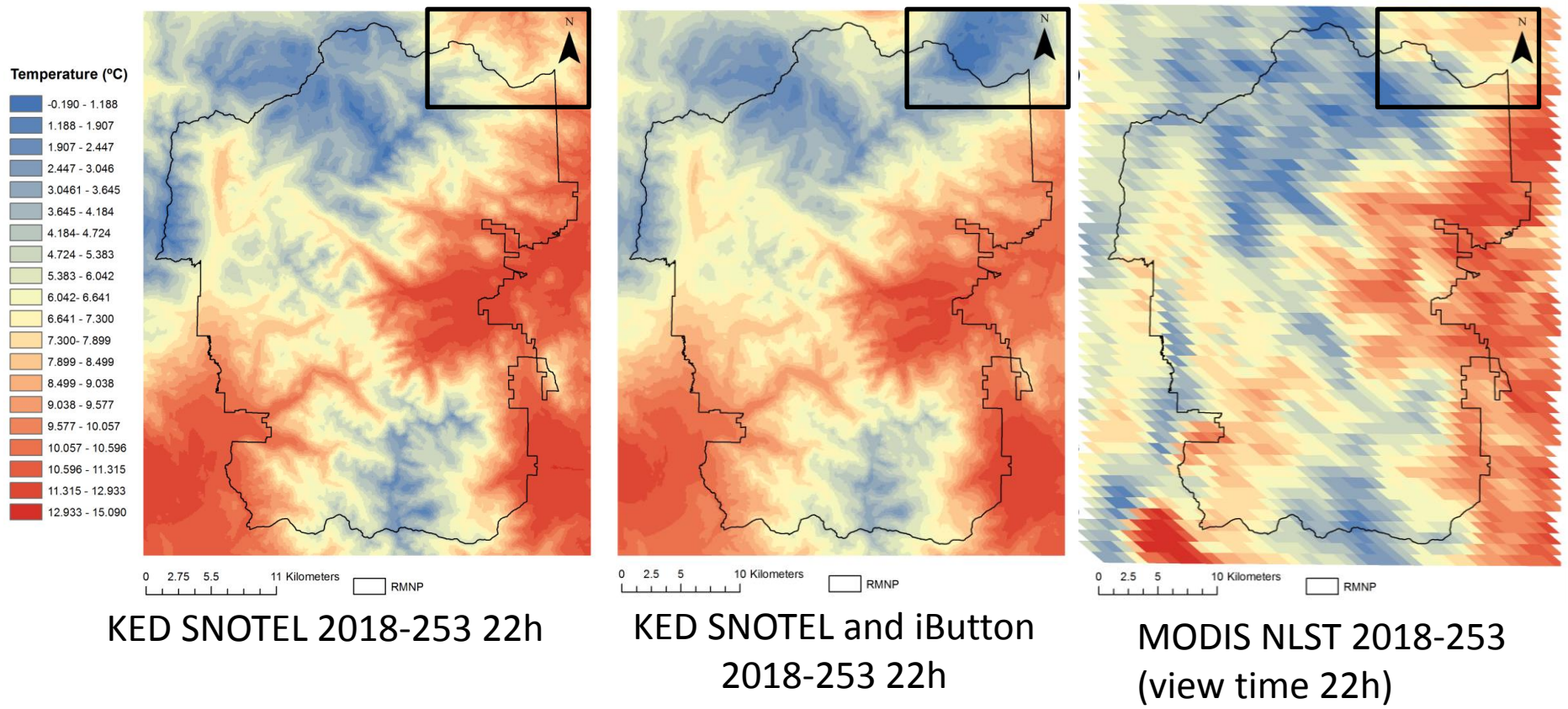
Ordinary Kriging (OK)  
SNOTEL and mean iButton 2018-253 22h



Kriging with External drift (KED)  
SNOTEL and mean iButton 2018-253 22h

# Results

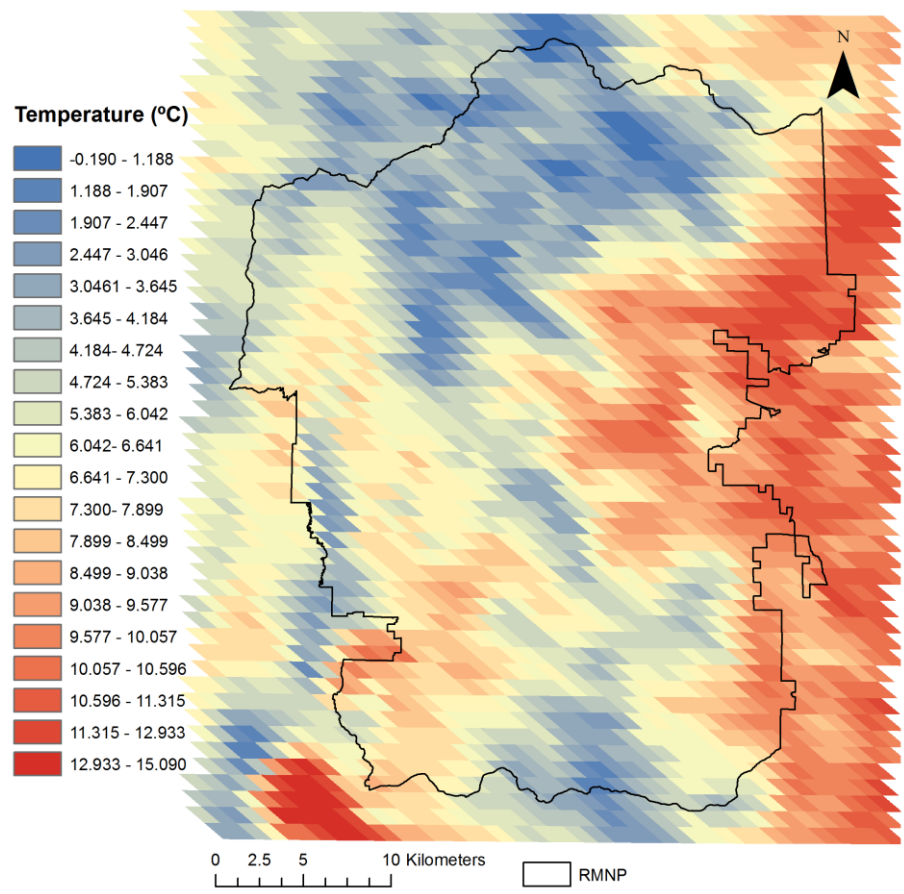
iButton information should not be incorporated for the estimation at large scale:



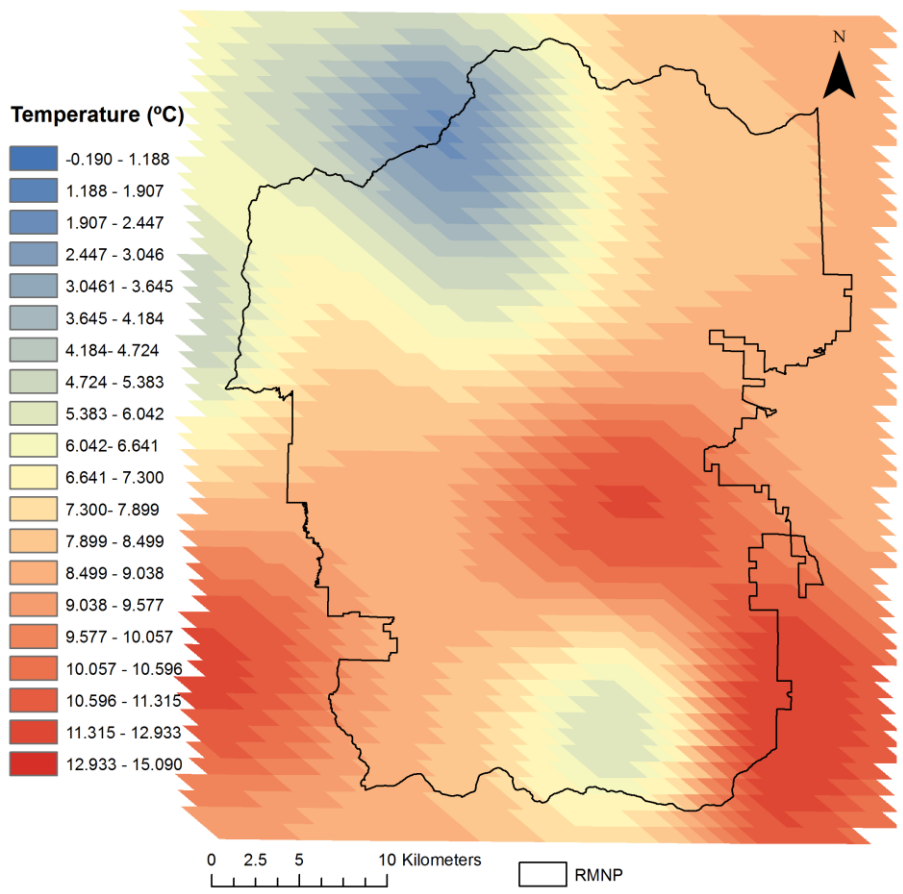
The local phenomena affecting the valley (where iButton are located) cannot be extrapolated to the large scale [see Collados-Lara et al., 2020(submitted to IJOC)]

Results

MODIS LST and SNOTEL at the same areal support



MODIS NLST 2018-253 (view time 22h)

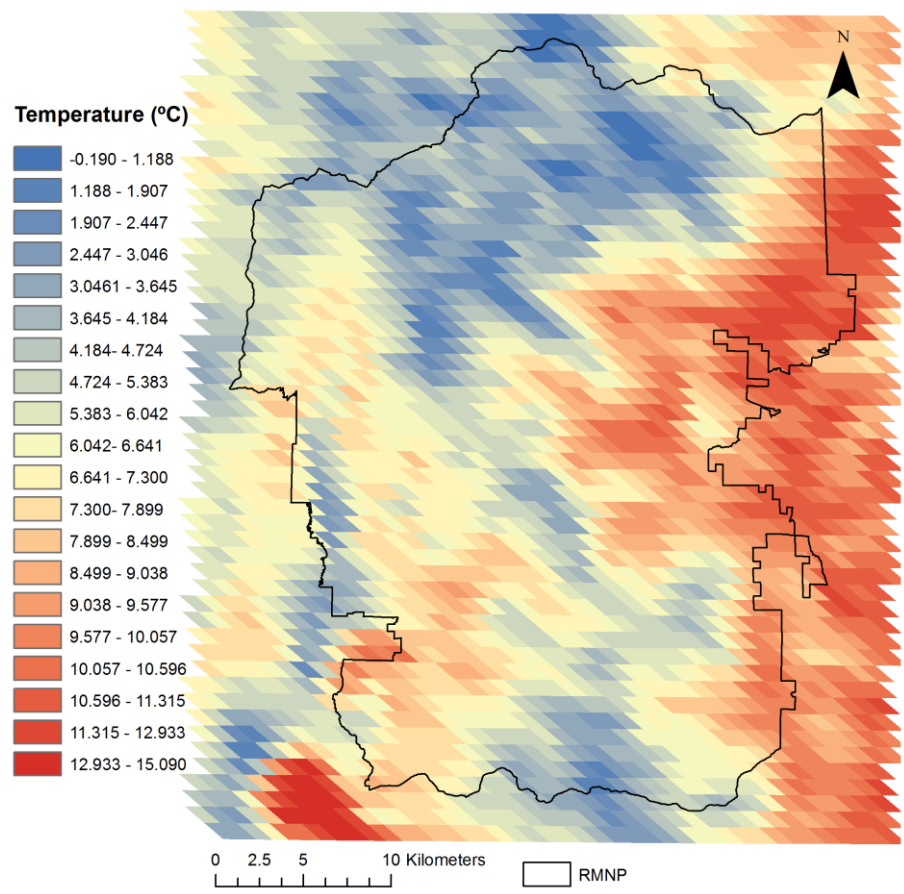


Ordinary Kriging (OK)  
SNOTEL 2018-253 22h

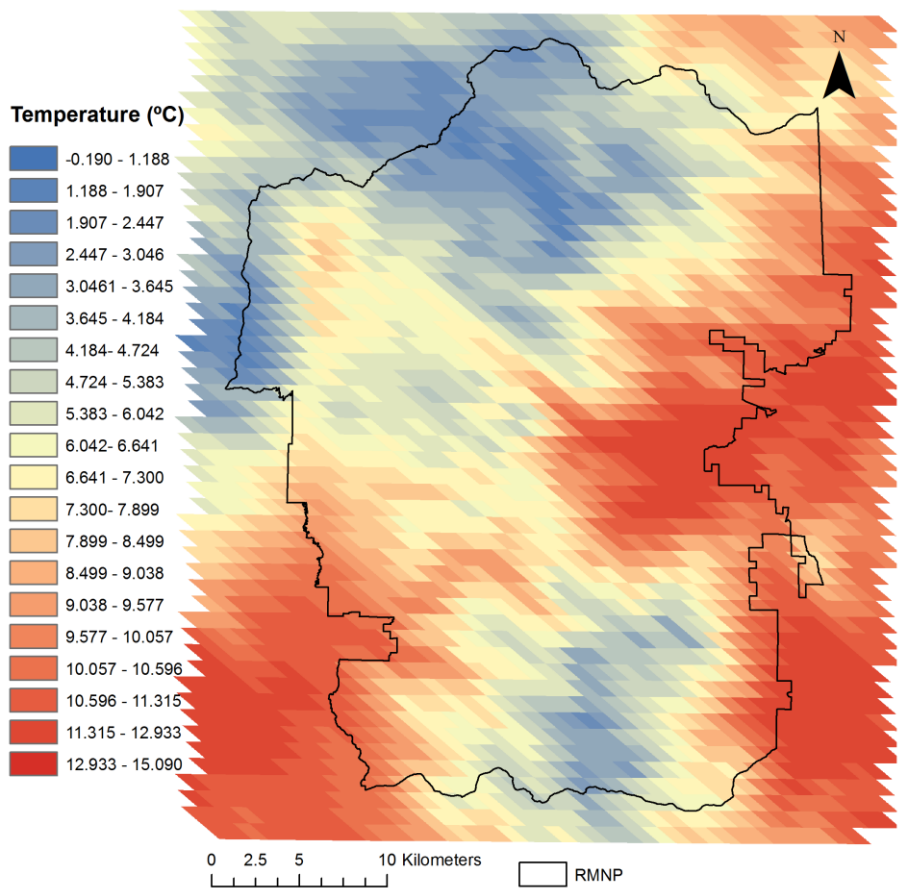


Results

MODIS LST and SNOTEL at the same areal support



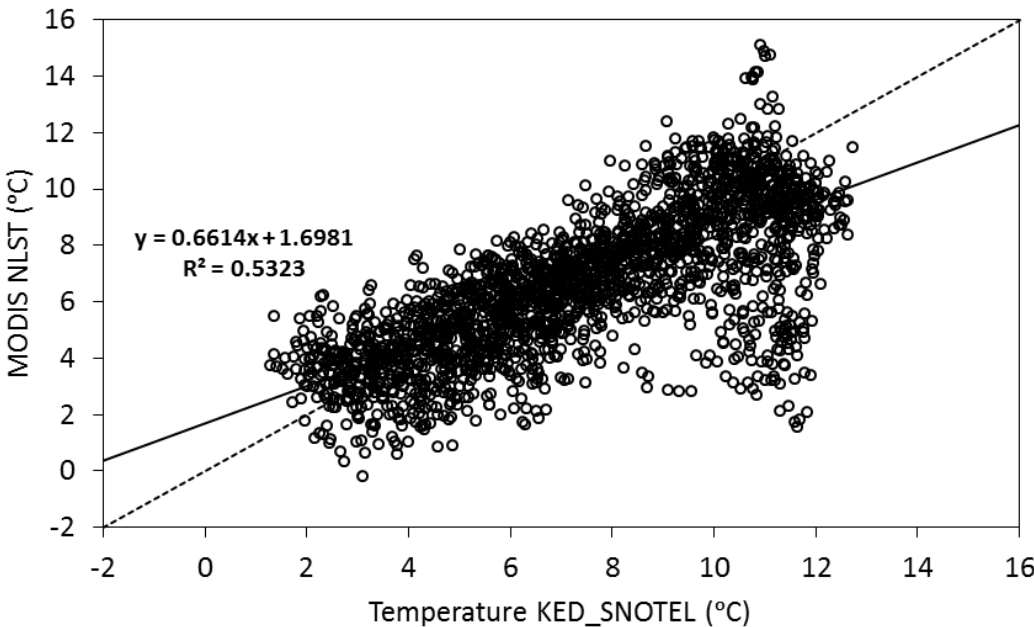
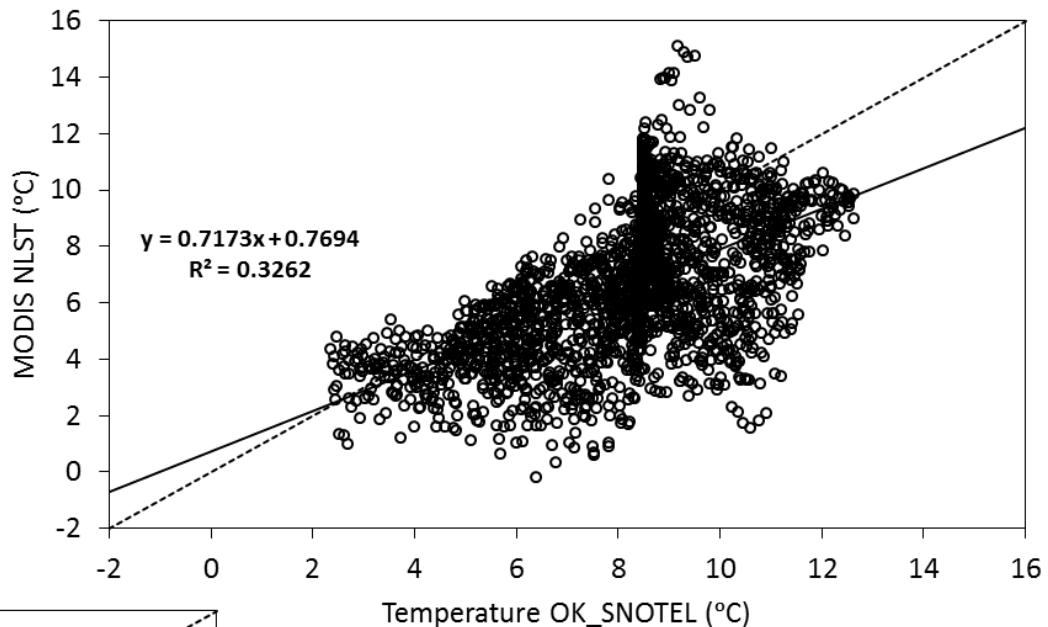
MODIS NLST 2018-253 (view time 22h)



Kriging with External drift (KED)  
SNOTEL 2018-253 22h

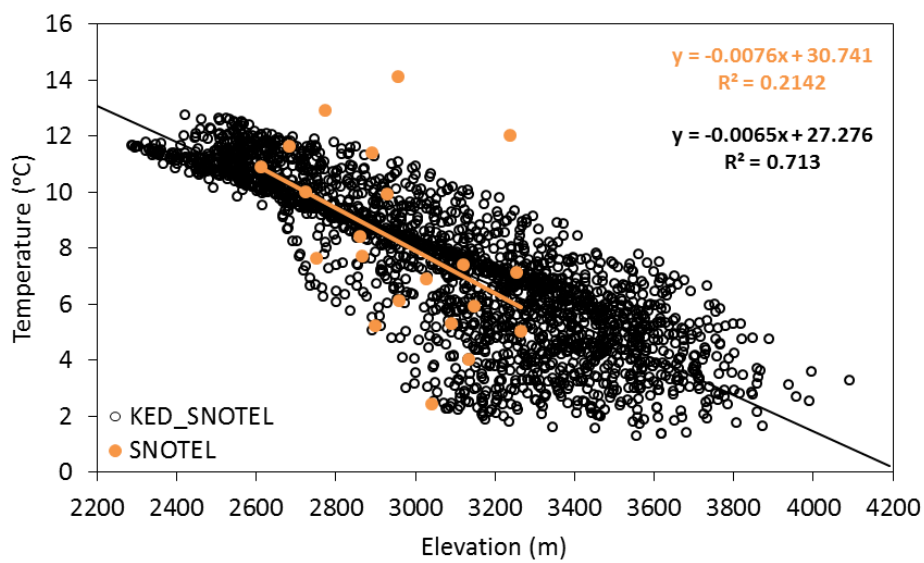
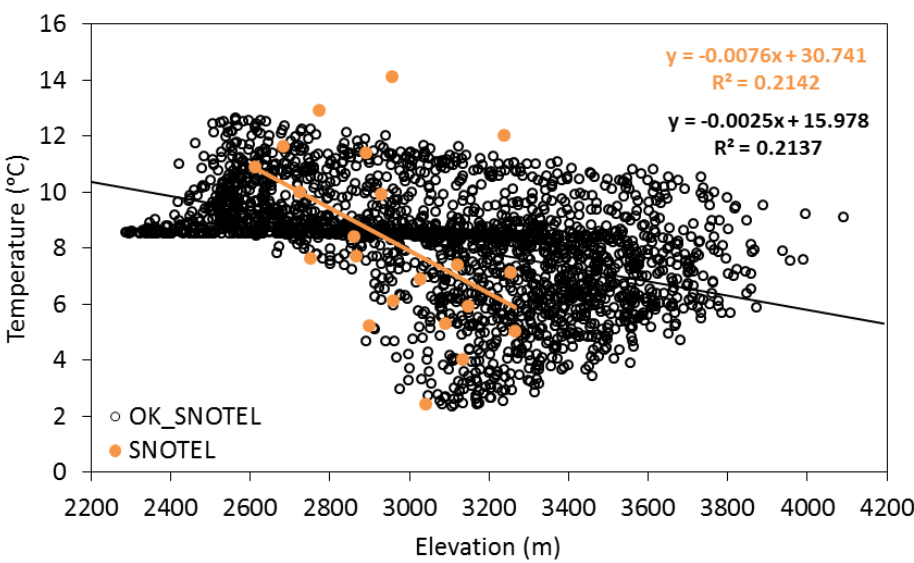
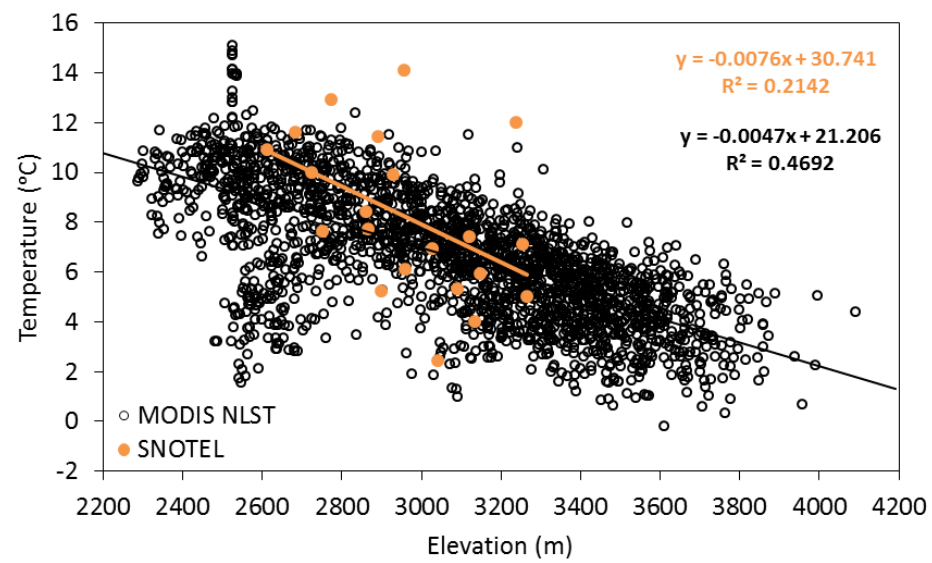
# Results

MODIS LST and SNOTEL at the same areal support



# Results

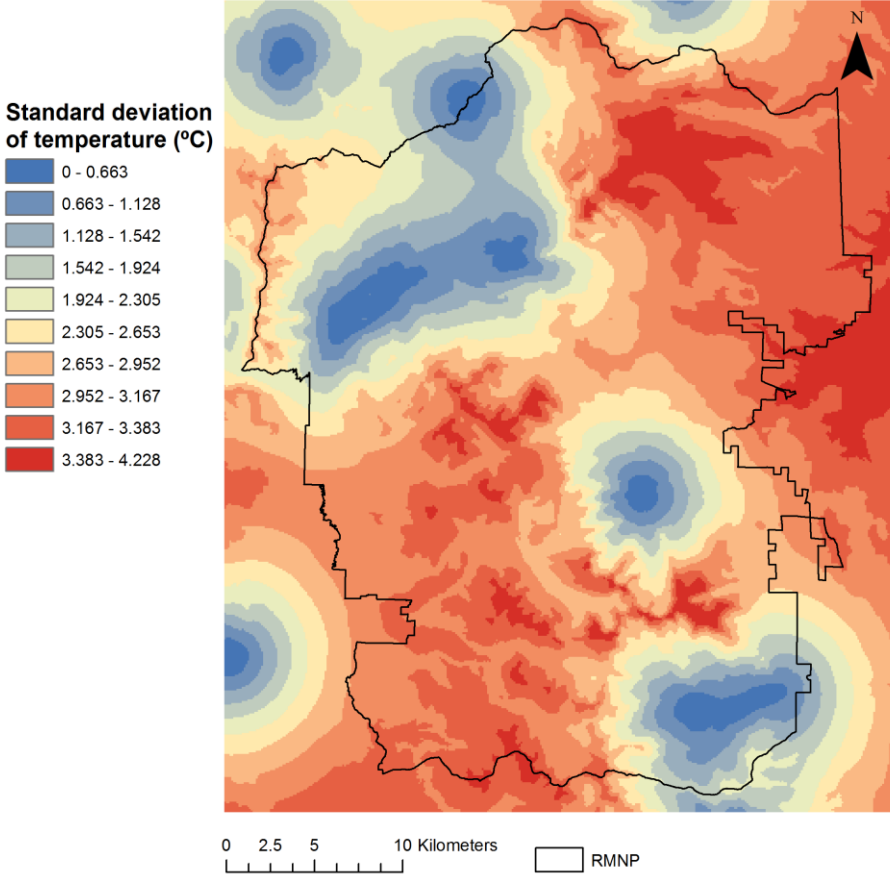
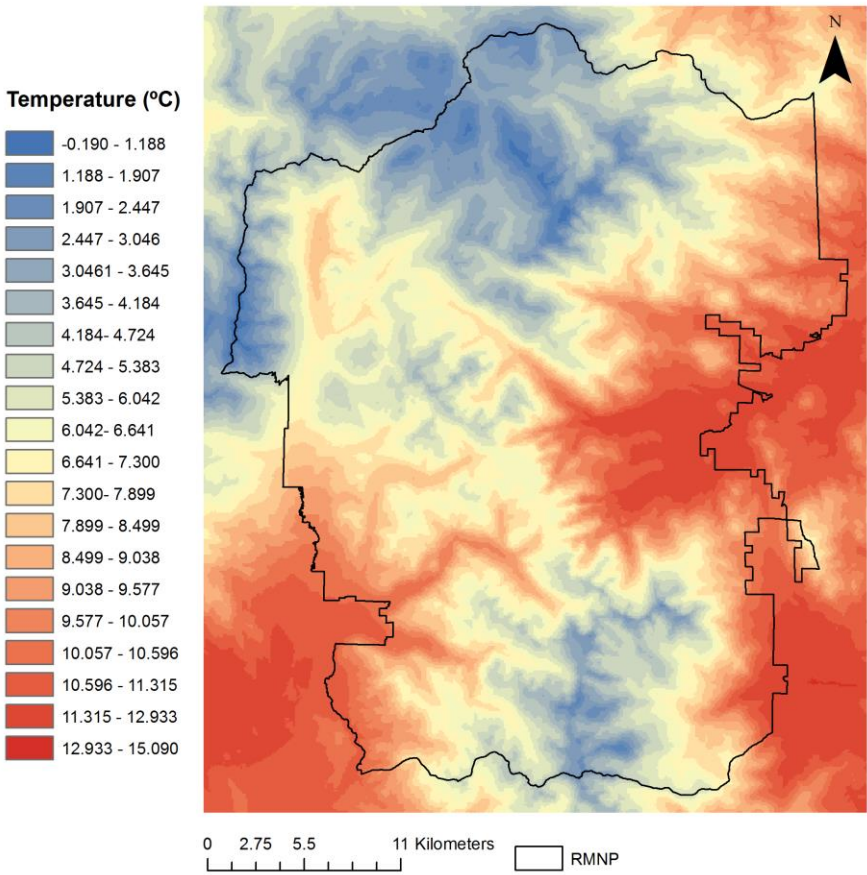
## Relationship with elevation



Results

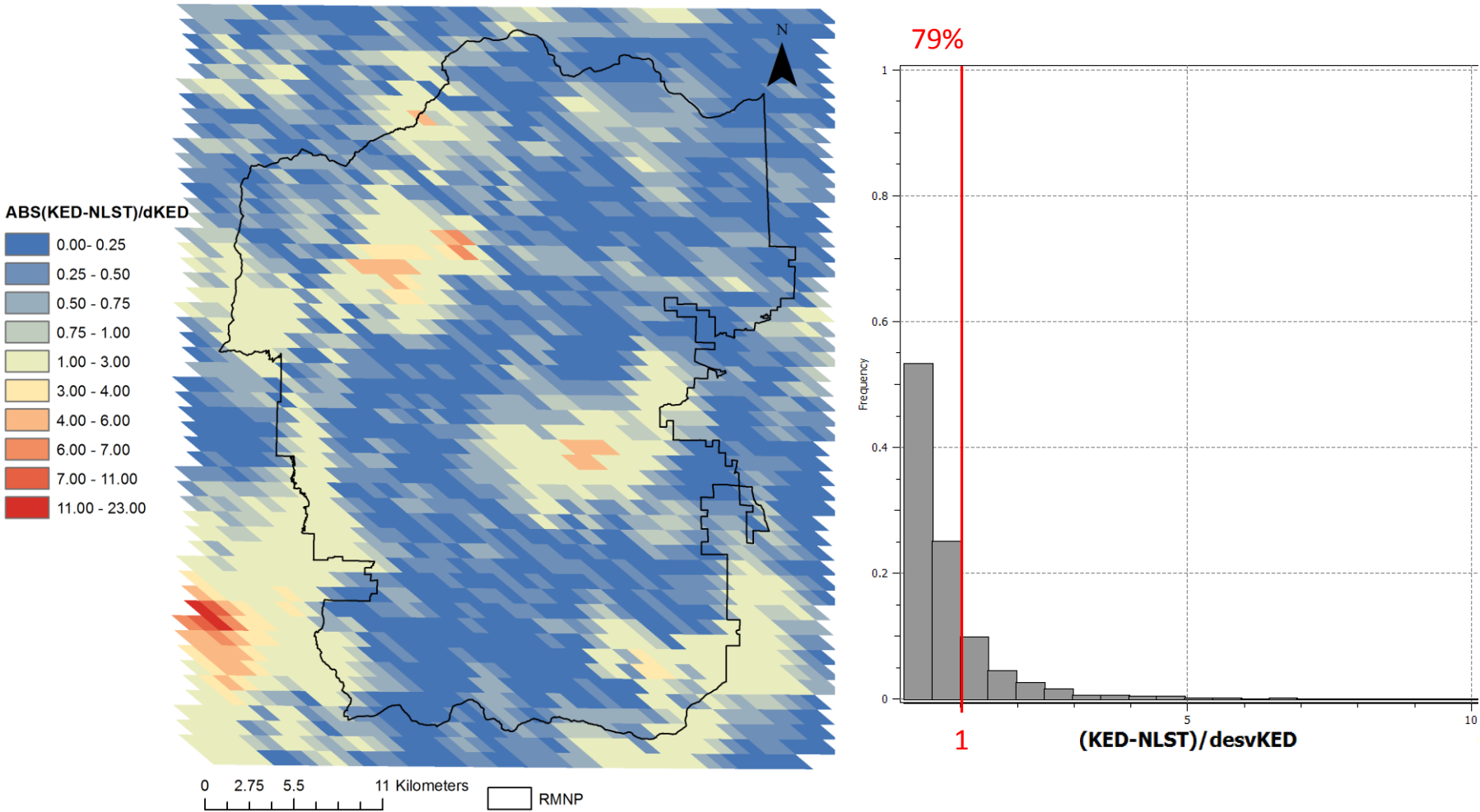
Estimation uncertainty using SNOTEL data (100m spatial resolution)

Kriging with External drift (KED) SNOTEL 2018-253 22h



# Results

MODIS LST and SNOTEL at the same areal support considering estimation uncertainty





## Summary

KED provides more realistic field of temperature than OK (spatial and slope of temperature – elevation relationship)

The local phenomena affecting the valley should not be extrapolated to the large scale

KED (using SNOTEL) and MODIS LST fields maps (at the same areal support) are similar but they have slightly different slope of the temperature – elevation relationship

79% of the MODIS LST are within the range (KED estimation –  $\sigma$ , KED estimation +  $\sigma$ )