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Henttonen, H. & Maekelae, A.

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Preface

This study contributes to the construction of the environmental data base of the Regional Acidification INformation and Simulatin (RAINS) model. It uses long-term data from European weather stations for calculating local values of temperature, precipitation and the effective sum of yearly temperature. The method presented in this paper involves three dimensions; latitude, longitude, and altitude, thus accounting for the lapse rates of temperature and the variation of precipitation with altitude. This feature is particularly attractive for applications in Central Europe where the topography is marked with high altitudinal gradients.

The method is currently available to all models included in the RAINS system, and it has already been used in the direct forest impact submodel. As the calculations of local values of the meteorological variables are not restricted to a particular grid size, the method has also wider applicability independent of the RAINS system.

R.W. Shaw
Leader, Acid Rain Project

Acknowledgements

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Abstract

The present paper presents a method for estimating the local values of meteorological variables from measurements in the vicinity of the subject point. Two interpolation methods are considered: the moving averages method, which calculates a weighted average of observations in the neighbourhood of the subject point, and the combined method, which improves the moving averages estimate by utilizing the statistical dependence on latitude and altitude of the variables.

The methods are applied to the estimation of the local values of monthly mean temperature, monthly precipitation sum, and the effective temperature sum in Europe. The input data consists of 30-year time series of monthly values from a network of meteorological stations, comprising 666 stations for monthly mean temperature and 517 for precipitation.

The methods are tested by subtracting one station at a time from the observation network and calculating the values of the climatic variables from the rest of the data. The root mean square error (RMSE) of the smoothed mean temperature in the period May-August is approximately 0.7 °C, and that of the precipitation sum in the order of 70 mm. In areas with a denser network of observations, the RMSE is lower.

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Estimation of Local Values of Monthly Mean Temperature, Effective Temperature Sum and Precipitation Sum in Europe

Helena Henttonen and Annikki Mäkelä

INTRODUCTION

One of the most critical components of large scale ecological models, such as those included in the Regional Acidification INformation and Simulation System (RAINS) (Alcamo *et al.*, 1987), is the availability of reliable input data in the regional scale. Even if regional data are available, they are not always in a form directly applicable to the model. In the case of meteorological data, it is often a question of converting the information from a network of stations to a systematic grid-based data system.

Ojansuu and Henttonen (1983) presented a method which aims at efficient and reliable prediction of local values of climatological variables from observations at neighbouring weather stations. The method utilizes the statistical dependence of temperature on both latitude and altitude. Its potential applications involve meteorological time series as well as long-term averages. The method was tested using data from meteorological stations in Finland, and it has now been incorporated in the Finnish forest inventory and management system.

The objective of the present study is to assess the applicability of the method in all Europe, as regards calculating local values of monthly mean temperature and precipitation, and the effective temperature sum (ETS, degree days). In particular, we focus on the applications we envisage in connection with the RAINS model. This sets the emphasis on predicting monthly mean values, but we also briefly con-

sider examples on applications to time series.

MATERIAL

For the mean value calculations, we used 30-year means of the monthly mean values of the meteorological variables. These were obtained from several sources, as explained in Table 1. A total of 666 stations were used for observations of long-term average temperature and 517 for those of precipitation.

In addition to long-term mean values, time series of the monthly means were available. The Austrian Meteorological Institute provided measurements of monthly mean temperature and precipitation from 63 stations over the period 1950–1984, and the British Meteorological Office those from 101 stations over the period 1959–1984. The yearbooks of the Finnish Meteorological Institute were used to select 88 stations for values of monthly mean temperature and precipitation over 1950–1982. Note that these stations were not used in the mean value analysis unless the series covered more than 15 years. The information on the stations comprises latitude, longitude and altitude. A list of the stations and their locations is presented in Appendix 1.

METHODS

Mean Temperature and Precipitation

The simplest method of smoothing is to calculate a weighted average of observations in the neighbourhood of the subject point (***method of moving average***) (Ojansuu and Henttonen, 1983).

The relative weights are calculated using the formula

$$W_i = \begin{cases} (1 - \dfrac{d_i}{d_{max}})^q, & d_i \le d_{max} \\ & z_i - z < 500m \\ 0, & otherwise \end{cases} \qquad (1)$$

Table 1. Number of observations from different sources by country.

Country \ Source of reference	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	1								
Austria	5								37
Belgium	2	2							
Bulgaria	4		1						
Czechoslovakia	3		9						
Denmark	5	4							
Eire	5	2							
Fed.Rep. of Germany	18	15							
Finland	8					56			
France	21	9							
German Dem.Rep.	4								
Greece	8								
Hungary	3								
Iceland	3	3							
Italy	16								
Luxembourg	1								
Netherlands	3	3							
Norway	11				154				
Poland	7		5						
Portugal	7			5					
Rumania	5		5						
Spain	14			9					
Sweden	11					80			
Switzerland	4	9							
USSR	29								
United Kingdom	17							43	
Yugoslavia	6			19					

(1) Müller (1982), mean values over 1931–1960
(2) Klimadaten von Europa (1980), monthly mean values over 1931–1960
(3) Klimadaten von Europa (1982), monthly mean values over 1931–1960
(4) Klimadaten von Europa (1981), monthly mean values over 1931–1960
(5) Bruun (1962), monthly mean temperatures over 1931–1960
(6) Taesler (1972), mean values over 1931–1960
(7) Meteorological yearbook of Finland, volumes 51–80, Part 1, monthly mean values over 1951–1980
(8) British Meteorological Office, monthly mean values over 1956–1984 (digital)
(9) Austrian Meteorological Institute, monthly mean values over 1951–1980 (digital)

where

W_i = weight for the observation at station i
d_i = the distance between the station and the subject point
z_i = altitude of station i
z = altitude of the subject point
d_{max} = maximum distance - parameter
q = parameter

If there are no measurements within the radius d_{max}, the nearest observation is searched and given the weight 1. The parameters d_{max} and q are determined by trial and error to give the best estimates. The choice of these parameters depends on the density of the data network.

The method does not account for site differences in topography and location among the stations and the subject points. The reliability of the smoothed result can be increased by utilizing the statistical dependence on latitude and altitude of the variables involved (*Combined method*) (Ojansuu and Henttonen, 1983).

The combined method was applied to the monthly mean temperature. A linear regression model was first formulated for describing the statistical dependence of average temperature on the above variables. This turned out to be strongly biased with respect to the altitude term. The bias disappeared upon the introduction of a term non-linear in the altitude:

$$t_{ki} = \beta_{k0} + \beta_{k1} y_i + \beta_{k2} z_i^{\beta_{k3}} + \varepsilon_{ki} \qquad i=1,\ldots,666 \quad k=1,12 \qquad (2)$$

where

y_i = latitude of station i
z_i = altitude of station i
t_{ki} = average temperature of month k at station i
ε_{ki} = estimation error

The dependent variable was the long-term average temperature. The parameters $\beta_0,\ldots, \beta_3$ of model (2) were estimated for each month separately, using the

method of least squares. The AR program (Derivative-Free Nonlinear Regression, Dixon *et al.*, 1985) of the BMDP library was used in the estimation.

The above statistical dependence (Equation 2) and the moving average smoothing method (Equation 1) are combined as follows:

(1) The estimates of monthly mean temperatures at the meteorological stations and at the subject point are calculated using regression model (2).

(2) The differences between the measured values and the estimates obtained with the model are smoothed with the weights given by Equation (1) in the neighbourhood of the subject point.

(3) The result given by the regression model is corrected with the smoothed differences at the subject point.

Effective Temperature Sum

The ffective temperature sum (ETS) is defined as follows:

$$ETS = \sum_{i=1}^{365} (T_i - T_0)\ \delta_i$$

$$\delta_i = \begin{cases} 1 \text{ if } T_i \geq T_0 \\ 0 \text{ if } T_i < T_0 \end{cases}$$

where T_i = daily mean temperature

T_0 = threshold temperature

The calculation of the effective temperature sum from the monthly mean temperatures comprises estimating the annual course of mean temperature (daily averages) and summing up the average temperatures that exceed the threshold temperature chosen (Ojansuu and Henttonen, 1983).

In smoothing the annual course of temperature, a smoothed curve is first calculated which passes through the monthly mean temperature at the centre of the month. The smoothing employs a spline function, which is found using the subpro-

gram ICSICU of the IMSL program library (IMSL Library 2, 1977). The difference between the monthly mean temperature obtained from this smoothing function, and the original mean temperature, is further smoothed with a spline function, and the difference is used for correcting the smoothing function for the annual course of temperature.

The resulting spline function gives the course of the daily temperature as averaged over the 30-year period in question. When calculating the average ETS over the period, the between-year variance of the daily temperatures is also accounted for. This procedure is essential for those days when the 30-year average temperature is near the threshold, 5 °C. The program only uses two values of variance, however; one for the earlier and one for the later half of the year. As no other daily data were available, the variances were estimated from the Finnish data.

Figures 1 and 2 illustrate the year-to-year variation in the effective temperature sum for locations in Finland and Austria.

RESULTS

The methods were tested by subtracting one station at a time from the observation network and calculating the values of the climatic variables of that station from the rest of the data. This procedure underestimates the reliability of the smoothing, as the observation network is actually more dense than the one used for testing.

Table 2 shows the root mean square error (RMSE) of the smoothed mean temperature and precipitation sum in May–August for the methods presented above. When using the combined method for the areas of dense network, with $q = 2$ and $d_{max} = 250$ km in Equation (1), the values of RMSE and the corresponding largest errors of mean temperature in May–August were as shown in Table 3.

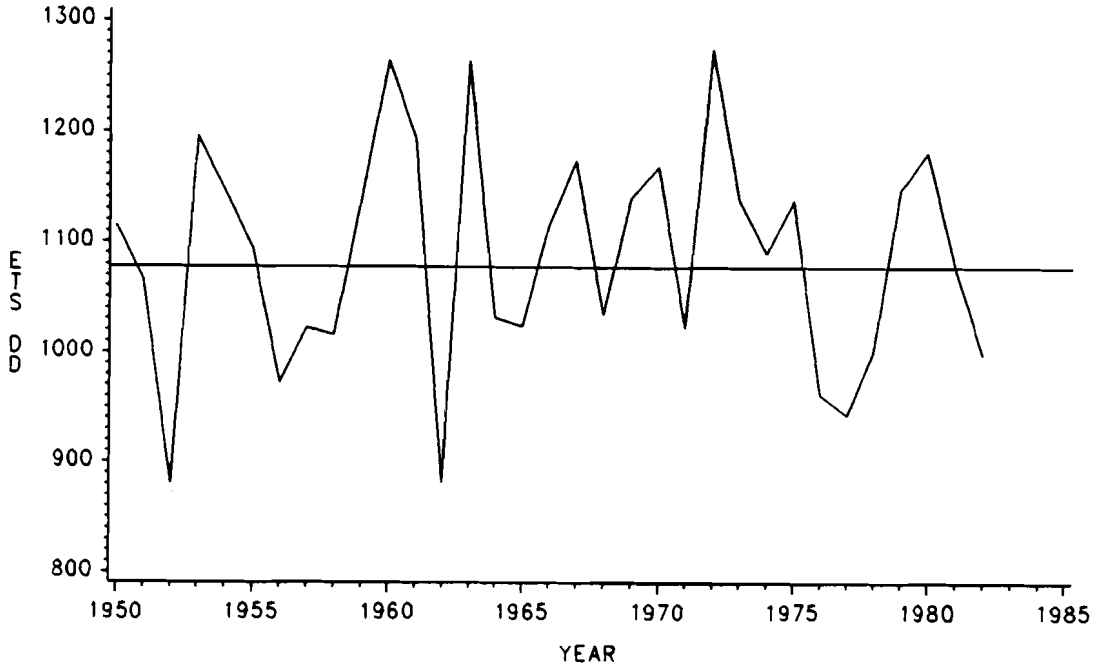

Figure 1. Effective temperature sum in 1950–1982 and as calculated for the 'mean year' with respect to monthly mean temperatures in the period (horizontal line). Location: latitude 63° N, longitude 24° E, altitude 130 m. Threshold temperature was 5 °C.

In Sweden, Finland and Norway, all the stations with errors greater than one degree were located on the coast.

Table 4 displays the reliability figures for the whole data set by month, obtained with the combined method with $q=2$ and $d_{max}=250$ km in Equation (1). Figure 3 shows the error of the estimate of mean temperature in May-August as a function of the altitude of the station, using the same method. Figure 4 shows the same errors in relation to latitude.

CONCLUDING REMARKS

The comparison between the combined method (Equations 1 and 2) and the moving averages method (Equation 1) (Table 2) shows clearly that the combined method is more reliable, for the monthly mean temperature. For further improving the reliability, the number of explaining variables should be increased (e.g. vicinity of

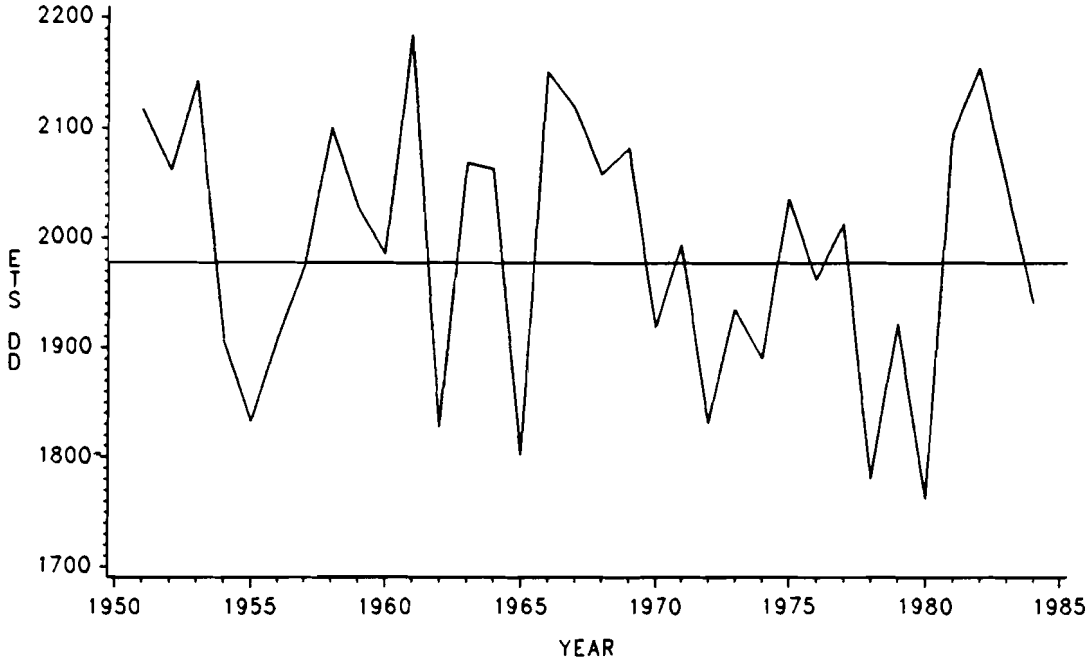

Figure 2. Effective temperature sum in 1950–1984 and as calculated for the 'mean year' with respect to monthly mean temperatures in the period (horizontal line). Location: latitude 48° N, longitude 15° E, altitude 300 m. Threshold temperature was 5 °C.

sea and direction of the slope). Some new smoothing methods could also be considered (e.g., 'universal kriging', Ripley, 1981). If the combined method is applied to precipitation also, a denser measurement network should be used in order to improve the present results.

The present approach is applied to a sparse network of data for most of Europe, and a denser network for Austria, Britain, Finland, Norway and Sweden. Comparing the root mean square errors of Table 2 and Table 3, it is apparent that increasing the number of observation stations improves the reliability of the results. Earlier work shows, however, that there is a limit to decreasing the estimation error this way. Ojansuu and Henttonen (1983) concluded that in the case of Finland, about 30 stations were sufficient to stabilize the root mean square error.

If further data are incorporated, the question of changing the parameter values arises. The best choice of the parameters q and d_{max} in the weighting func-

Table 2. The root mean square error (RMSE) of the smoothed mean temperature and precipitation in May–August.

		d_{max} (km)					
	q	100	150	200	250	300	350
Average temperature (°C)							
moving averages	0.5	2.16	1.98	1.69	1.69	1.66	1.66
	1.0	2.19	2.02	1.71	1.68	1.67	1.65
	2.0	2.25	2.09	1.78	1.71	1.68	1.66
combined method	0.5	0.73	0.69	0.68	0.69	0.71	0.74
	1.0	0.73	0.69	0.67	0.68	0.69	0.71
	2.0	0.73	0.69	0.67	0.66	0.67	0.68
Precipitation (mm)							
moving averages	0.5	81.4	73.5	72.0	73.3	75.1	77.8
	1.0	83.1	74.2	70.9	71.8	73.0	75.2
	2.0	86.3	76.2	71.5	70.6	71.0	72.1

Table 3. RMSE and the corresponding largest errors of mean temperature in May-August (q = 2, d_{max} = 250).

	RMSE, °C	number of stations	abs (maximum error), °C, and station (station number in parentheses)
Sweden and Finland	0.44	143	1.7 Svenska Hogarna (456)
Norway	0.56	163	2.9 Jan Mayen (4)
United Kingdom	0.38	49	0.9 Lerwick (48)
Austria	0.51	42	1.3 Vils (815)

tion (Equation 1), in principle, depends on the density of the measurement network. As shown by the results in Table 2, however, the RMSE is not very sensitive to these parameters. The most important requirement seems to be that the radius d_{max} is not considerably smaller than the average distance between the observa-

Table 4. Bias and root mean square error (RMSE) of the smoothed estimates of monthly mean temperature and precipitation by month. Combined method (d_{max} = 250 km, q = 2).

	January	February	March	April	May	June
Mean temperature						
bias	-.02	0.00	0.00	0.00	-.01	-.03
RMSE	1.54	1.32	0.91	0.58	0.65	0.74
Precipitation						
bias	-1.3	-1.1	-1.0	-1.6	-1.7	-2.3
RMSE	27.1	23.5	19.9	18.9	16.8	18.6
	July	August	September	October	November	December
Mean temperature						
bias	-.02	-.02	-.00	0.00	-.01	-.02
RMSE	0.84	0.69	0.61	0.87	1.12	1.44
Precipitation						
bias	-2.9	-2.2	-0.8	-0.0	-0.5	-0.6
RMSE	21.6	18.9	21.1	24.1	27.1	30.4

tion points, to make sure that the circle always covers some points. From then on, the results are not very sensitive to further increasing the radius, because of the efficiency of the relative weighting by distance.

As regards the regression equation (Equation 2), our experience indicates that if the additional data merely serves to make the network denser, then the same parameters as before can be safely used for both the regression and the weighting of the points. However, if entirely new areas are included, the regression parameters may have to be recalculated, due to possible differences in the macroclimate of the newly incorporated area.

The improvements indicated above may be necessary if the system is applied to small scale studies with high requirement of accuracy. For a large scale model,

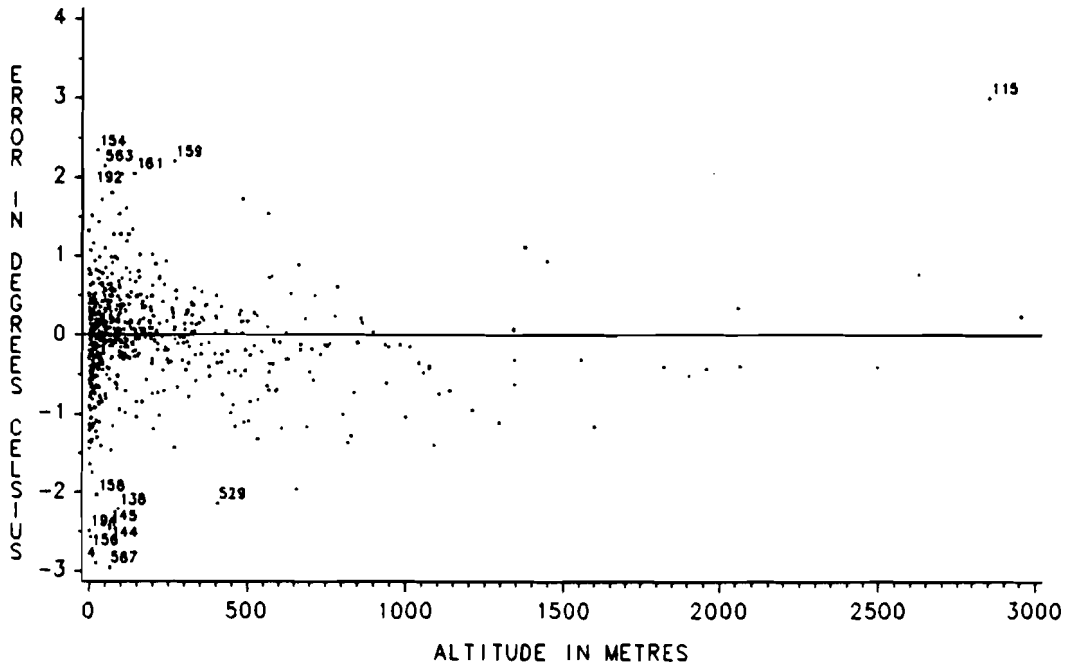

Figure 3. Estimation errors of the mean temperature for the period May–August as a function of altitude. The figures indicate number of station.

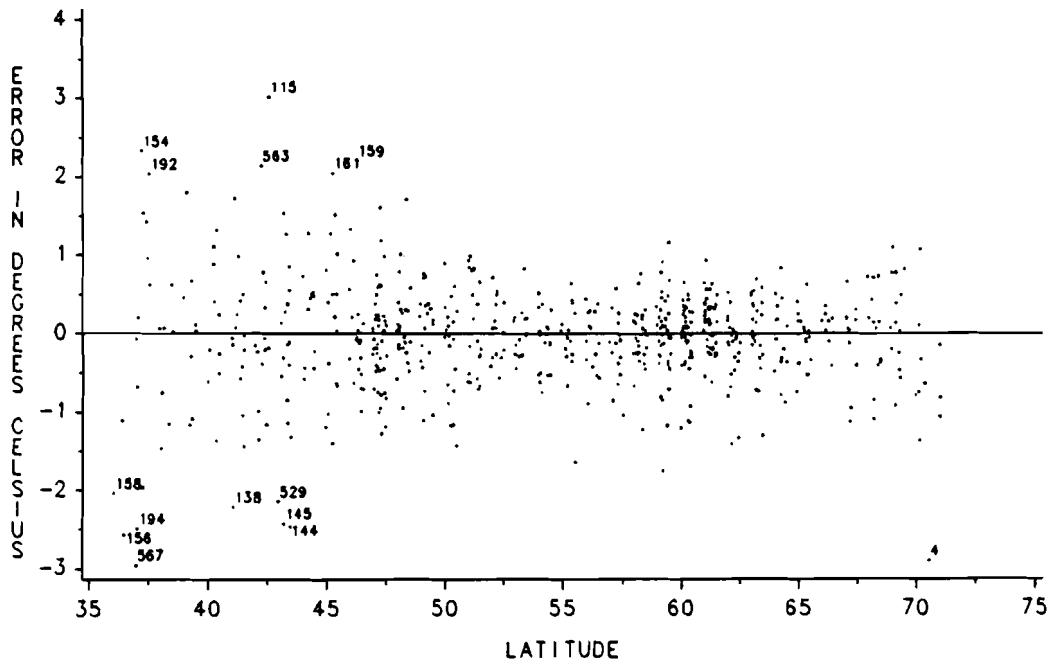

Figure 4. Estimation errors of the mean temperature for the period May–August as a function of latitude. The figures indicate number of station.

however, the present level of accuracy seems sufficient in most of the foreseeable situations.

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Appendix 1. Location of the meteorological stations and sources of information
(A) = number of station, (B) = latitude,
(C) = longitude, (D) = altitude, m.
The number after station name refers to the source (see p. 2).
(E) after station name refers to stations out of use.
(F) after station name refers to stations lacking data
on mean temperature or precipitation

(A)	(B)	(C)	(D)			(A)	(B)	(C)	(D)		
1	65.41	-18.15	7.	AKUREYRI	(1)	51	52.25	-4.03	138.	ALBERSTWYTH	(1)
2	65.05	-14.39	40.	HALLORMSTADUR	(1)	52	51.28	-0.19	5.	KEW	(1)
3	64.08	-21.56	18.	REYKJAVIK	(1)	53	51.07	1.19	6.	DOVER	(1)
4	70.59	-8.20	23.	JAN MAYEN	(1)	54	50.21	-4.07	27.	PLYMOUTH	(1)
5	70.22	31.06	10.	VARDO	(1)	55	49.56	-6.18	50.	ST. MARY'S	(1)
6	69.36	18.57	115.	TROMSO	(1)	56	55.22	-7.20	20.	MALIN HEAD	(1)
7	66.21	14.08	20.	MO I RANA	(1)	57	54.14	-10.00	9.	BELMULLET	(1)
8	63.25	10.27	133.	TRONDHEIM	(1)	58	53.26	-6.15	68.	DUBLIN	(1)
9	62.04	9.07	643.	DOMBAAS	(1)	59	52.40	-7.16	67.	KILKENNY	(1)
10	61.06	10.26	226.	LILLEHAMMER	(1)	60	51.56	-10.15	9.	VALENTIA	(1)
11	60.12	5.19	45.	BERGEN	(1)	61	53.08	6.35	5.	EELDE	(1)
12	59.56	10.44	96.	OSLO	(1)	62	52.58	4.45	6.	DEN HELDER	(1)
13	59.27	8.00	77.	DALEN	(1)	63	52.06	5.11	3.	DE BILT	(1)
14	58.10	7.59	23.	KRISTIANSAND	(1)	64	50.48	4.21	100.	BRUXELLES	(1)
15	65.50	24.09	7.	HAPARANDA	(1)	65	50.30	6.06	694.	BOTRANGE-ROBERT	(1)LE
16	65.04	17.10	330.	STENSELE	(1)	66	49.37	6.03	334.	LUXEMBOURG-CITY	(1)
17	63.10	14.40	328.	OSTERSUND	(1)	67	54.11	7.54	4.	HELGOLAND	(1)
18	62.28	17.57	8.	HARNOSAND	(1)	68	53.38	10.00	14.	HAMBURG	(1)
19	59.22	13.28	47.	KARLSTAD	(1)	69	52.58	11.10	21.	LUCHOW	(1)
20	59.21	18.04	44.	STOCKHOLM	(1)	70	52.28	13.18	51.	BERLIN-DAHLEM	(1)
21	57.46	14.11	92.	JONKOPING	(1)	71	52.20	9.43	53.	HANNOVER-LANGEN	(1)EN
22	57.42	11.58	31.	GOTEBORG	(1)	72	51.24	6.58	154.	ESSEN	(1)
23	57.39	18.18	28.	VISBY	(1)	73	51.19	9.29	158.	KASSEL	(1)
24	56.39	16.23	12.	KALMAR	(1)	74	50.20	7.43	77.	BAD EMS	(1)
25	55.26	13.03	8.	MALMO	(1)	75	50.19	11.53	567.	HOF	(1)
26	67.22	26.36	178.	SODANKYLA	(1)	76	50.07	8.39	103.	FRANKFURT/MAIN	(1)RPOR
27	65.01	25.29	17.	OULU	(1)	77	49.45	6.40	265.	TRIER	(1)
28	64.17	27.41	134.	KAJAANI	(1)	78	49.30	11.06	310.	NURNBERG	(1)
29	63.03	21.46	6.	VAASA	(1)	79	49.22	8.08	161.	NEUSTADT/WEINST	(1)SE
30	61.48	29.17	88.	PUNKAHARJU	(1)	80	49.01	12.04	376.	REGENSBURG	(1)
31	61.28	23.46	84.	TAMPERE	(1)	81	48.42	9.12	401.	STUTTGART	(1)
32	60.12	24.55	45.	HELSINKI(ILMALA	(1)	82	48.09	11.42	527.	MUNCHEN	(1)
33	60.07	19.54	4.	MAARIANHAMINA	(1)	83	47.40	9.30	401.	FRIEDRICHSHAFEN	(1)
34	62.02	-6.45	20.	HOYVIK	(1)	84	47.23	10.59	2960.	ZUGSPITZE	(1)
35	57.11	9.57	13.	TYLSTRUP	(1)	85	54.06	13.27	2.	GREIFSWALD	(1)
36	56.05	8.55	54.	STUDSGAARD	(1)	86	51.48	10.37	1142.	BROCKEN	(1)
37	55.41	12.33	9.	KOBENHAVN	(1)	87	51.07	13.41	246.	DRESDEN	(1)
38	55.17	14.47	11.	SANDVIG	(1)	88	50.59	10.58	315.	ERFURT	(1)
39	60.09	-1.10	82.	LERWIK	(1)	89	54.31	18.33	15.	GDYNIA	(1)
40	58.13	-6.20	3.	STORNOWAY	(1)	90	54.06	22.55	170.	SUWALKI	(1)
41	57.37	-1.50	26.	RATTRAY HEAD	(1)	91	52.25	16.50	92.	POZNAN	(1)
42	57.29	-5.16	67.	ACHNASHELLACH	(1)	92	52.09	20.59	107.	WARSZAWA	(1)
43	56.56	-4.14	359.	DALWHINNIE	(1)	93	51.08	16.59	119.	WROCLAW	(1)
44	55.19	-3.12	242.	ESKDALEMUIR	(1)	94	50.44	23.15	219.	ZAMOSC	(1)
45	55.01	-1.25	33.	TYNEMOUTH	(1)	95	50.05	20.01	213.	KRAKOW	(1)
46	54.39	-6.13	67.	BELFAST	(1)	96	50.05	14.25	197.	PRAHA	(1)
47	54.10	-4.28	87.	DOUGLAS	(1)	97	49.00	21.15	270.	PRESOV	(1)
48	53.45	-0.16	2.	KINGSTON-UPON-H	(1)	98	48.59	14.28	383.	CESKE BUDEJOVIC	(1)
49	52.56	1.17	54.	CROMER	(1)	99	49.39	-1.38	8.	CHERBOURG	(1)
50	52.29	-1.56	136.	BIRMINGHAM	(1)	100	49.18	4.02	94.	REIMS	(1)

101	48.58	2.27	52.	PARIS(LE BOURGE	(1)		158	36.06	-5.21	27.	GIBRALTAR TOWN	(1)		
102	48.33	7.38	149.	STRASBOURG	(1)		159	46.30	11.21	271.	BOLZANO	(1)		
103	48.27	-4.25	98.	BREST	(1)		160	45.39	13.46	11.	TRIESTE	(1)		
104	48.04	-1.43	35.	RENNES	(1)		161	45.28	9.11	147.	MILANO	(1)		
105	47.25	0.46	98.	TOURS	(1)		162	45.27	12.19	1.	VENEZIA	(1)		
106	47.16	5.06	220.	DIJON	(1)		163	44.25	8.55	54.	GENOVA	(1)		
107	47.10	-1.37	26.	NANTES	(1)		164	43.46	11.15	76.	FIRENZE	(1)		
108	45.49	1.17	282.	LIMOGES	(1)		165	43.37	13.31	17.	ANCONA	(1)		
109	45.48	3.09	329.	CLERMONT-FERRAN	(1)		166	41.54	12.29	46.	ROMA	(1)		
110	45.43	4.57	200.	LYON	(1)		167	41.28	15.33	74.	FOGGIA	(1)		
111	45.10	5.44	223.	GRENOBLE	(1)		168	40.51	14.15	25.	NAPOLI	(1)		
112	44.50	-0.42	47.	BORDEAUX	(1)		169	40.38	15.48	826.	POTENZA	(1)		
113	43.37	1.22	151.	TOULOUSE	(1)		170	40.28	17.13	16.	TARANTO	(1)		
114	43.27	5.13	3.	MARSEILLE	(1)		171	39.13	9.06	75.	CAGLIARI	(1)		
115	42.56	0.09	2860.	PIC-DU-MIDI	(1)		172	38.12	15.33	54.	MESSINA	(1)		
116	42.44	2.52	43.	PERPIGNAN	(1)		173	38.07	13.21	71.	PALERMO	(1)		
117	42.33	9.29	10.	BASTIA	(1)		174	37.29	14.04	570.	CALTANISSETTA	(1)		
118	43.43	7.25	55.	MONACO	(1)		175	35.54	14.31	70.	VALETTA	(1)	(E)	
119	42.30	1.31	1080.	LES ESCALDES	(1)		176	45.49	15.58	163.	ZAGREB	(1)		
120	47.23	8.34	569.	ZURICH	(1)		177	44.48	20.27	132.	BEOGRAD	(1)		
121	47.15	9.20	2500.	SANTIS	(1)		178	43.52	18.26	537.	SARAJEVO	(1)		
122	46.12	6.09	405.	GENEVE	(1)		179	43.31	16.26	128.	SPLIT	(1)		
123	46.00	8.57	278.	LUGANO	(1)		180	43.20	17.49	99.	MOSTAR	(1)		
124	48.15	16.22	203.	WIEN	(1)		181	42.00	21.06	245.	SKOPJE	(1)		
125	47.48	13.00	436.	SALZBURG	(1)		182	43.36	24.35	110.	PLEVEN	(1)		
126	47.16	11.24	582.	INNSBRUCK	(1)		183	43.12	27.55	3.	VARNA	(1)		
127	47.03	12.57	3107.	SONNBLICK	(1)		184	42.42	23.20	550.	SOFIJA	(1)		
128	46.59	15.27	342.	GRAZ	(1)		185	42.09	24.45	160.	PLOVDIV	(1)		
129	47.33	21.37	123.	DEBRECEN	(1)		186	41.18	19.48	114.	TIRANE	(1)		
130	47.31	19.02	120.	BUDAPEST	(1)		187	40.51	25.53	7.	ALEXANDROPOULIS	(1)		
131	46.05	18.15	141.	PECS	(1)		188	40.39	23.07	2.	THESSALONIKI	(1)		
132	47.10	27.36	101.	IASI	(1)		189	39.53	25.04	2.	LIMNOS	(1)		
133	46.47	23.42	313.	CLUJ	(1)		190	39.37	19.55	25.	KERKIRA	(1)		
134	45.47	21.13	90.	TIMISOARA	(1)		191	39.33	21.46	149.	TRIKKALA	(1)		
135	45.47	24.09	407.	SIBIU	(1)		192	37.58	23.43	107.	ATHINAI	(1)		
136	44.25	26.06	82.	BUCARESTI	(1)		193	37.31	22.21	661.	TRIPOLIS	(1)		
137	41.49	-6.46	720.	BRAGANCA	(1)		194	37.06	25.25	3.	NAXOS	(1)		
138	41.08	-8.36	95.	PORTO	(1)		195	35.21	25.08	29.	IRAKLION	(1)	(E)	
139	40.12	-8.25	141.	COIMBRA	(1)		196	35.09	33.17	218.	LEVKOSIA	(1)	(E)	
140	39.01	-7.04	280.	CAMPO MAJOR	(1)		215	68.58	33.03	46.	MURMANSK	(1)		
141	38.43	-9.09	77.	LISBOA	(1)		216	66.05	32.59	94.	LOUCHI	(1)		
142	37.45	-25.40	35.	PONTA DEGADA	(1)		217	65.00	34.48	10.	KEM	(1)		
143	37.07	-8.32	19.	PRAIA DA ROCHA	(1)		218	61.49	34.16	40.	PETROZAVODSK	(1)		
144	43.48	-3.49	68.	SANTANDER	(1)		219	64.30	40.30	4.	ARCHANGELSK	(1)		
145	43.22	-8.25	67.	LA CORUNA	(1)		220	59.17	39.52	118.	VOLOGDA	(1)		
146	41.39	-4.43	715.	VALLADOLID	(1)		255	54.42	20.37	27.	KALININGRAD	(1)		
147	41.39	-0.53	237.	ZARAGOZA	(1)		256	41.14	44.57	490.	TBILISI	(1)		
148	41.24	2.09	95.	BARCELONA	(1)		257	59.25	24.48	44.	TALLINN	(1)		
149	40.25	-3.41	667.	MADRID	(1)		258	56.58	24.04	3.	RIGA	(1)		
150	39.33	2.39	28.	PALMA (BALEARIC	(1)	L.)	259	54.53	23.53	75.	KAUNAS	(1)		
151	39.29	-0.23	13.	VALENCIA	(1)		260	48.38	22.16	118.	UZGOROD	(1)		
152	38.59	-3.56	628.	CIUDAD REAL	(1)		261	53.52	27.32	234.	MINSK	(1)		
153	37.59	-1.08	44.	MURCIA	(1)		262	47.01	28.52	95.	KISHINEV	(1)		
154	37.24	-6.00	30.	SEVILLA	(1)		263	59.58	30.18	4.	LENINGRAD	(1)		
155	37.09	-3.35	689.	GRANADA	(1)		264	50.24	30.27	179.	KIJEV	(1)		
156	36.50	-2.28	7.	ALMERIA	(1)		265	55.45	37.34	156.	MOSKVA	(1)		
157	28.11	-15.28	6.	LAS PALMAS (CAN	(1)	(E)	266	49.56	36.17	152.	CHARKOV	(1)		

267	53.11	45.01	235.	PENZA	(1)		418	57.47	14.17	99.	HUSKVARNA	(6)		
268	55.47	49.11	64.	KAZAN	(1)		419	64.16	19.38	179.	HALLNAS-LUND	(6)		
274	46.29	30.38	64.	ODESSA	(1)		420	68.27	22.30	327.	KARESUANDO	(6)		
275	45.01	33.59	205.	SIMFEROPOL	(1)		421	58.31	14.32	94.	KALSBORG	(6)		
276	47.48	35.15	86.	ZAPOROZJE	(1)		422	56.10	14.52	5.	KARLSHAMN	(6)		
277	47.15	39.49	77.	ROSTOV-NA-DONU	(1)		423	67.51	20.14	505.	KIRUNA	(6)		
278	44.03	43.02	573.	PATIGORSK	(1)		424	60.09	13.48	198.	KNON	(6)		
281	48.42	44.31	42.	VOLGOGRAD	(1)		425	56.02	14.09	6.	KRISTIANSTAD	(6)		
298	45.02	39.09	33.	KRASNODAR	(1)		426	56.18	12.27	72.	KULLEN	(6)		
299	43.35	39.43	31.	SOCI	(1)		427	58.21	13.08	80.	LANNA	(6)		
300	42.16	42.38	116.	KUTAISI	(1)		428	59.18	11.56	125.	LENNARTSFORS	(6)		
305	41.27	31.48	42.	ZONGULDAK	(1)	(E)	430	58.25	15.38	64.	LINKOPING	(6)		
306	41.17	36.19	40.	SAMSUN	(1)	(E)	431	56.05	13.14	43.	LJUNGBYHED	(6)		
309	40.11	29.05	161.	BURSA	(1)	(E)	433	65.33	22.08	10.	LULEAA FLYGPLAT	(6)		
310	39.57	32.53	861.	ANKARA	(1)	(E)	434	55.43	13.12	73.	LUND	(6)		
311	39.54	41.16	1951.	ERZURUM	(1)	(E)	435	67.11	20.42	366.	MALMBERGET	(6)		
312	39.44	36.59	1185.	SIVAS	(1)	(E)	436	60.41	13.43	308.	MALUNG	(6)		
316	37.07	38.46	540.	URFA	(1)	(E)	437	61.01	14.31	170.	MORA	(6)		
317	36.59	35.18	25.	ADANA	(1)	(E)	438	58.33	15.05	94.	MOTALA	(6)		
318	36.53	30.42	40.	ANTALYA	(1)	(E)	439	63.34	19.30	6.	NORDMALING	(6)		
319	36.14	37.08	390.	HALAB(ALEPPO)	(1)	(E)	440	58.36	16.13	3.	NORRKOPING	(6)		
321	33.30	36.20	720.	DIMASHQ	(1)	(E)	442	59.46	18.43	10.	NORRTALJE	(6)		
322	33.54	35.28	34.	BAYRUT	(1)	(E)	443	58.46	17.00	25.	NYKOPING	(6)		
324	31.48	35.15	757.	JERUSALEM	(1)	(E)	444	57.39	14.42	305.	NASSJO	(6)		
325	29.33	34.57	2.	ELAT	(1)	(E)	445	63.09	17.46	27.	OFFER	(6)		
351	33.34	-7.40	49.	CASABLANCA	(1)	(E)	446	67.12	23.25	176.	PAJALA	(6)		
352	34.04	-6.40	75.	RABAT	(1)	(E)	447	68.26	18.08	508.	RIKSGRANSEN	(6)		
353	35.43	-5.54	15.	TANGER	(1)	(E)	448	60.22	15.31	152.	ROMMEHED	(6)		
354	34.47	-1.56	470.	OUJDA	(1)	(E)	450	58.24	13.27	116.	SKARA	(6)		
355	31.36	-8.01	460.	MARRAKECH	(1)	(E)	451	63.19	12.06	595.	STORLIEN	(6)		
356	35.44	-0.39	11.	ORAN	(1)	(E)	452	62.48	13.04	575.	STORSJO	(6)		
357	36.46	3.03	60.	ALGER	(1)	(E)	453	58.56	11.12	17.	STROMSTAD	(6)		
364	32.54	13.11	20.	TARABULUS	(1)	(E)	454	62.31	17.26	4.	SUNDSVALL FLYGP	(6)	S	
365	31.12	16.35	20.	SURT	(1)	(E)	455	62.02	14.22	360.	SVEG	(6)		
366	32.06	20.04	25.	BANGHAZI	(1)	(E)	456	59.27	19.30	12.	SVENSKA HOGARNA	(6)		
367	32.49	22.38	7.	DARNAH	(1)	(E)	457	58.26	12.42	50.	SAATENAS	(6)		
371	31.53	25.11	170.	AL-SALLUM	(1)	(E)	458	61.41	13.08	441.	SARNA	(6)		
372	31.12	29.51	7.	ALEXANDRIA	(1)	(E)	459	61.16	17.06	25.	SODERHAMN	(6)		
373	30.08	31.34	95.	CAIRO	(1)	(E)	460	57.43	11.47	4.	TORSLANDA FLYGP	(6)	S	
400	55.39	13.05	10.	ALNARP	(6)		462	59.11	17.55	45.	TULLINGE	(6)		
401	58.53	14.54	100.	ASKERSUND	(6)		463	63.50	20.17	11.	UMEAA	(6)		
402	59.25	17.52	16.	BARKABY	(6)		464	59.53	17.36	18.	UPPSALA	(6)		
403	63.01	16.41	165.	BISPGAARDEN	(6)		465	59.52	17.38	13.	UPPSALA	(6)		
404	64.29	21.35	36.	BJUROKLUBB	(6)		466	55.57	15.42	6.	UTKLIPPAN	(6)		
405	64.03	12.57	445.	BJORKEDET	(6)		467	57.38	11.37	19.	VINGA	(6)		
406	57.46	12.57	140.	BORAAS	(6)		469	58.23	12.20	49.	VANERSBORG	(6)		
407	56.16	15.17	56.	BREDAAKRA	(6)		470	57.47	16.36	5.	VASTERVIK	(6)		
408	59.21	17.57	15.	BROMMA FLYGPLAT	(6)		471	59.36	16.39	3.	VASTERAAS	(6)		
409	61.23	15.48	163.	EDSBYN	(6)		473	56.52	14.48	168.	VAXJO	(6)		
410	60.44	17.34	5.	EGGEGRUND	(6)		474	55.26	13.50	32.	YSTAD	(6)		
411	60.36	15.38	122.	FALUN	(6)		476	59.03	12.42	60.	AAMAAL	(6)		
412	63.11	14.30	360.	FROSON	(6)		477	58.25	13.46	300.	AASABORG	(6)		
413	63.42	15.22	320.	GISSELAAS	(6)		478	56.12	16.24	4.	OLANDS S UDDE	(6)		
414	64.30	14.08	317.	GADDEDE	(6)		479	59.15	15.13	51.	OREBRO	(6)		
415	60.40	17.08	11.	GAVLE	(6)		480	42.41	26.19	265.	SLIVEN	(3)		
416	57.18	14.08	169.	HAGSHULTS FLYGP	(6)	S	481	51.44	19.24	184.	LODZ-LUBLINEK	(3)		
417	56.41	12.50	25.	HALMSTAD	(6)		482	50.44	15.44	1603.	SNIEZKA	(3)		

483	53.24	14.37		1.	SZCZECIN-DABIE	(3)		540	46.57	7.26	572.	BERN	(2)	
484	53.03	18.35		69.	TORUN	(3)		541	46.48	9.49	1561.	DAVOS	(2)	
485	49.18	19.57	844.		ZAKOPANE	(3)		542	46.32	6.39	589.	LAUSANNE	(2)	
486	44.11	28.40		32.	CONSTANTA	(3)		543	46.21	7.00	1350.	LEYSIN	(2)	
487	47.47	23.56	498.		OCNA SUGATAG	(3)		544	47.04	8.19	498.	LUZERN	(2)	
488	45.30	25.23	1093.		PREDEAL	(3)		545	46.19	7.29	1453.	MONTANA	(2)	
489	45.09	29.40		3.	SULINA	(3)		546	47.00	6.57	489.	NEUCHATEL	(2)	
490	44.38	22.38		70.	TURNU SEVERIN	(3)		547	41.03	21.22	586.	BITOLA	(4)	
491	48.12	17.12	133.		BRATISLAVA	(3)		548	43.43	18.16	2067.	BJELASNICA	(4)	
492	49.12	16.34	223.		BRNO	(3)		549	42.17	18.51	2.	BUDVA	(4)	
493	49.54	15.24	249.		CASLAV	(3)		550	42.39	18.06	49.	DUBROVNIK	(4)	
494	47.52	18.12	115.		HURBANOVO	(3)		551	43.10	16.27	20.	HVAR	(4)	
495	49.23	13.18	421.		KLATOVY	(3)		552	42.57	17.08	20.	KORCULA	(4)	
496	48.42	21.16	206.		KOSICE	(3)		553	46.04	14.31	299.	LJUBLJANA	(4)	
497	49.12	20.13	2633.		LOMNICKY STIT	(3)		554	44.32	14.28	53.	MALI-LOSINJ	(4)	
498	49.15	19.20	493.		ORAVSKY PODZAMO	(3)		555	46.32	15.39	275.	MARIBOR	(4)	
499	49.08	20.13	1018.		STARY SMOKOVEC	(3)		556	43.20	21.54	202.	NIS	(4)	
500	51.14	2.55		10.	OOSTENDE	(2)		557	41.07	20.48	760.	OHRID	(4)	
501	50.23	5.40	460.		WERBOMONT	(2)		558	45.14	13.36	15.	POREC	(4)	
502	50.12	10.05	216.		BAD KISSINGEN	(2)		559	44.52	13.51	30.	PULA	(4)	
503	50.55	8.32	273.		BIEDENKOPF	(2)		560	44.45	14.46	24.	RAB	(4)	
504	53.35	6.40		12.	BORKUM	(2)		561	45.20	14.27	104.	RIJEKA	(4)	
505	51.43	10.37	607.		BRAUNLAGE	(2)		562	43.44	15.54	77.	SIBENIK	(4)	
506	51.13	6.45		36.	DUSSELDORF	(2)		563	42.26	19.17	52.	TITOGRAD	(4)	
507	48.28	8.25	710.		FREUDENSTADT	(2)		564	41.55	19.13	97.	ULCINJ	(4)	
508	47.30	11.06	704.		GARMISCH-PARTEN	(2)CHEN		565	44.08	15.13	5.	ZADAR	(4)	
509	50.34	8.42	185.		GIESSEN	(2)		566	38.01	-7.52	272.	BEJA	(4)	
510	53.54	10.42		5.	LUBECK	(2)		567	37.01	-9.00	67.	C. D. SAO VICEN	(4)	
511	47.24	10.17	810.		OBERSTDORF	(2)		568	37.01	-7.55	36.	FARO	(4)	
512	48.35	13.24	301.		PASSAU	(2)		569	41.49	-7.47	1005.	MONTALEGRE	(4)	
513	53.00	9.50		77.	SOLTAU	(2)		570	40.25	-7.33	1383.	PENHAS DOURADAS	(4)	
514	48.23	9.58	480.		ULM	(2)		571	38.53	-6.58	203.	BADAJOZ	(4)	
515	49.02	10.58	422.		WEISSENBURG	(2)		572	36.43	-4.25	33.	MALAGA	(4)	
516	54.55	8.19		12.	WESTERLAND AUF	(2)T		573	39.52	4.15	47.	MAHON	(4)	
517	54.56	12.03		25.	BOGÖ	(2)		574	38.22	-0.30	81.	ALICANTE	(4)	
518	55.23	10.27		15.	ODENSE	(2)		575	37.51	-4.50	91.	CORDOBA	(4)	
519	54.56	8.52		2.	TÖNDER	(2)		576	42.49	-1.39	466.	PAMPLONA	(4)	
520	56.46	8.19		19.	VESTERVIG	(2)		577	41.46	-2.28	1080.	SORIA	(4)	
521	41.55	8.48		4.	AJACCIO	(2)		578	40.49	.30	44.	TORTOSA	(4)	
522	50.44	1.36		73.	BOULOGNE-SUR-ME	(2)		579	40.04	-2.08	944.	CUNENCA	(4)	
523	45.37	6.46	865.		BOURG-SAINT-MAU	(2)E		601	60.55	9.18	635.	AABJORSBRAATEN	(5)	
524	48.51	-3.00		35.	BREHALT	(2)		602	69.58	23.22	4.	ALTA	(5)	
525	49.10	-0.25		66.	CAEN	(2)		603	62.02	10.48	485.	ALVDAL	(5)	
526	43.40	7.13		5.	NICE	(2)		604	69.19	16.07	5.	ANDENES	(5)	
527	47.59	1.45	125.		ORLEANS	(2)		605	59.40	10.47	95.	AAS	(5)	
528	47.18	-3.13		37.	POINTE-DU-TALUT	(2)		606	59.51	10.26	154.	ASKER	(5)	
529	43.00	1.06	411.		SAINT-GIRONS	(2)		607	69.04	18.31	76.	BARDUFOSS	(5)	
530	54.11	-8.27		37.	COLLOONEY	(2)		608	62.50	10.01	424.	BERKAAK	(5)	
531	51.54	-8.29		15.	CORK	(2)		609	68.26	18.05	512.	BJORNFELL	(5)	
532	65.38	-16.07	384.		GRIMMSSTADIR	(2)		610	68.37	14.27	7.	BO I VASTERAALE	(5)	
533	65.05	-22.44		26.	STYKKISHOLMUR	(2)		611	67.16	14.22	10.	BODO	(5)	
534	63.24	-20.17	118.		VESTMANNAEYJAR	(2)		612	59.09	11.34	114.	BREKKE SLUSE	(5)	
535	51.59	4.12		1.	NAALDWIJK	(2)		613	65.28	12.13	5.	BRONNOYSUND I	(5)	
536	51.27	3.36		6.	VLISSINGEN	(2)		614	58.40	7.49	206.	BYGLANDSFJORD I	(5)	
537	51.56	6.43		33.	WINTERSWIJK	(2)		615	60.25	8.27	870.	DAGALI	(5)	
538	46.52	8.38	451.		ALTDORF	(2)		616	68.47	19.43	226.	DIVIDALEN	(5)	
539	47.33	7.35	317.		BASEL-BINNINGEN	(2)		617	68.03	16.02	60.	DRAG I TYSTFJOR	(5)	

618	61.53	12.03	675.	DREVSJO	(5)
619	60.13	10.19	195.	EGGEMOEN	(5)
620	59.30	11.17	140.	EIDSBERG	(5)
621	70.05	30.06	6.	EKKEROY	(5)
622	61.42	8.17	674.	ELVESETER	(5)
623	61.31	7.54	2062.	FANARAAKEN	(5)
624	67.15	15.23	14.	FAUSKE	(5)
625	59.02	10.32	6.	FERDER	(5)
626	59.11	6.04	1.	FISTER	(5)
627	61.25	6.47	10.	FJAERLAND	(5)
628	60.37	12.01	183.	FLISA	(5)
629	60.47	10.12	160.	FLUBERG	(5)
630	62.07	9.17	952.	FOKSTUA	(5)
631	61.27	5.51	3.	FORDE I SUNNFJO	(5)
632	59.54	10.38	18.	FORNEBU	(5)
633	61.30	7.42	27.	FORTUN	(5)
634	71.06	24.00	13.	FRUHOLMEN	(5)
635	60.12	11.05	202.	GARDERMOEN	(5)
636	59.51	8.40	1828.	GAUSTATOPPEN	(5)
637	60.32	8.13	768.	GEILO (STRAND)	(5)
638	69.21	18.05	12.	GIBOSTAD	(5)
639	62.37	7.10	51.	GJERMUNDNES	(5)
640	67.53	13.03	31.	GLAAPEN FYR	(5)
641	66.49	13.59	39.	GLOMFJORD	(5)
642	58.20	8.36	7.	GRIMSTAD	(5)
643	67.50	14.47	6.	GROTOY	(5)
644	59.24	9.11	24.	GVARV	(5)
645	65.36	13.59	221.	HATTFJELLDAL	(5)
646	60.31	7.52	988.	HAUGASOL I	(5)
647	67.24	13.54	14.	HELLIGVAER	(5)
648	60.45	4.43	20.	HELLISOY FYR	(5)
649	71.04	26.14	33.	HELNES FYR	(5)
650	64.36	12.16	21.	HOYLANDETT	(5)
651	60.06	11.24	162.	HVAM	(5)
652	59.51	6.00	24.	INDRE MATRE	(5)
653	58.52	9.36	15.	JOMFRULAND	(5)
654	69.00	23.02	306.	KAUTOKEINO	(5)
655	59.19	11.03	58.	KALNES	(5)
656	69.23	25.31	129.	KARASJOK	(5)
657	69.40	30.23	12.	KARPBUKT	(5)
658	61.34	4.48	9.	KINN	(5)
659	69.44	30.02	5.	KIRKENES	(5)
660	60.46	10.49	128.	KISE PA HEDMARK	(5)
661	70.27	25.13	12.	KISTRAND	(5)
662	58.12	8.05	12.	KJEVIK	(5)
663	64.10	12.29	195.	KJEVLI I SNAASA	(5)
664	58.48	5.38	14.	KLEPP	(5)
665	59.40	9.39	172.	KONGSBERG	(5)
666	58.16	7.20	337.	KONSMO	(5)
667	61.37	10.53	303.	KOPPANG	(5)
668	62.02	4.59	38.	KRAAKENES FYR	(5)
669	63.07	7.45	48.	KRISTIANSUND N.	(5)
670	60.24	5.55	408.	KVAMSKOGEN	(5)
671	61.04	7.31	36.	LAERDAL	(5)
672	61.11	6.52	22.	LEIKANGER	(5)
673	65.05	11.42	50.	LEKA	(5)
675	58.06	6.34	13.	LISTA	(5)
676	61.07	9.04	526.	LOKEN I VOLBU	(5)
677	70.20	21.28	10.	LOPPA	(5)
678	61.26	7.25	484.	LUSTER SANATORI	(5)
679	59.54	9.32	290.	LYNGDAL I NUMED	(5)
680	58.38	9.09	4.	LYNGOR FYR	(5)
681	65.13	13.22	352.	MAJAVATN	(5)
682	70.42	30.05	11.	MAKKAUR FYR	(5)
683	58.03	7.27	138.	MANDAL II	(5)
684	63.25	11.46	218.	MERAAKER	(5)
685	60.50	5.56	104.	MODALEN	(5)
686	66.46	12.29	19.	MYKEN	(5)
687	68.28	17.30	32.	NARVIK II	(5)
688	60.34	9.08	165.	NESBYEN	(5)
689	66.22	12.39	7.	NORD-SOLVAER	(5)
690	61.56	6.06	71.	NORDFJORDEID	(5)
691	64.48	10.33	33.	NORDOYAN	(5)
692	60.42	10.53	270.	O. TOTEN	(5)
693	58.39	5.34	24.	OBRESTAD	(5)
694	68.20	15.38	16.	OFFERSOY	(5)
695	58.04	8.03	9.	OKSOY	(5)
696	62.52	6.33	11.	ONA	(5)
697	61.56	7.14	201.	OPSTRYN	(5)
698	63.42	9.37	9.	ORLAND	(5)
699	69.10	29.15	54.	PASVIK	(5)
700	59.19	10.49	14.	RAADE	(5)
701	62.34	11.23	628.	ROROS	(5)
702	67.30	12.04	8.	ROST	(5)
703	70.24	28.12	9.	RUSTEFJELBMA	(5)
704	59.23	10.47	40.	RYGGE	(5)
705	68.57	16.40	17.	SANDSOY I SENJA	(5)
706	59.39	6.22	5.	SAUDA	(5)
707	63.12	11.07	197.	SELBU	(5)
708	68.45	23.33	382.	SICCAJAVRE	(5)
709	65.52	12.11	4.	SKAALVAER	(5)
710	69.42	19.01	14.	SKATTORA	(5)
711	69.23	20.18	46.	SKIBOTN	(5)
712	67.25	11.53	18.	SKOMVAER FYR	(5)
713	59.59	12.08	150.	SKOTTERUD	(5)
714	68.09	14.39	11.	SKROVA	(5)
715	59.09	5.15	47.	SKUDENES	(5)
716	59.54	5.04	15.	SLAATTEROY	(5)
717	71.05	28.14	8.	SLETNES FYR	(5)
718	60.37	7.25	1300.	SLIRAA	(5)
719	58.53	5.38	8.	SOLA	(5)
720	69.38	18.01	2.	SOMMAROY I SENJ	(5)
721	61.53	10.09	738.	SOR-NESSET	(5)
722	58.57	5.44	67.	STAVANGER	(5)
723	59.14	10.17	76.	STOKKE	(5)
724	63.51	8.28	28.	SULA FYR	(5)
725	63.40	12.01	251.	SULSTUA	(5)
726	62.33	9.07	195.	SUNNDAL	(5)
727	59.51	6.57	1048.	SVANDALSFLONA	(5)
728	62.20	5.16	39.	SVINOY FYR	(5)
729	60.14	5.27	55.	SYFTELAND	(5)
730	62.13	7.26	27.	TAFJORD	(5)

730	62.13	7.26	27.	TAFJORD	(5)		835	47.45	16.12	310.	FOEHRENAU	(9)	(F)
731	61.02	5.23	39.	TAKLE	(5)		836	47.20	12.44	1964.	SCHMITTENHOEHE	(9)	
732	58.40	6.42	57.	TONSTAD	(5)		837	47.18	12.47	753.	ZELL AM SEE	(9)	
733	70.15	19.30	22.	TORSVAAG	(5)		838	47.25	13.08	1503.	MITTERBERG	(9)	(F)
734	58.24	8.48	12.	TORUNGEN FYR	(5)		839	47.19	14.03	1110.	ST. NIKOLAI	(9)	
735	63.25	10.27	127.	TRONHEIM(VOLL)	(5)		840	47.24	14.49	695.	MAUTERN	(9)	(F)
736	61.20	12.15	356.	TRYSIL	(5)		841	47.25	15.16	489.	BRUCK/MUR	(9)	
737	59.59	10.41	512.	TRYVASSHOGDA	(5)		842	47.20	16.14	360.	BAD TATZMANNSDO	(9)	(F)
738	59.02	8.31	252.	TVEITSUND	(5)		843	47.18	16.26	335.	RECHNITZ	(9)	
739	62.18	10.45	483.	TYNSET II	(5)		844	47.14	10.45	785.	IMST	(9)	
740	60.20	6.40	71.	ULLENSVANG	(5)		845	47.03	10.52	1410.	PIOESMES	(9)	(F)
741	59.18	4.53	55.	UTSIRA	(5)		846	47.14	12.11	1062.	KRIMML	(9)	
742	61.52	9.06	371.	VAAGAAMO	(5)		847	47.12	12.36	1041.	SCHNEIDERAU	(9)	(F)
743	63.51	9.44	4.	VALLERSUND	(5)		848	47.00	12.39	1347.	KALS	(9)	
744	61.10	6.39	53.	VANGSNES	(5)		849	47.03	12.48	1950.	PALIK	(9)	(F)
747	63.28	10.56	12.	VAERNES	(5)		850	47.08	13.41	1118.	MAUTERNDORF	(9)	(F)
748	59.00	9.13	68.	VEFALL I DRANGE	(5)		851	47.12	14.47	657.	ZELTWEG	(9)	(F)
749	60.13	12.01	175.	VINGER	(5)		852	47.04	16.20	240.	GUESSING	(9)	
750	63.12	9.00	9.	VINJEORA	(5)		853	46.58	9.55	1474.	GARGELLEN	(9)	(F)
751	61.36	9.46	241.	VINSTRA	(5)		854	46.52	10.56	1908.	VENT	(9)	
752	61.05	8.59	403.	VOLLEN I SLIDRE	(5)		855	46.51	14.30	598.	SILBEREGG	(9)	
753	60.38	6.26	61.	VOSS	(5)		856	46.52	15.54	303.	BAD GLEICHENBER	(9)	
754	63.48	11.13	74.	YTTEROY	(5)		857	46.43	13.19	941.	WEISSENSEE-NEUS	(9)	
801	48.54	15.17	573.	PFAFFENSCHLAG	(9)		858	46.34	13.17	1525.	NASSFELD	(9)	(F)
802	48.47	15.25	585.	SCHOENFELD	(9)		859	46.37	13.41	904.	BAD BLEIBERG	(9)	
803	48.50	15.43	465.	LANGAU	(9)	(F)	860	46.37	14.02	535.	VELDEN	(9)	
804	46.59	15.07	640.	LANGMANNSPERRE	(9)	(F)	861	46.32	14.09	466.	FEISTRITZ	(9)	(F)
805	48.40	15.39	315.	HORN	(9)		862	46.40	14.38	465.	VOELKERMARKT	(9)	
806	48.35	16.39	192.	WILFERSDORF	(9)		863	46.42	14.52	384.	ST. PAUL	(9)	(F)
807	48.18	15.54	199.	HEILIGENEICH	(9)		901	60.46-	.53	24.	BALTASOUND	(8)	
808	48.25	16.10	192.	SCHOENBORN	(9)	(F)	902	58.57-	2.54	26.	KIRKWALL	(8)	(F)
809	48.35	16.26	199.	SCHLEINBACH	(9)	(F)	903	58.27-	3.05	36.	WICK	(8)	
810	48.02	14.26	336.	STEYR	(9)		904	58.37-	5.00	112.	CAPE WRATH	(8)	
811	48.07	14.52	328.	AMSTETTEN	(9)		905	57.35-	4.05	5.	FORTROSE	(8)	
812	48.09	15.09	252.	PETZENKIRCHEN	(9)		906	57.28-	7.22	5.	BENBECULA	(8)	
813	48.13	15.37	274.	ST. POELTEN	(9)		907	57.01-	6.17	5.	ISLE OF RHUM	(8)	(F)
814	48.02	15.37	340.	TRAISEN	(9)		908	56.43-	5.13	15.	ONICH	(8)	(F)
815	47.34	10.36	835.	VILS	(9)		909	57.08-	4.43	58.	FORT AUGUSTUS	(8)	(F)
816	48.12	16.45	149.	FUCHSENBIGL	(9)		910	57.29-	4.13	4.	INVERNESS	(8)	(F)
817	48.06	16.55	182.	BAD DEUTCH ALTE	(9)	(F)	911	57.35-	3.54	8.	NAIRN	(8)	(F)
818	47.59	13.25	538.	FRANKENMARKT	(9)	(F)	912	57.43-	3.19	6.	LOSSIEMOUTH	(8)	(F)
819	47.56	13.29	539.	THALHAM	(9)		913	57.21-	3.21	215.	GLENLIVET	(8)	(F)
820	47.49	13.47	425.	EBENSEE	(9)		914	57.00-	3.24	339.	BRAEMAR	(8)	(F)
821	47.51	15.00	612.	LUNZ	(9)		915	57.02-	3.12	283.	BALMORAL	(8)	
822	47.48	16.16	270.	WR. NEUSTADT-KL	(9)	ANLA	916	57.27-	2.23	55.	FYVIE CASTLE	(8)	(F)
823	47.57	16.52	133.	NEUSIEDL AM SEE	(9)		917	57.12-	2.12	65.	DYCE	(8)	
824	47.47	17.02	118.	ANDAU	(9)	(F)	918	56.32-	4.07	130.	ARDTALNAIG	(8)	
825	47.40	13.05	801.	DUERRNBERG	(9)	(F)	919	56.23-	2.52	10.	LEUCHARS	(8)	
826	47.32	13.43	1350.	SCHOENBERGALM	(9)		920	55.57-	3.21	35.	TURNHOUSE	(8)	
827	47.33	13.39	525.	HALLSTATT	(9)	(F)	921	56.00-	2.31	23.	DUNBAR	(8)	(F)
828	47.35	13.59	1609.	HOLLHAUS	(9)	(F)	922	55.43-	3.22	253.	BLYTH BRIDGE	(8)	
829	47.44	14.20	600.	WINDISCHGARSTEN	(9)	(F)	923	55.14-	2.34	201.	KIELDER CASTLE	(8)	
830	47.33	14.54	792.	EISENERZ	(9)		924	54.58-	2.15	82.	HAYDON BRIDGE	(8)	(F)
831	47.31	14.57	1215.	PRAEBICHL	(9)		925	55.13-	1.41	99.	COCKLE PARK	(8)	
832	47.35	15.30	664.	VEITSCH	(9)	(F)	926	54.46-	1.35	102.	DURHAM	(8)	
833	47.39	15.50	855.	SEMMERING	(9)		927	54.20-	0.31	203.	SILPHO MOOR	(8)	
834	47.42	16.08	338.	PITTEN	(9)	(F)	928	54.06-	0.38	175.	HIGH MOWTHORPE	(8)	(F)

928	54.06-	0.38	175.	HIGH MOWTHORPE	(8)		983	51.42-	5.09	33.	DALE FORT	(8)	(F)
929	53.10-	0.31	68.	WADDINGTON	(8)		984	51.37-	3.55	10.	SWANSEA	(8)	(F)
930	53.09	0.21	5.	SKEGNESS	(8)	(F)	985	51.24-	3.20	65.	RHOOSE	(8)	(F)
931	52.45	0.18	2.	TERRINGTON ST.	(8)	(F)	986	51.26-	2.40	51.	LONG ASHTON	(8)	(F)
932	52.39	0.34	23.	MARHAM	(8)	(F)	987	51.12-	4.08	8.	ILFRACOMBE	(8)	(F)
933	51.57	1.02	5.	EAST BERGHOLT	(8)	(F)	988	50.44-	3.25	32.	EXETER	(8)	
934	52.07	0.58	89.	WATTISHAM	(8)	(F)	989	50.07-	5.32	19.	PENZANCE	(8)	(F)
935	52.30	1.45	25.	LOWESTOFT	(8)	(F)	990	50.26-	5.00	103.	ST. MAWGAM	(8)	
936	52.21-	0.07	40.	WUTON	(8)	(F)	991	50.50-	4.33	15.	BUDE	(8)	
937	52.01-	0.25	59.	SILSOE	(8)		992	54.39-	6.13	68.	ALDERGROVE	(8)	
938	51.53	0.13	101.	STANSTED	(8)		993	55.01-	6.07	235.	PARKMORE	(8)	(F)
939	53.59-	2.26	192.	SLAIDBURN	(8)	(F)	994	54.21-	6.39	62.	ARMAGH	(8)	
940	54.06-	2.10	393.	MALHAM TARN	(8)	(F)	1002	59.47	21.23	9.	UTO	(7)	
941	53.39-	1.50	232.	HUDDERSFIELD OA	(8)	(F)	1003	59.58	19.57	8.	NYHAMN	(7)	(F)
942	53.49-	1.46	134.	BRADFORD	(8)	(F)	1005	59.46	22.57	6.	RUSSARO	(7)	
943	53.56-	1.50	83.	ILKLEY	(8)	(F)	1006	60.23	22.33	6.	PIIKKIO	(7)	
944	53.15-	1.55	307.	BUXTON	(8)		1008	60.24	23.46	84.	SUOMUSJARVI KET	(7)A	
945	52.50-	1.15	48.	SUTTON BONNINGT	(8)		1010	60.08	23.33	12.	POHJA FISKARS	(7)	
946	53.09-	1.11	114.	MANSFIELD	(8)	(F)	1011	60.22	23.06	3.	SALO	(7)	
947	53.29-	1.00	10.	FINNINGLEY	(8)	(F)	1012	60.19	24.58	53.	HELSINKI-VANTAA	(7)	
948	52.27-	1.44	96.	ELMDON	(8)	(F)	1014	60.06	24.55	5.	KATAJALUOTO HEL	(7)KI	
949	52.27-	1.45	98.	ELMDON	(8)	(F)	1017	60.12	24.55	47.	HELSINKI-ILMALA	(7)	(F)
950	51.46-	1.16	63.	OXFORD	(8)		1018	60.15	24.03	37.	LOHJA PORLA	(7)	
951	53.00-	2.16	179.	KEELE	(8)	(F)	1019	60.25	24.24	39.	VIHTI MAASOJA	(7)	
952	52.48-	2.40	72.	SHAWBURY	(8)		1020	60.15	25.03	17.	HELSINKI-MALMI	(7)	
953	51.29-	0.27	25.	HEATHROW	(8)		1021	60.17	25.04	22.	VANTAA TIKKURIL	(7)	
995	52.07-	2.30	84.	PRESTOW WYNNE	(8)		1024	60.25	25.02	45.	TUUSULA HYRYLA	(7)	
954	51.09-	0.11	59.	GATWICK	(8)		1026	60.22	22.65	11.	RANKKI/KOTKA	(7)	
996	51.54-	2.03	65.	CHELTENHAM	(8)		1030	61.28	21.48	13.	PORI LENTOASEMA	(7)	
955	51.04	0.27	85.	GOUDHURST	(8)		1031	61.08	21.22	6.	KUUSKAJASKARI/R	(7)A	
956	51.17	0.27	33.	EAST MALLING	(8)	(F)	1032	60.38	21.52	13.	MIETOINEN	(7)	(F)
957	51.11	0.57	56.	WYE	(8)		1034	60.31	22.16	51.	TURKU LENTOASEM	(7)	
958	51.24	1.24	16.	MARGATE	(8)	(F)	1035	61.11	22.43	48.	HUITTINEN	(7)	
959	50.46	0.17	7.	EASTBOURNE	(8)	(F)	1036	61.16	22.15	38.	KOKEMAKI	(7)	
960	50.47-	1.50	10.	HURN	(8)		1037	60.49	23.30	104.	JOKIOINEN OBSER	(7)ORIO	
961	50.36-	1.13	60.	VENTNOR	(8)	(F)	1038	61.28	23.44	85.	TAMPERE LENTOAS	(7)	(F)
962	51.10-	1.45	126.	BOSCOMBE DOWN	(8)		1039	60.36	24.48	86.	HYVINKAA	(7)	
963	56.30-	6.53	9.	TIREE	(8)		1040	61.04	24.14	88.	HATTULA, LETEEN	(7)	
964	55.52-	4.22	8.	RENFREW	(8)	(F)	1041	61.08	24.20	91.	HATTULA, LEPAA	(7)	
965	55.52-	4.26	5.	ABBOTSINCH	(8)	(F)	1043	61.20	24.13	103.	PALKANE	(7)	
966	55.25-	3.45	387.	LEADHILLS	(8)	(F)	1045	60.58	25.38	83.	LAHTI	(7)	(F)
967	55.30-	4.35	16.	PRESTWICK	(8)		1050	60.54	26.56	99.	UTTI LENTOKENTT	(7)	
968	55.04-	3.36	49.	DUMFRIES	(8)		1053	60.43	26.48	33.	ANJALANKOSKI	(7)	
969	55.04-	4.34	110.	BARGRENNAN	(8)	(F)	1055	61.13	26.03	100.	HEINOLA	(7)	
970	54.59-	4.55	166.	PENWHIRN	(8)	(F)	1057	61.05	28.09	105.	LAPPEENANTA LEN	(7)SEMA	
971	54.05-	4.38	16.	RONALDSWAY	(8)		1060	61.51	22.28	134.	NIINISALO	(7)	
972	54.25-	3.30	13.	SELLAFIELD	(8)	(F)	1061	61.31	22.59	92.	MOUHIJARVI	(7)	
973	54.40-	2.47	171.	NEWTON RIGG	(8)	(F)	1064	62.12	23.19	171.	KIHNIO	(7)	
974	53.46-	3.02	10.	SQUIRES GATE	(8)		1068	62.24	25.41	140.	JYVASKYLA LENTO	(7)MA	
975	53.46-	2.42	33.	PRESTON	(8)	(F)	1070	61.53	26.06	147.	LEIVONMAKI	(7)	
976	53.21-	2.16	75.	RINGWAY	(8)	(F)	1072	61.44	27.18	138.	MIKKELIN MLK, S	(7)	(F)
977	53.21-	3.24	4.	PRESTATYN	(8)	(F)	1073	62.20	27.53	81.	VARKAUS	(7)	
978	53.04-	3.33	335.	ALWEN	(8)	(F)	1079	62.14	30.21	90.	TOHMAJARVI	(7)	
979	53.13-	4.09	84.	PEN-Y-FFRIDD	(8)		1080	63.03	21.46	4.	VAASA LENTOASEM	(7)	(F)
980	52.08-	4.34	133.	ABERPORTH	(8)		1084	62.56	22.30	26.	YLISTARO	(7)	
981	52.26-	4.01	31.	GOGGERDAN	(8)		1086	63.06	23.02	42.	KAUHAVA LENTOKE	(7)A	
982	52.10-	3.42	301.	CWMYSTWYTH	(8)	(F)	1088	62.33	24.09	154.	AHTARI INHA	(7)	(F)

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1094 63.01 27.48  94. KUOPIO LENTOASE(7)
1096 63.09 27.19  88. MAANINKA       (7)
1098 62.40 29.38 116. JOENSUU LENTOAS(7)
1099 63.14 29.15 109. JUUKA          (7) (F)
1100 62.41 30.57 162. ILOMANTSI      (7) (F)
1101 63.18 30.02 105. LIEKSA TIMITRA (7)
1109 64.09 25.26 123. HAAPAVESI      (7)
1112 64.17 27.41 134. KAJAANI LENTOAS(7) (F)
1113 63.50 27.13 207. VIEREMA        (7)
1117 64.56 25.22  12. OULU LENTOASEMA(7)
1118 64.41 25.06  48. RUUKKI REVONLAH(7)
1121 64.31 26.28 113. VAALA PELSO    (7)
1122 65.22 27.01 114. PUDASJARVI     (7) (F)
1125 66.22 23.55  70. YLITORNIO PORTI(7)ARVI
1126 65.47 24.35  10. KEMI LENTOASEMA(7)
1127 65.55 26.32 145. RANUA          (7) (F)
1128 65.35 28.15 209. TAIVALKOSKI    (7)
1130 65.58 29.11 262. KUUSAMO        (7)
1136 66.34 25.50 195. ROVANIEMI LENTO(7)MA
1139 66.35 26.01 103. ROVANIEMEN MLK,(7)UKKA
1142 66.49 28.40 221. SALLA          (7) (F)
1143 67.17 28.10 180. SAVUKOSKI      (7) (F)
1149 68.05 27.12 246. SODANKYLA VUOTS(7) (F)
1154 68.37 27.25 145. IVALO LENTOASEM(7)
1155 69.04 27.05 150. INARI, TOIVONIE(7)
1156 69.45 27.02 107. UTSJOKI KEVO   (7) (F)
1157 70.05 27.54  22. UTSJOKI NUORGAM(7) (F)
1158 68.51 28.18 120. INARI, NELLIM  (7)
1245 64.55 28.57 201. SUOMUSSALMI    (7)
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