

Analysis of parallel measurements of daily maximum and minimum temperatures in Greece

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Introduction

- The necessity of homogenized weather time series is beyond any doubt.
- A common cause of non-climate disturbance of weather time series is the transition to AWS.
- Comparison of time series obtained by conventional and AWS offers valuable information for homogenization exercises.
- In Greece, this transition took place in the middle of 00's, but no systematic assessment of it's impact on the time series has been performed until now.
- The aim of this presentation is to provide some first results.

Rationale

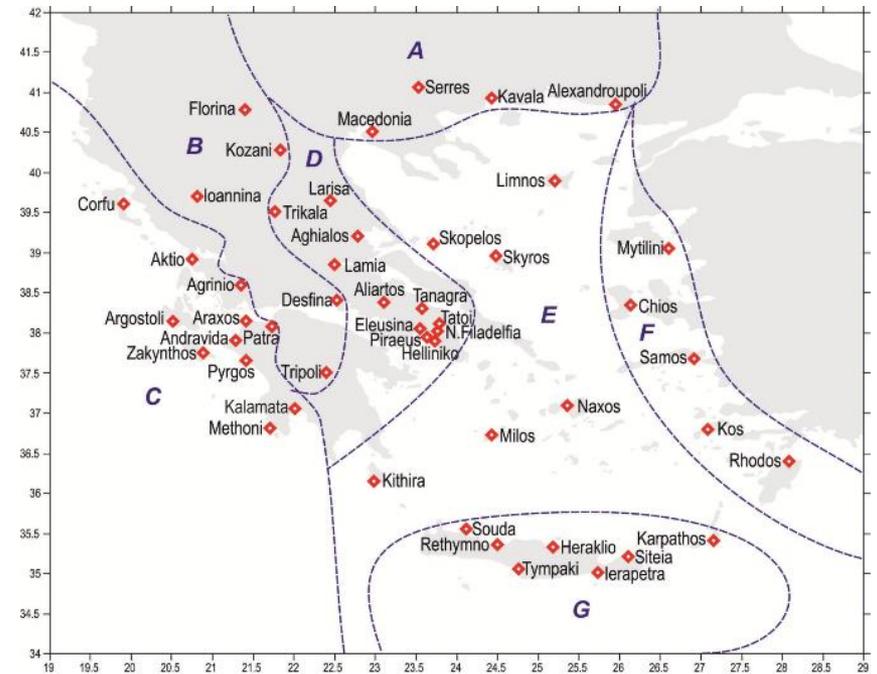
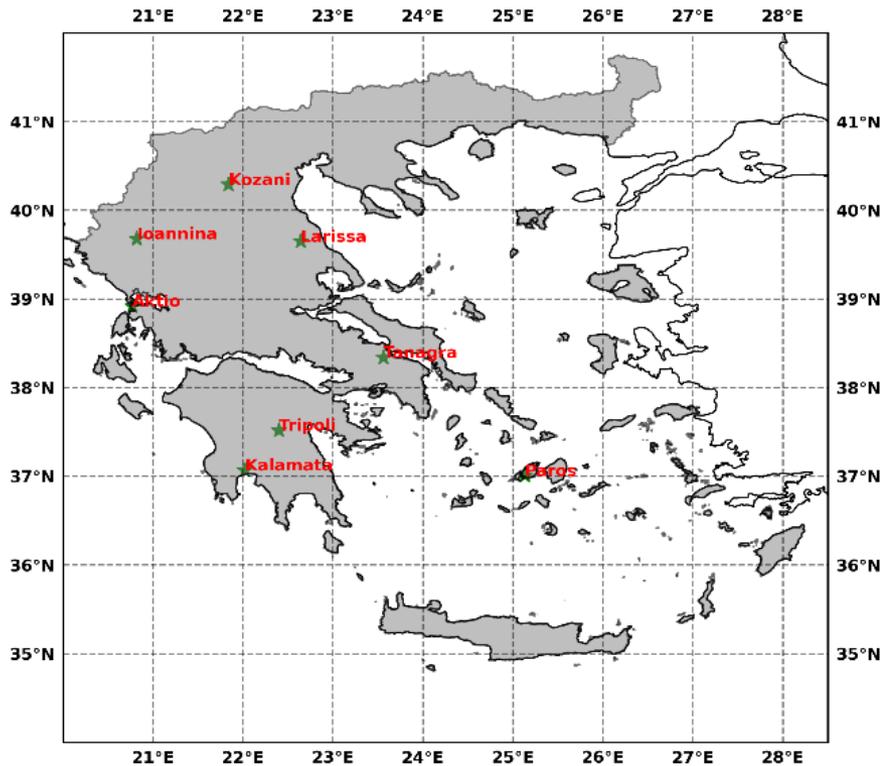
- The weather and climate station network in Greece, part of the WMO network is that of the Hellenic National Weather Service (HMNS).
- The network suffers from two main causes of inhomogeneity:
 - The relocation of stations in the '80s from urban environment to airports.
 - The transition from conventional (Stevenson screen) stations to AWS, in the '00s.
- Unfortunately, the number of locations where parallel measurements were undertaken and their duration, have been rather limited.

Parallel Measurement Station List

WMO ID	Station name – ICAO code	Parallel measurements period	Latitude (°)	Longitude (°)	Altitude (m)	Climatic zone
16632	Kozani - LGKZ	1/2009 – 12/2011	40° 17' 22.20"	21° 50' 29.40"	621.00	B
16642	Ioannina - LGIO	11/2010 – 12/2012	39° 41' 41.70"	20° 49' 09.50"	483.36	B
16643	Aktio - LGPZ	1/2013 - 12/2014	38° 55' 19.17"	20° 46' 07.79"	1.47	C
16648	Larissa - LGLR	1/2009 – 3/2012	39° 38' 45.80"	22° 27' 36.55"	71.15	D
16699	Tanagra - LGTG	1/2009 – 2/2012	38° 20' 07.44"	23° 33' 46.44"	138.05	D
16710	Tripoli - LGTP	1/2012 – 12/2014	37° 31' 28.92"	22° 23' 49.92"	650.57	B
16726	Kalamata - LGKL	11/2012 – 12/2014	37° 04' 09.12"	22° 01' 21.36"	6.20	C
16766	Paros - LGPA	08/2010 – 12/2013	37° 00' 41.24"	25° 07' 44.85"	33.30	E

Parameters analyzed: daily TX, TN and DTR

Parallel Measurement Station Locations



Only 4 out of the 8 climate zones of Greece are covered.

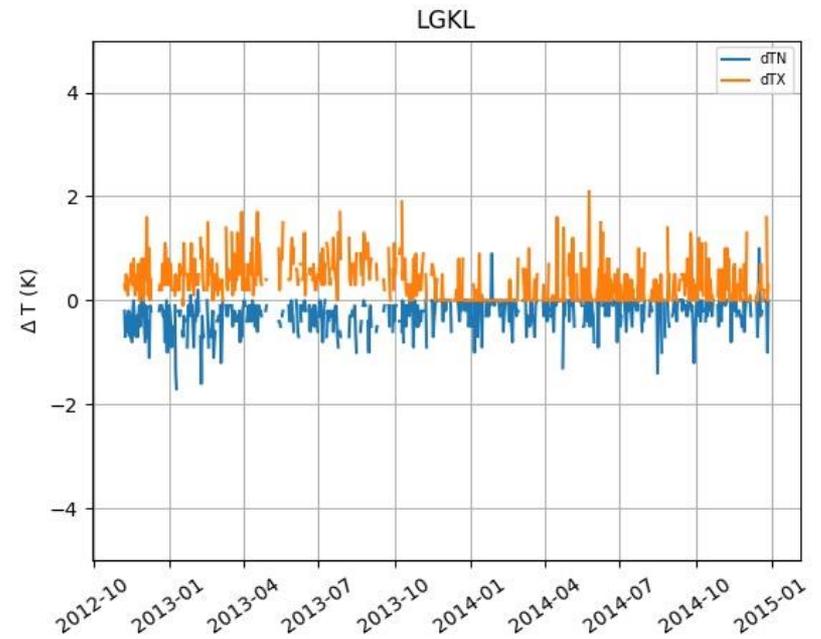
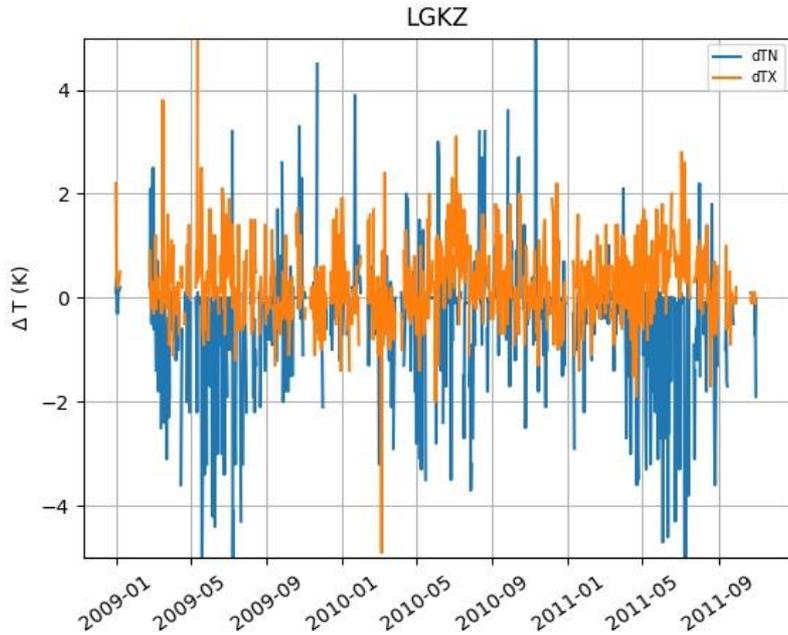
$$\Delta TX = TX_{AWS} - TX_{Stevenson}$$

Station name – ICAO code	Number of points (-)	Mean value ± Standard deviation (°C)	Minimum value (°C)	Maximum value (°C)
Kozani - LGKZ	776	0,3 ± 0,8	-4,9	5,4
Ioannina - LGIO	531	1,2 ± 0,9	-1,5	5,3
Aktio - LGPZ	517	0,3 ± 0,4	-2,8	2,2
Larissa - LGLR	1079	0,6 ± 0,4	-1,1	4,2
Tanagra - LGTG	1032	0,6 ± 0,4	-1,4	4,3
Tripoli - LGTP	584	0,0 ± 0,2	-2,7	1,9
Kalamata - LGKL	608	0,4 ± 0,4	-0.1	2,1
Paros - LGPA	796	0,3 ± 0,5	-6,1	3,1

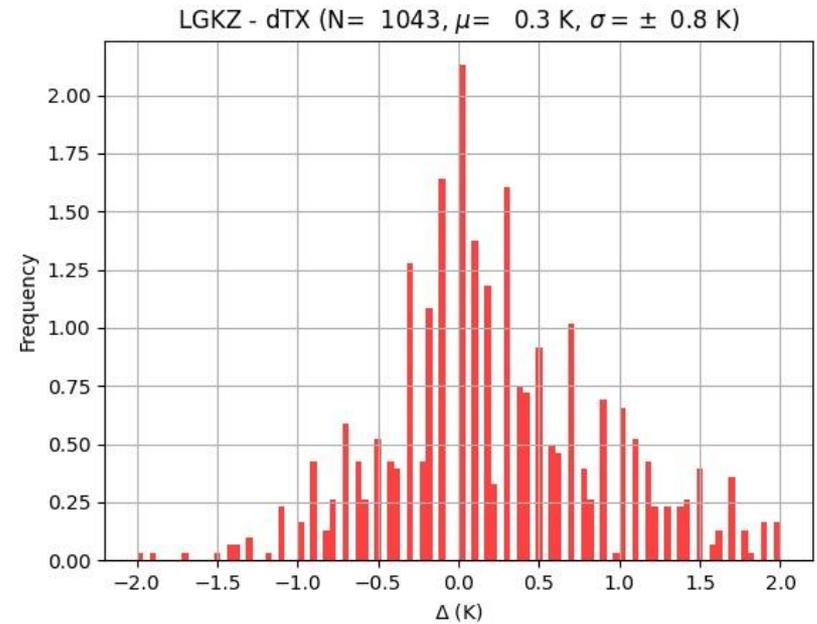
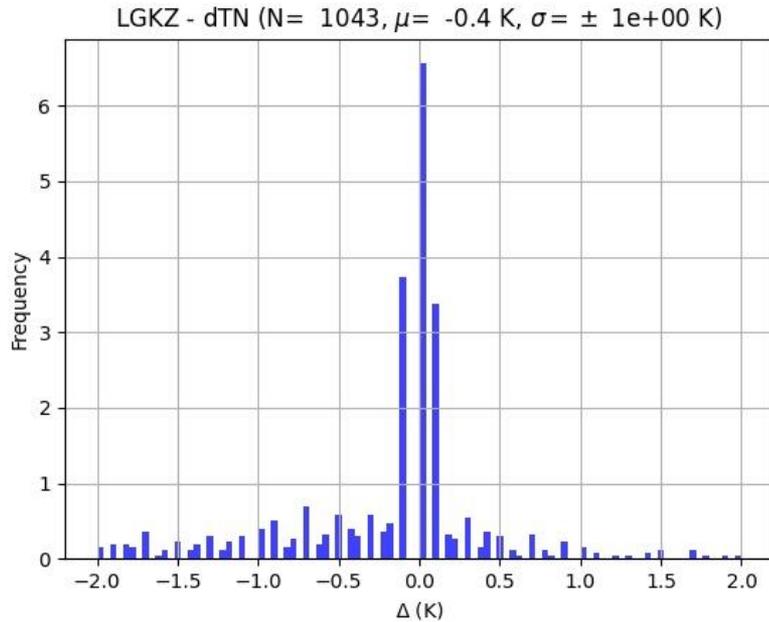
$$\Delta TN = TN_{AWS} - TN_{Stevenson}$$

Station name – ICAO code	Number of Points (-)	Mean value ± Standard deviation (°C)	Minimum value (°C)	Maximum value (°C)
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Ioannina - LGIO	531	-1,2 ± 1,2	-7,4	3,8
Aktio - LGPZ	517	-0,3 ± 0,4	-2,4	2,7
Larissa - LGLR	1079	-0,5 ± 0,5	-3,0	4,0
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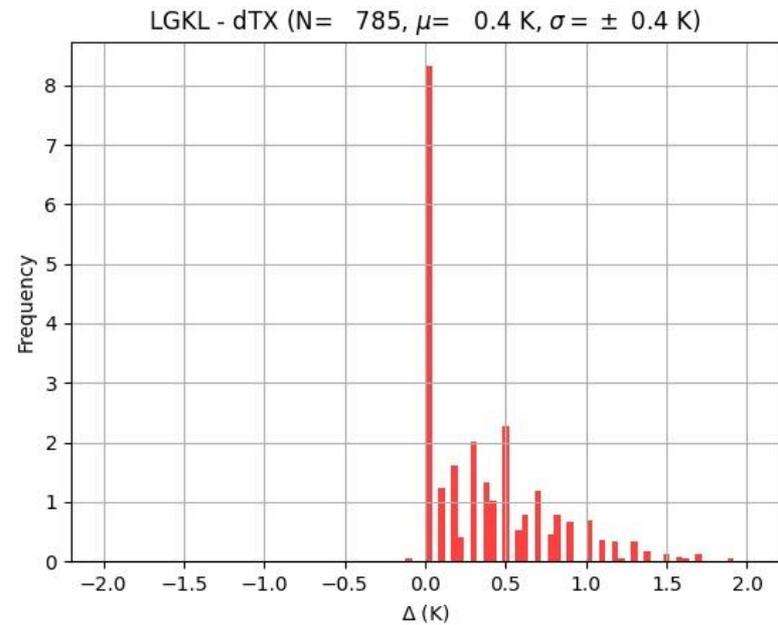
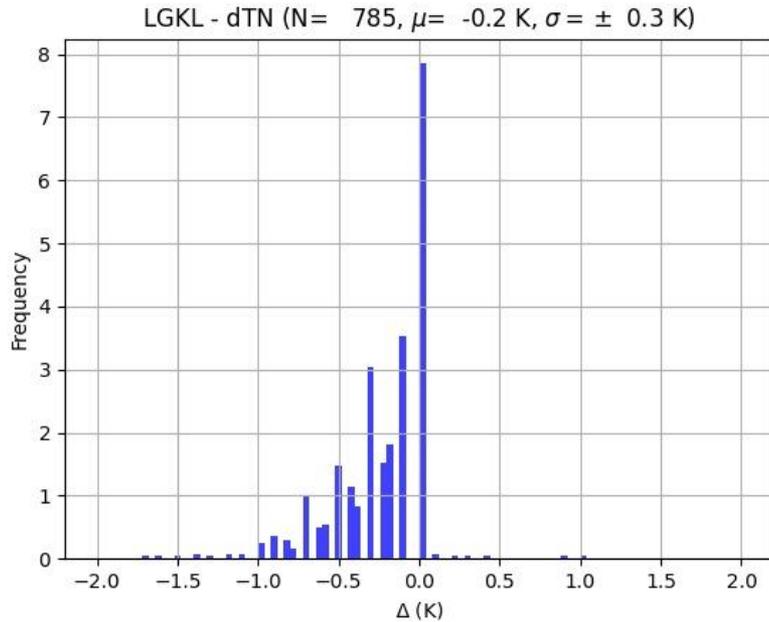
Time Series Plots



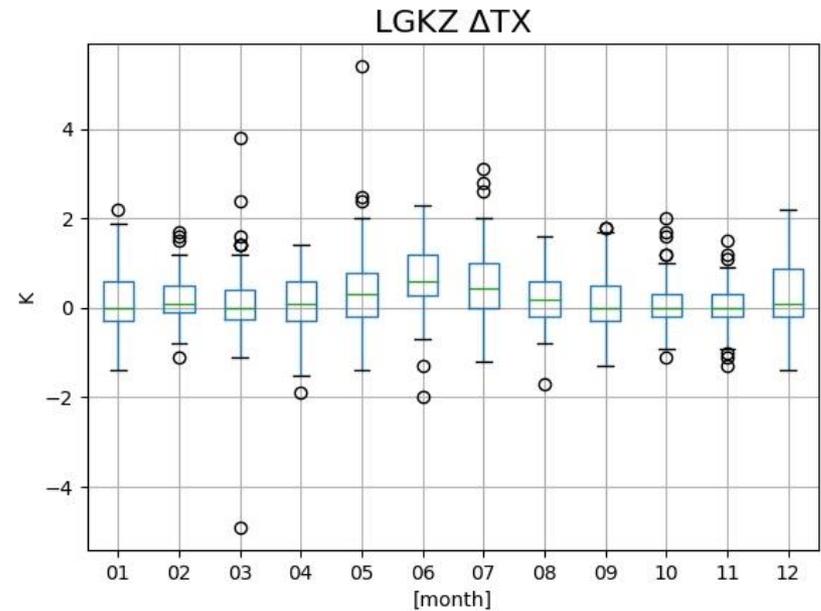
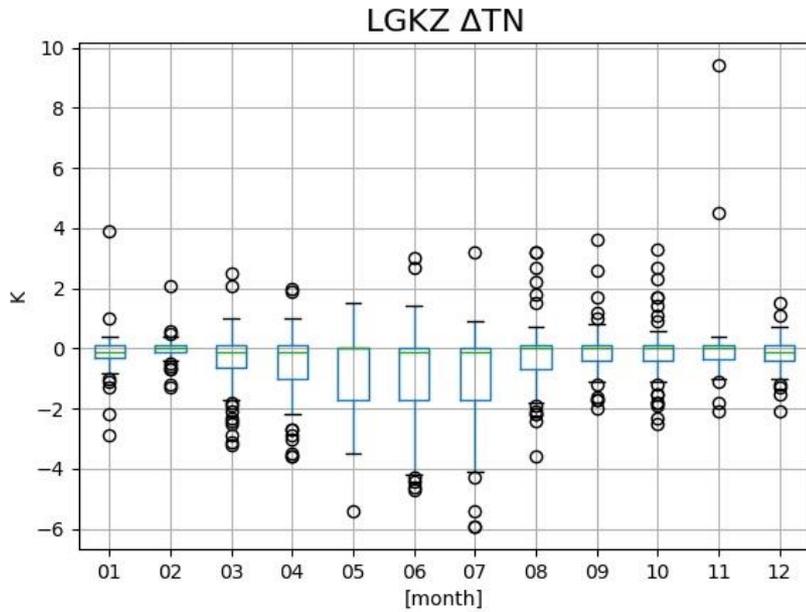
Histograms LGKZ



Histograms LGKL

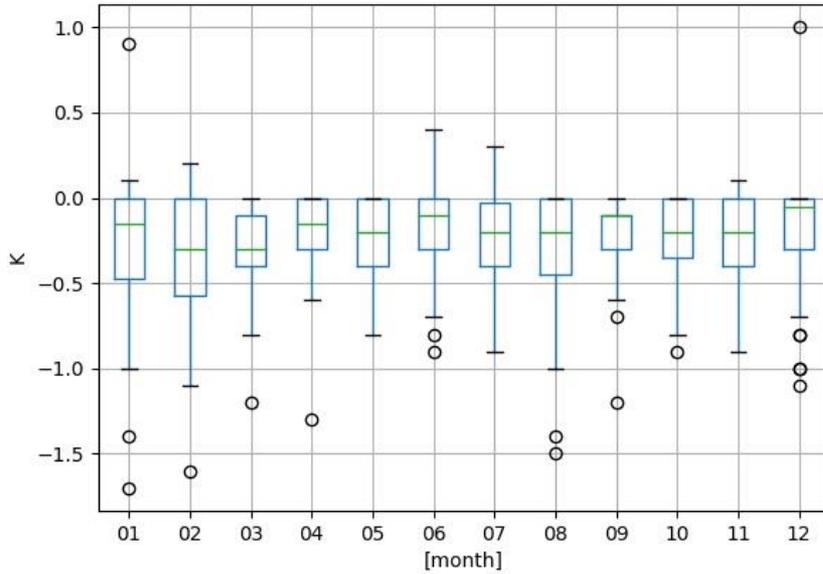


Boxplots LGKZ

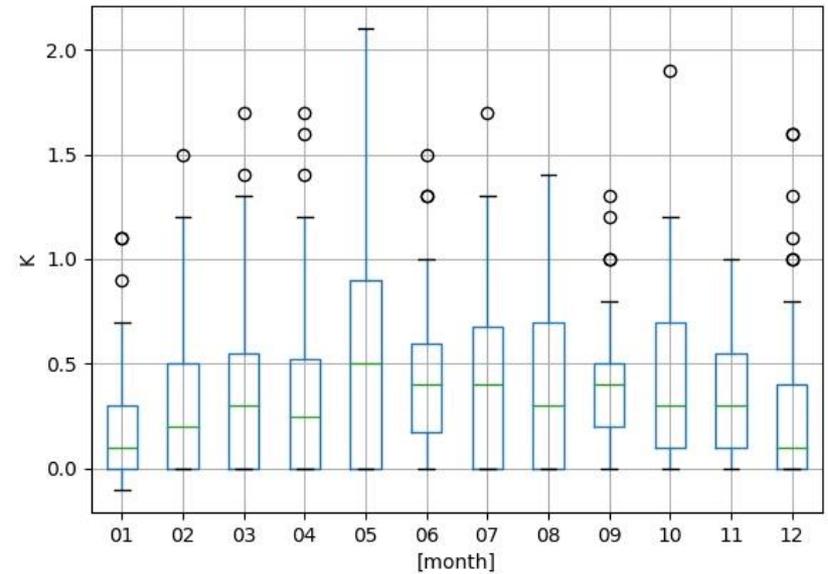


Boxplots LGKL

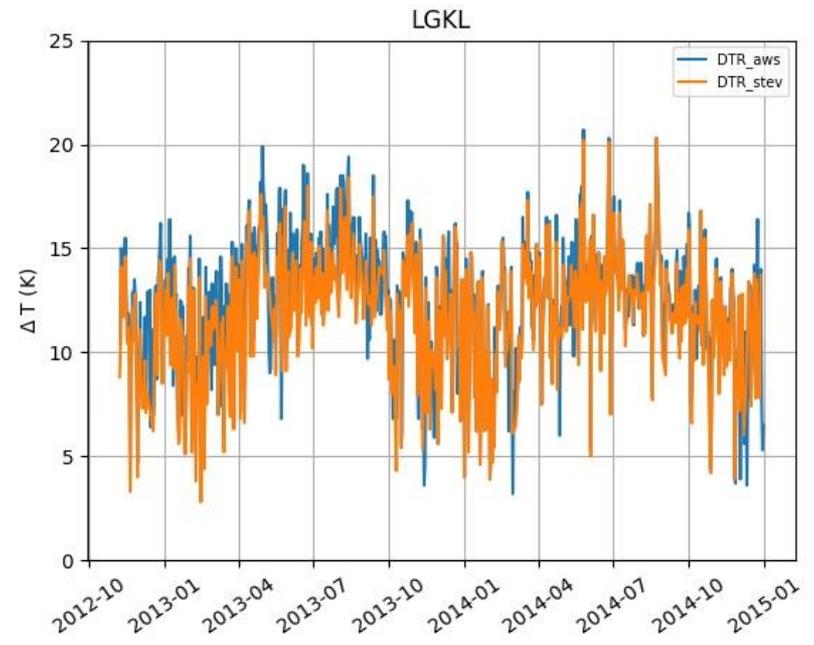
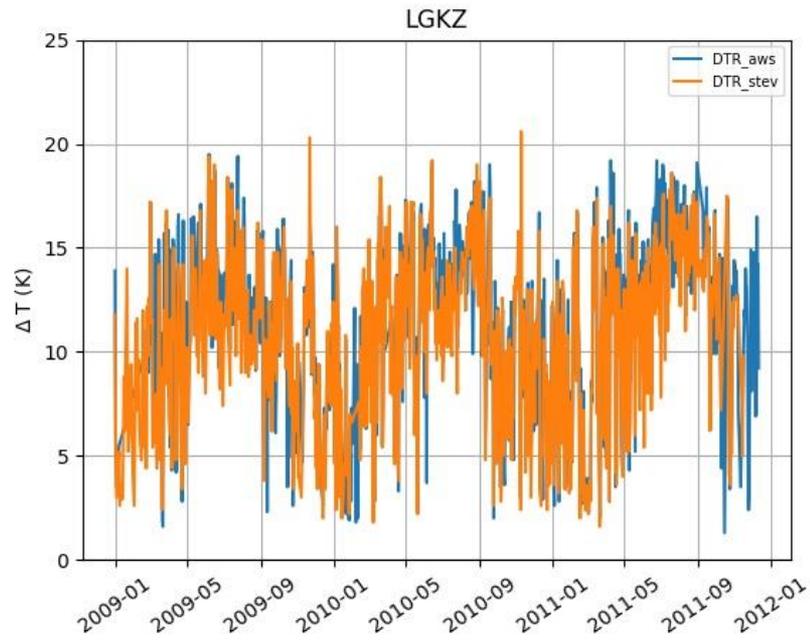
LGKL Δ TN



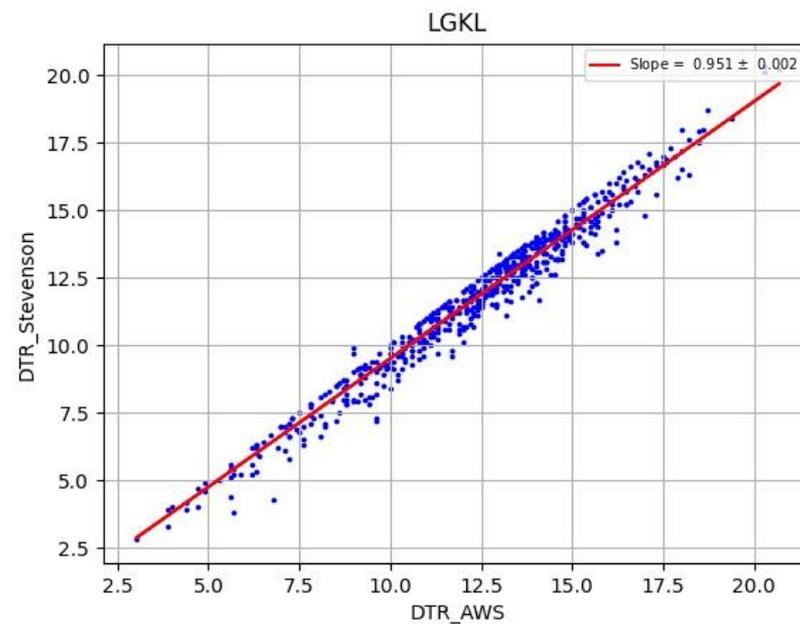
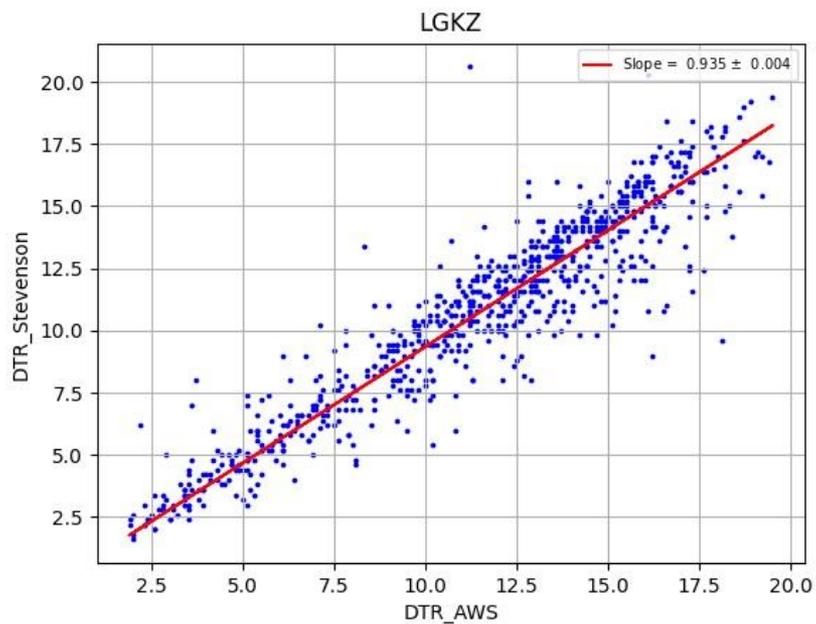
LGKL Δ TX



DTR (1)



DTR (2)



Conclusions

- The differences between TN and TX reported by conventional and AWS are of about 0.5 K in average for all stations.
- AWS tend to record lower TN values and higher TX values compared to conventional station readings throughout the year (no seasonality).
- This behavior results to higher DTR values via the AWS readings.
- The recorded differences are expected to introduce breaks in long term time series of daily measurements.
- Further investigation is required.

Thank you for your attention!

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