

Kolarctic CBC – Project KO4178; Conserving our Atlantic salmon as a sustainable resource for people in the North; fisheries and conservation in the context of growing threats and a changing environment.

## **REPORT V. Simultaneous variations in the water temperatures during summer months in large, medium and small rivers in Barents Sea area in Norway and Finland**

Niemelä<sup>1,2</sup>, E., Hassinen<sup>1,2</sup>, E., Kuusela<sup>3</sup>, J., Kalske<sup>4</sup>, T.H., Høstmark<sup>4</sup>, M.S.

<sup>1)</sup> *University of Turku, Finland*

<sup>2)</sup> *Firm Olli van der Meer, Oulu; Finland*

<sup>3)</sup> *Natural Resource Institute Finland (Luke), 99980 Utsjoki, Finland*

<sup>4)</sup> *County Governor of Troms and Finnmark; Vadsø, Norway*



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<p>REPORT V. Simultaneous variations in the water temperatures during summer months in large, medium and small rivers in Barents Sea area in Norway and Finland</p> <p>Niemelä <sup>1,2</sup>, E., Hassinen <sup>1,2</sup>, E., Kuusela <sup>3</sup>, J., Kalske <sup>4</sup>, T.H., Høstmark <sup>4</sup>, M.S.</p> <p><i><sup>1)</sup> University of Turku, Finland</i>  <sup>2)</sup> <i>Firm Olli van der Meer, Oulu; Finland</i>  <sup>3)</sup> <i>Natural Resource Institute Finland (Luke), 99980 Utsjoki, Finland</i>  <sup>4)</sup> <i>County Governor of Troms and Finnmark; Vadsø, Norway</i></p>	
<p><b>Abstract</b></p> <p>Daily mean water temperatures show different development in the rivers Altaelv and Lakselv compared to the developments in the rivers Tanaelv and Neidenelv. The same difference in development can be seen in all the months. Especially early in the summer, May and June, daily water temperatures are lower than in the rivers Tanaelv and Neidenelv. A reason for the lower daily temperatures is in the River Altaelv, is the large dam in the upper areas of the river, which is releasing cold water from the reservoir. In River Lakselv, there are large and deep lakes which keep cold water early in the summer also in the upper areas of the river. What is remarkable in the water temperature developments in the rivers Altaelv and Lakselv is that daily temperatures are not fluctuating during the whole summer like in "lakeless" rivers Tanaelv and Neidenelv. In the end of summer daily water temperatures are higher in the rivers Altaelv and Lakselv because reservoir and lakes are keeping warm watermasses for longer periods. In the River Tanaelv watershed, the coldest waters are in the tributary river Leavvajohka during almost the entire summer. A reason for the cold water is that the drainage area starts from the highest mountain, Rastigaissa, in the height of appr. 1000 meters. Snow cover stays in the mountainside until early August and melting of snow keeps water cold in the River Leavvajohka. Summer temperatures in the brooks, which are running into the Tana mainstem or into its tributaries, like into the River Utsjoki, depends on the sun's heat and if it is directed to streams or not. Brooks Äimäjoki and Rassijoki are running in sheltered small valleys where the sun doesn't heat the water in the middle of the day and therefore water temperatures in these kind of rivers is cold during all the summer months.</p>	
<p><b>Key words:</b>  Lakselv, Tana, Neiden, Altaelv, water temperatures</p>	
<p><b>Front page photo:</b>  Eero Niemelä</p>	

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# 1. Daily annual mean water temperatures and simultaneous fluctuations in northern salmon rivers

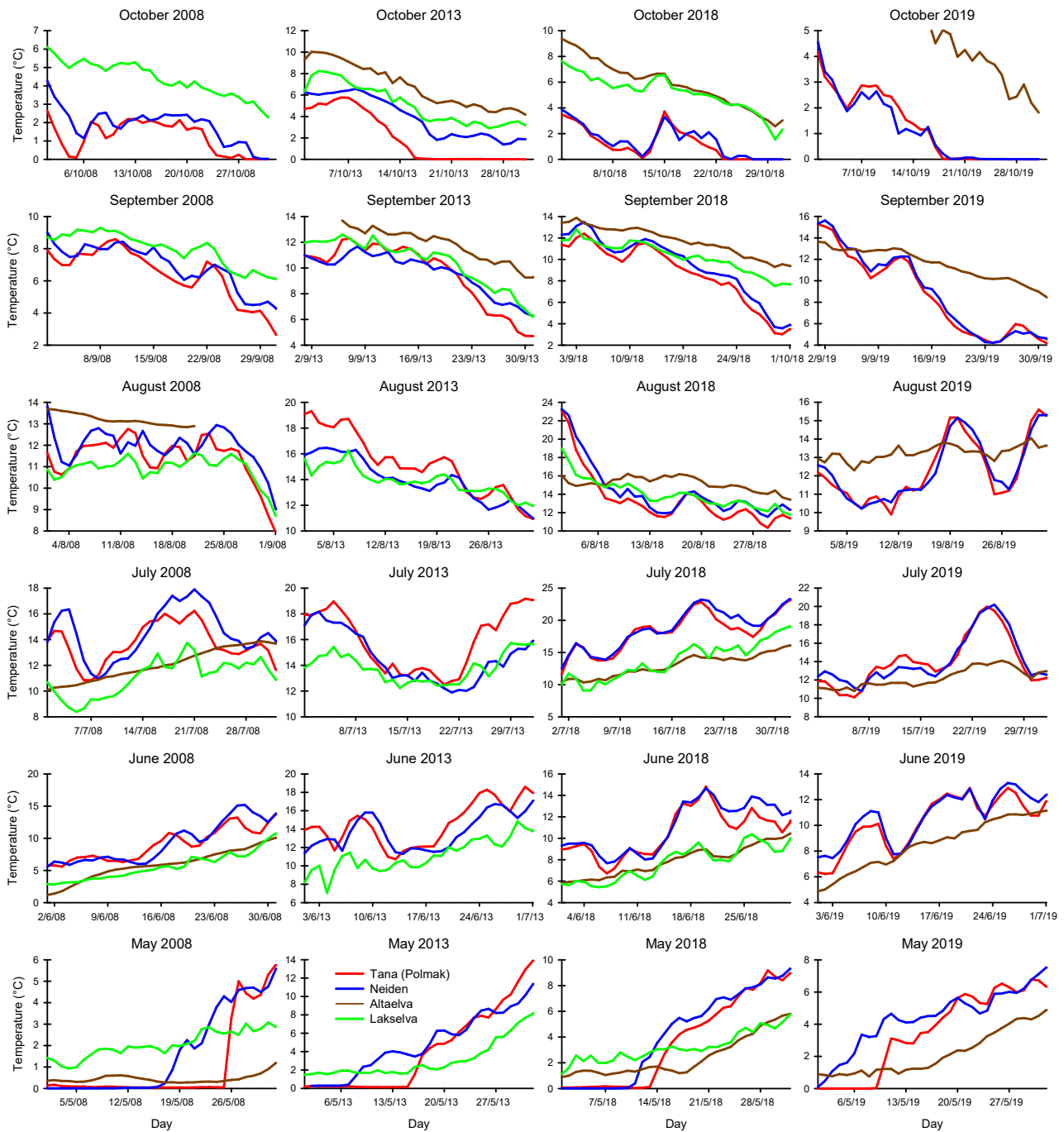


Figure 1. Daily mean water temperatures during summer months in the largest rivers in Finnmark in the years 2008, 2013, 2018 and 2019. Source; NVE (Norway).

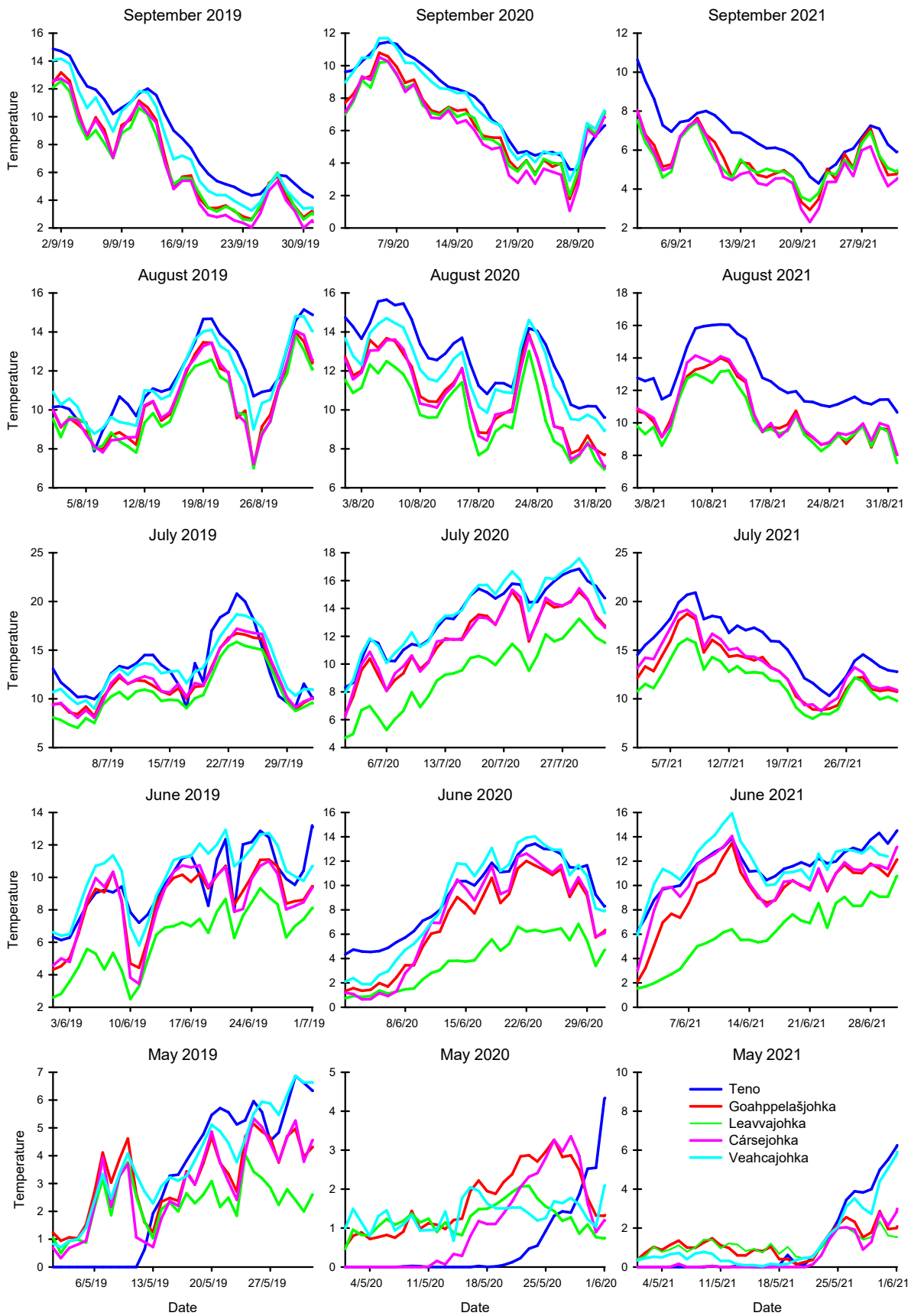


Figure 2. Daily mean water temperatures during summer months in the River Tana and its tributaries in the years 2019, 2020 and 2021. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway), Luke (Finland).

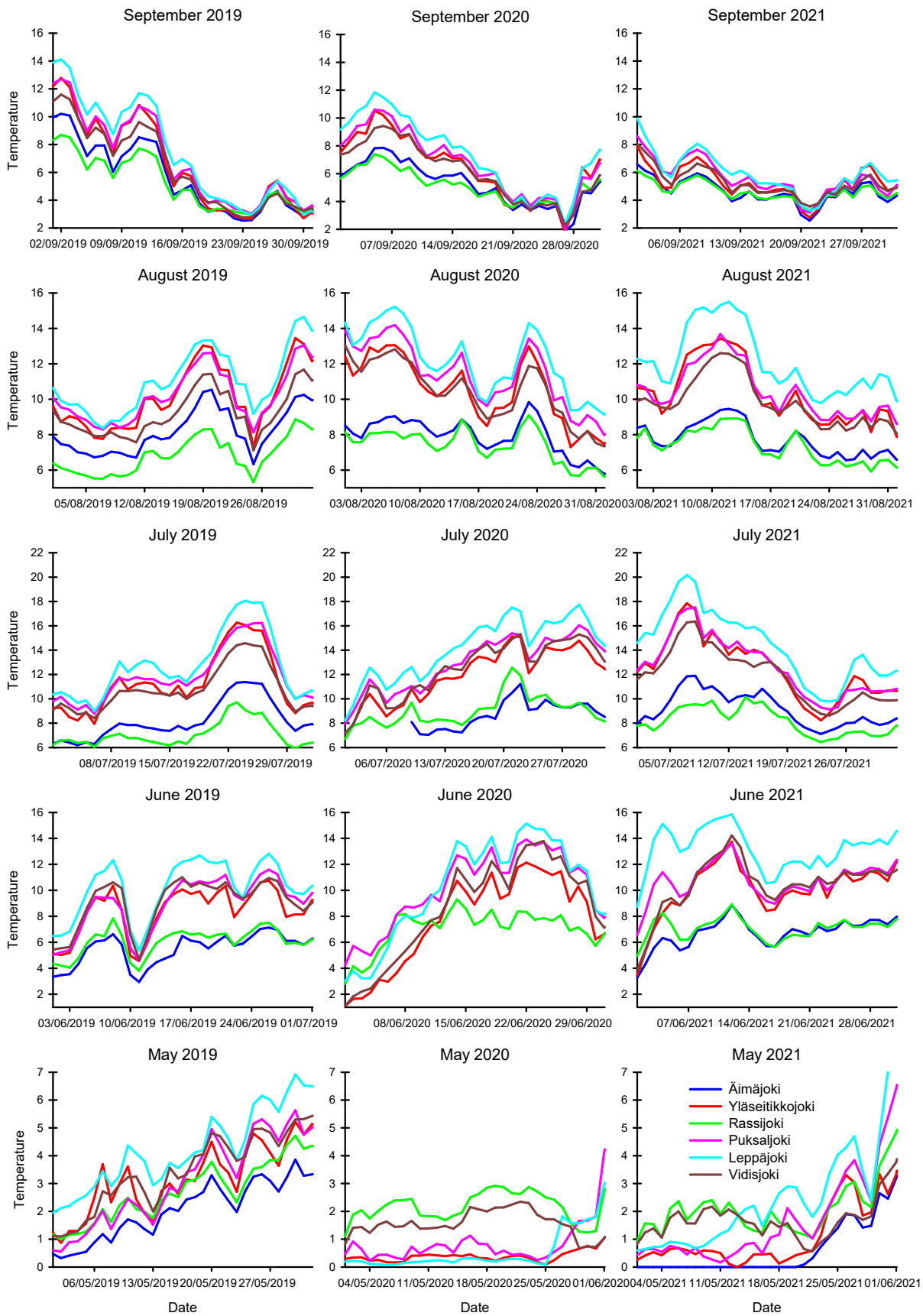


Figure 3. Daily mean water temperatures during summer months in the brooks of River Tana watershed in the years 2019, 2020 and 2021. Source; County Governor in Troms and Finnmark (Norway), Luke (Finland).

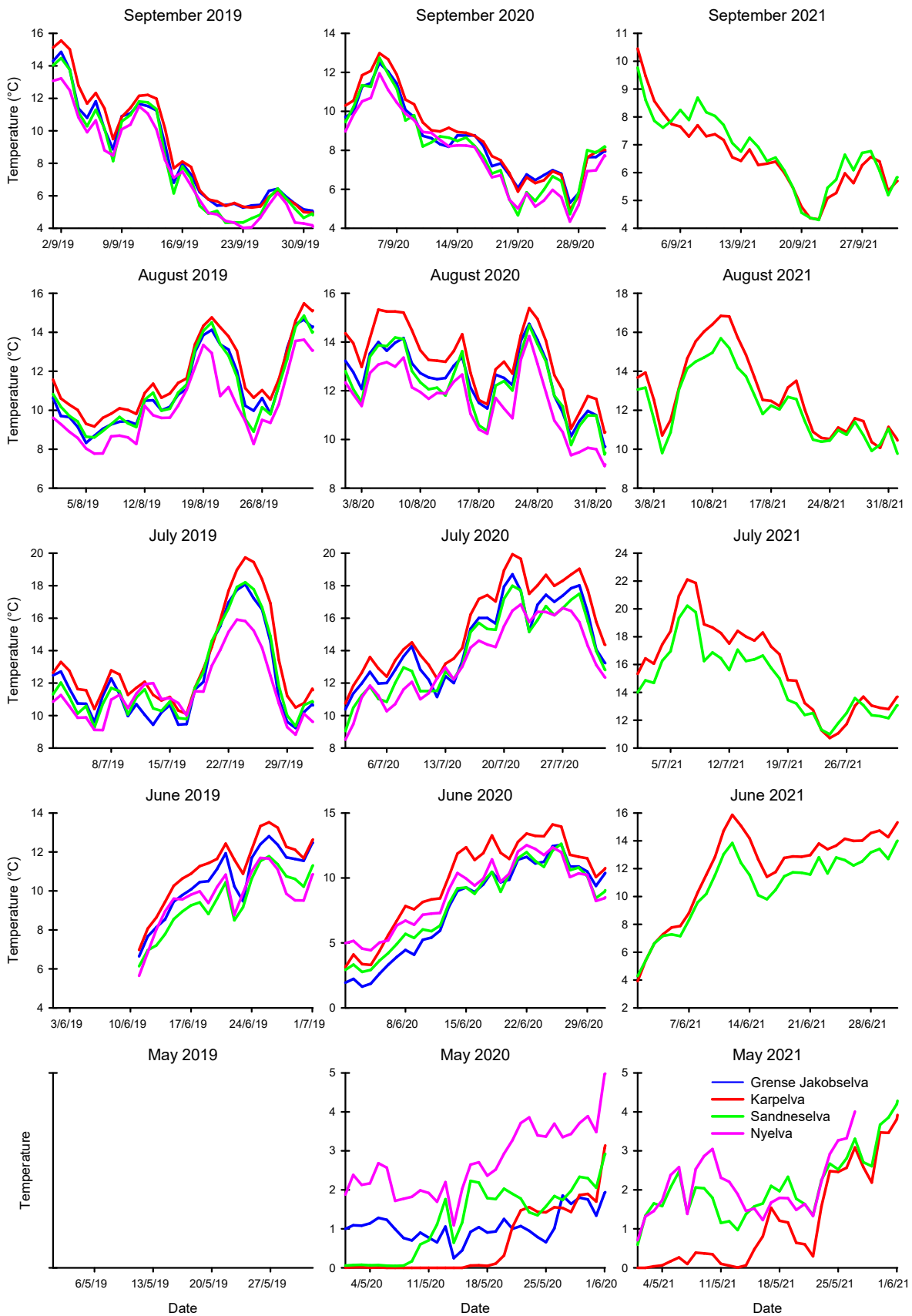


Figure 4. Daily mean water temperatures during summer months in the East-Finmark rivers in the years 2019, 2020 and 2021. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway).

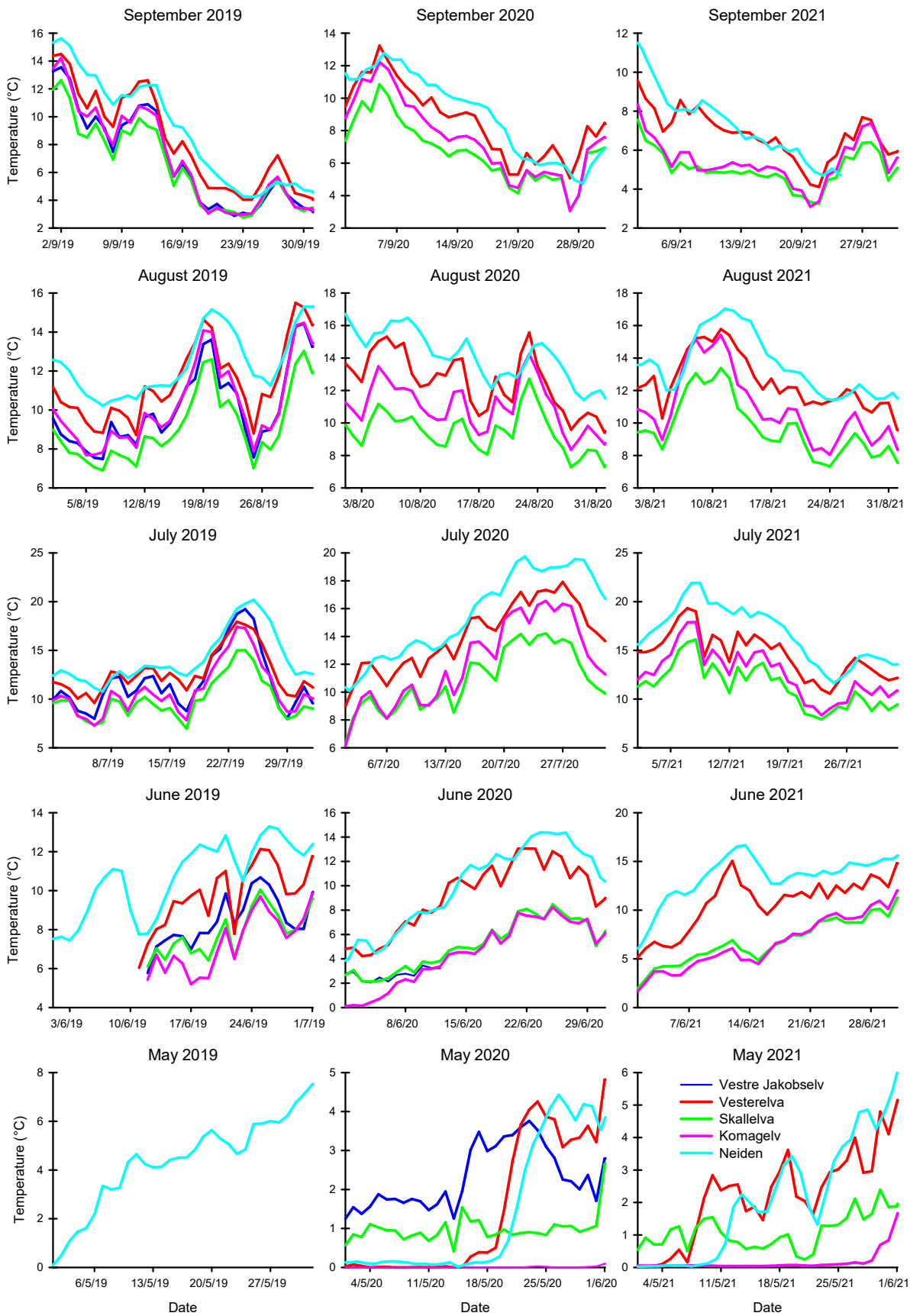


Figure 5. Daily mean water temperatures during summer months in the Southern and Northern Varangerfjord rivers in the years 2019, 2020 and 2021. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway).



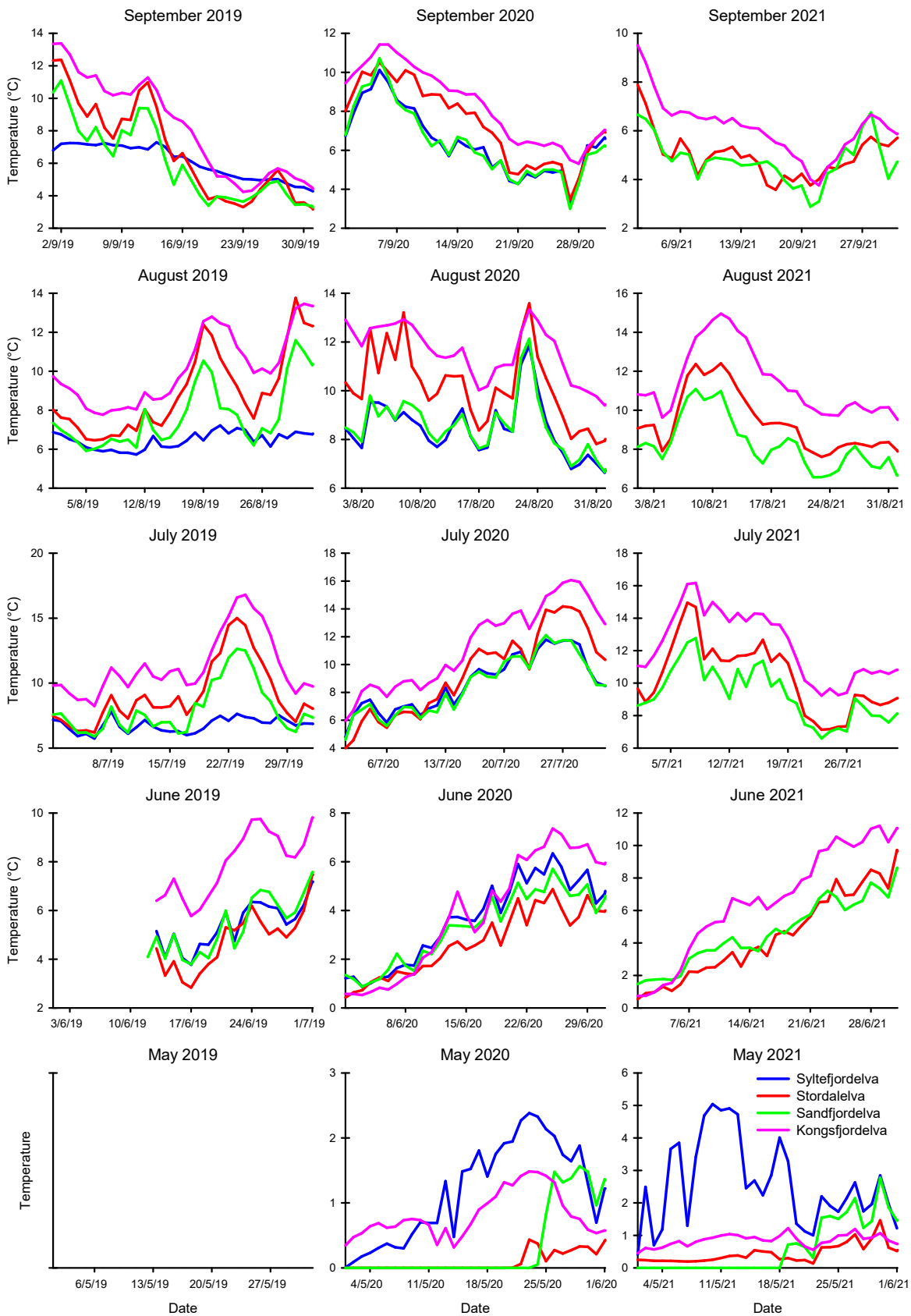


Figure 6. Daily mean water temperatures during summer months in the Northern Varanger Peninsula rivers in the years 2019, 2020 and 2021. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway), Luke (Finland).

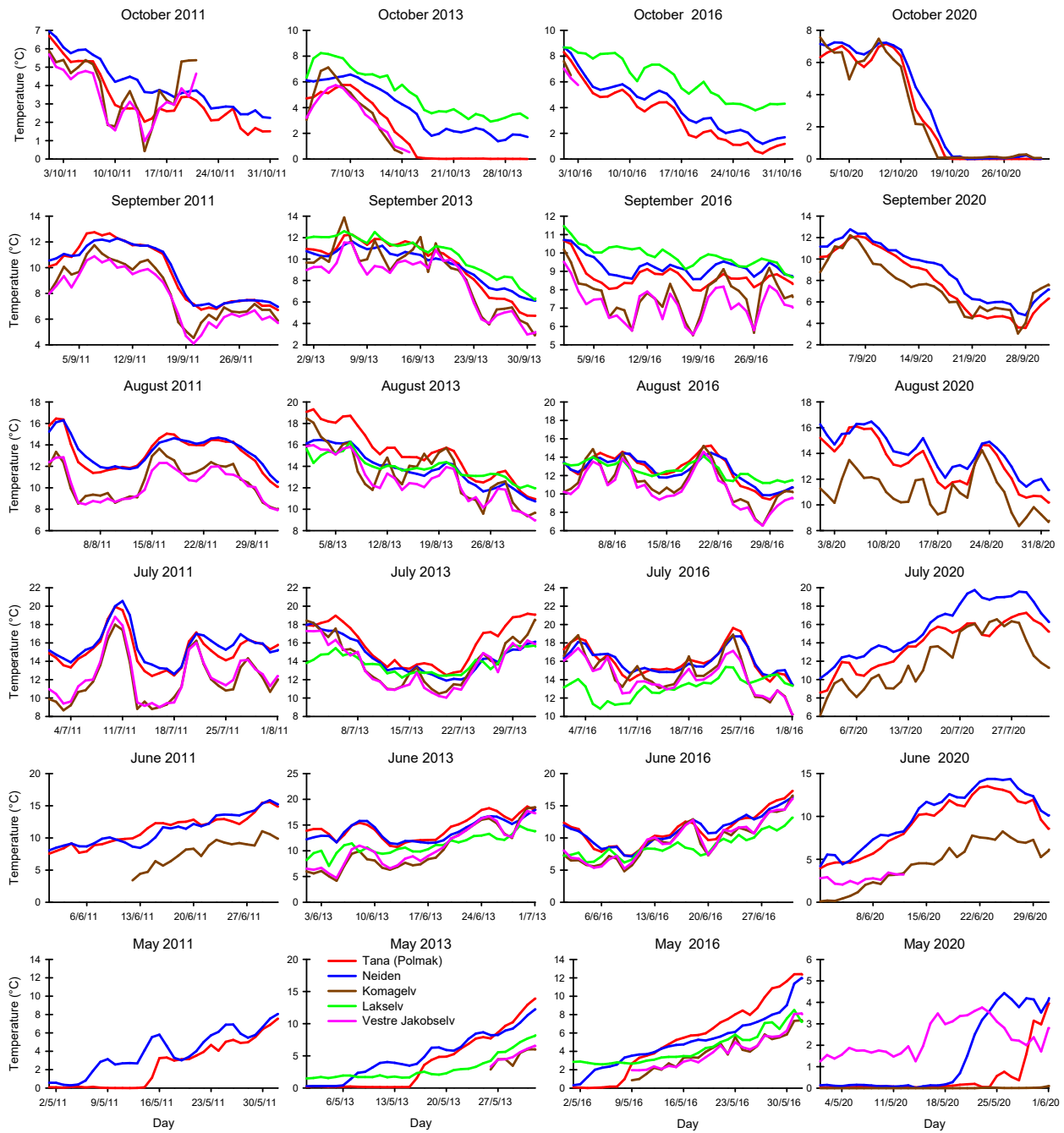


Figure 7. Daily mean water temperatures during summer months in the West Finnmark rivers in the years 2011, 2013, 2016 and 2020. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway).

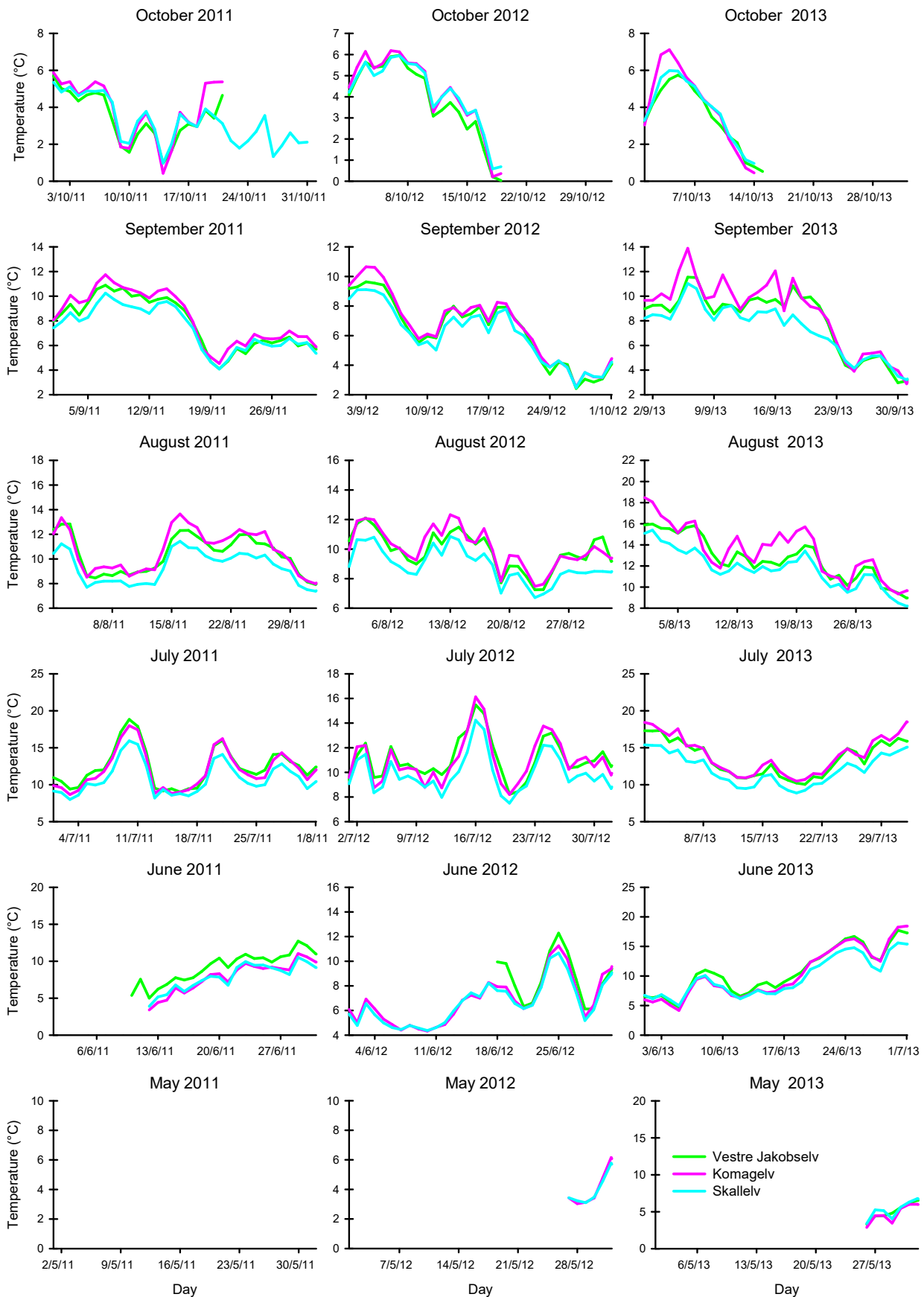


Figure 8. Daily mean water temperatures during summer months in the Northern Varangerfjord rivers in the years 2011, 2012 and 2013. Source; County Governor in Troms and Finnmark (Norway).

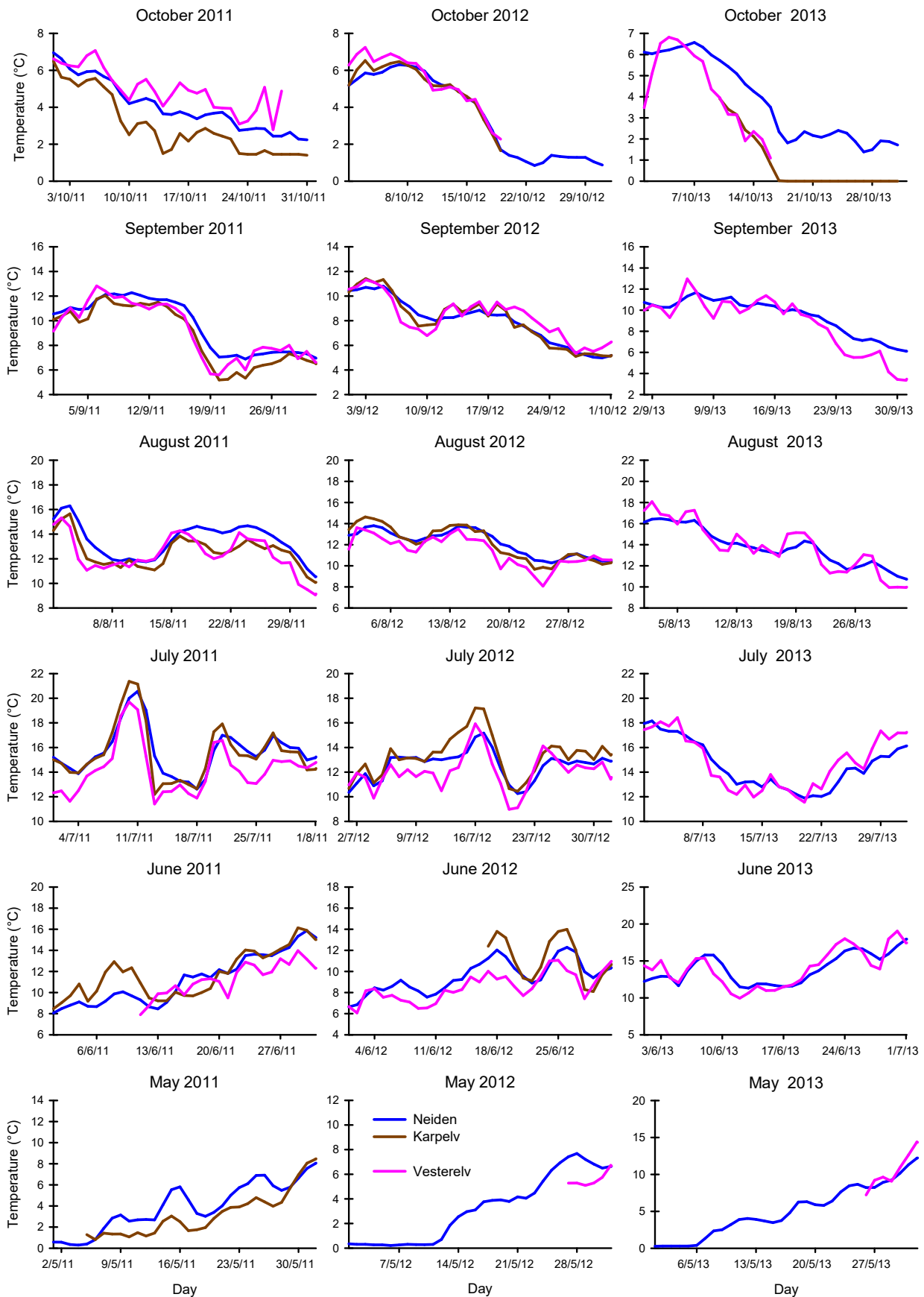


Figure 9. Daily mean water temperatures during summer months in the Southern Varangerfjord rivers in the years 2011, 2012 and 2013. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway).

## 2. Special water temperature expedition to clarify possible simultaneous changes in Northern Norway and Finland in the year 2016

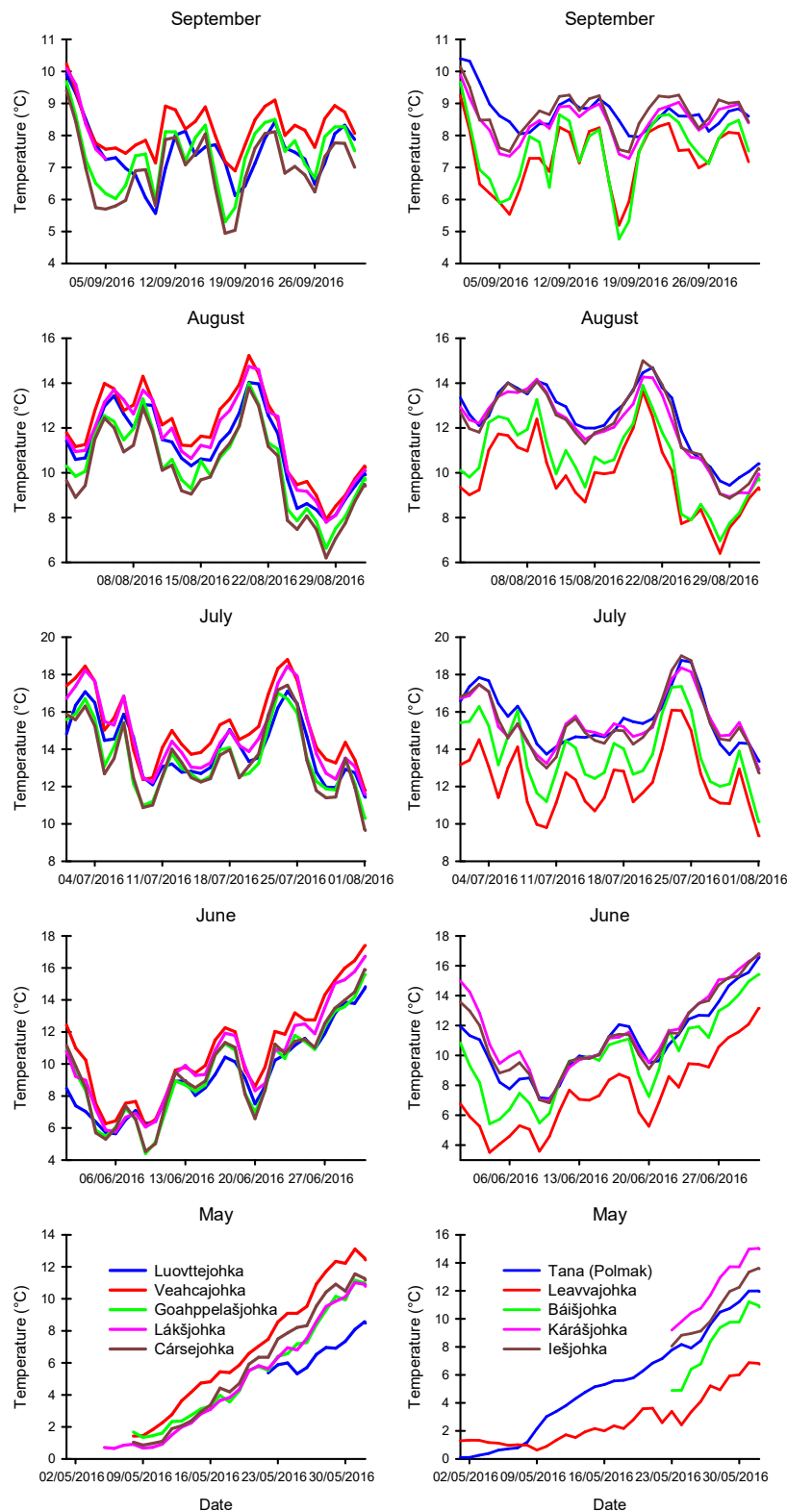


Figure 10. Daily mean water temperatures during summer months within the River Tana watershed in the year 2016. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway), Luke (Finland).

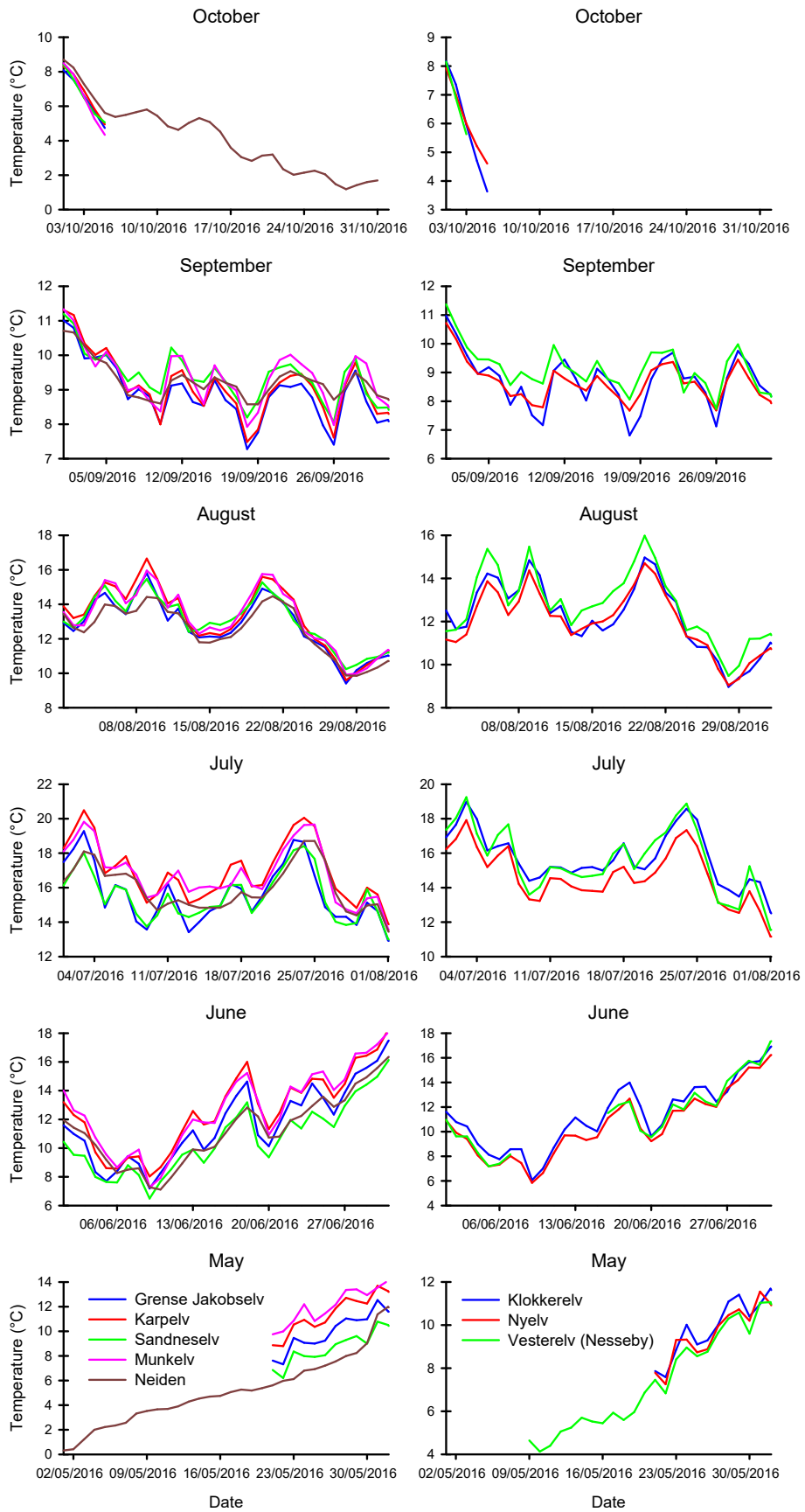


Figure 11. Daily mean water temperatures during summer months in East- Finnmark rivers from River Grene Jakobselv in the east to the River Vesterelv in western Varangerfjord in the year 2016. Source; County Governor in Troms and Finnmark (Norway), Luke (Finland).

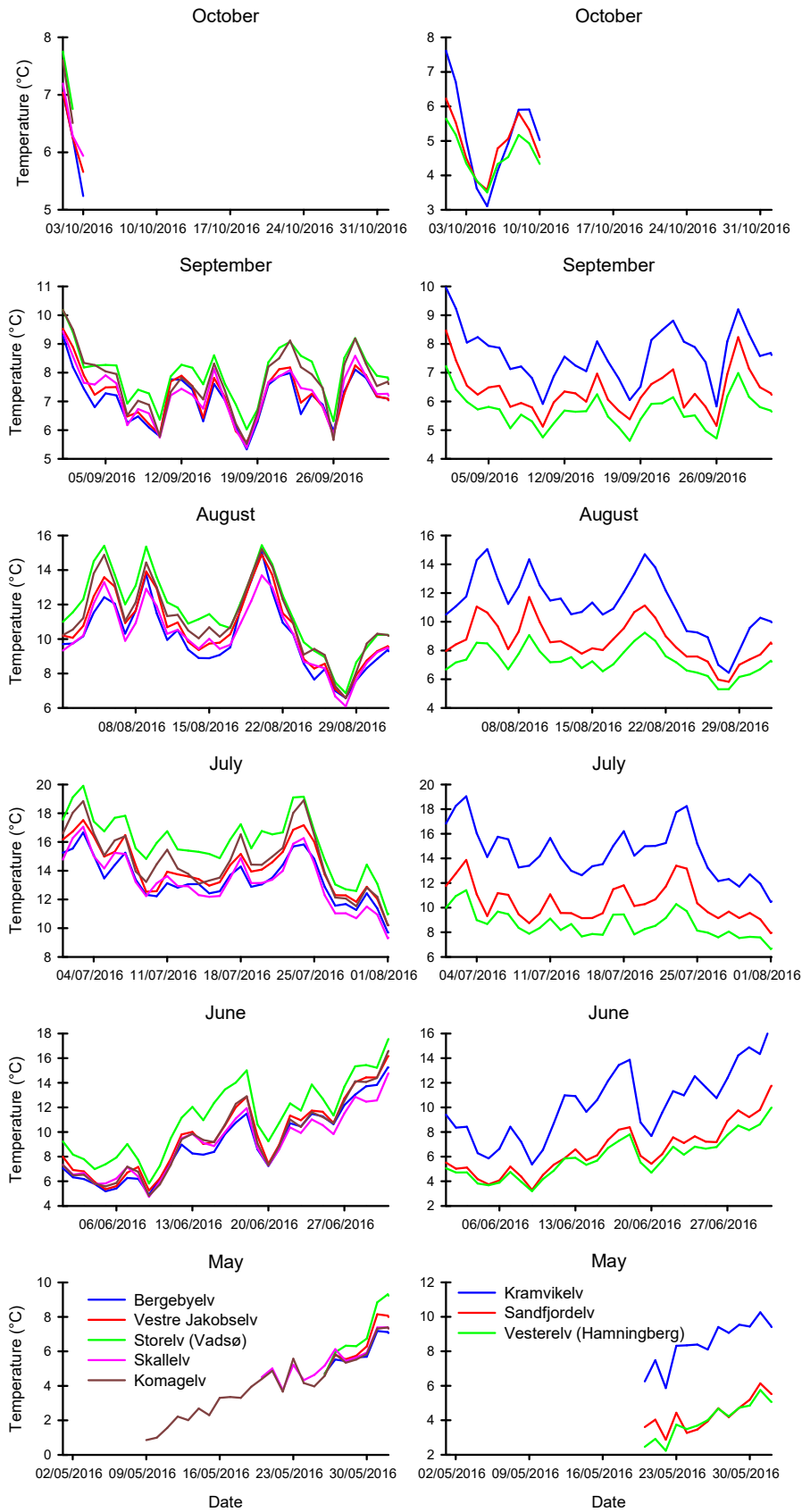


Figure 12. Daily mean water temperatures in the year 2016 during summer months in East-Finmark rivers from River Bergebyelv in northern Varangerfjord to River Sandfjordelv in northern Varanger Peninsula. Source; County Governor in Troms and Finnmark (Norway), Luke (Finland).

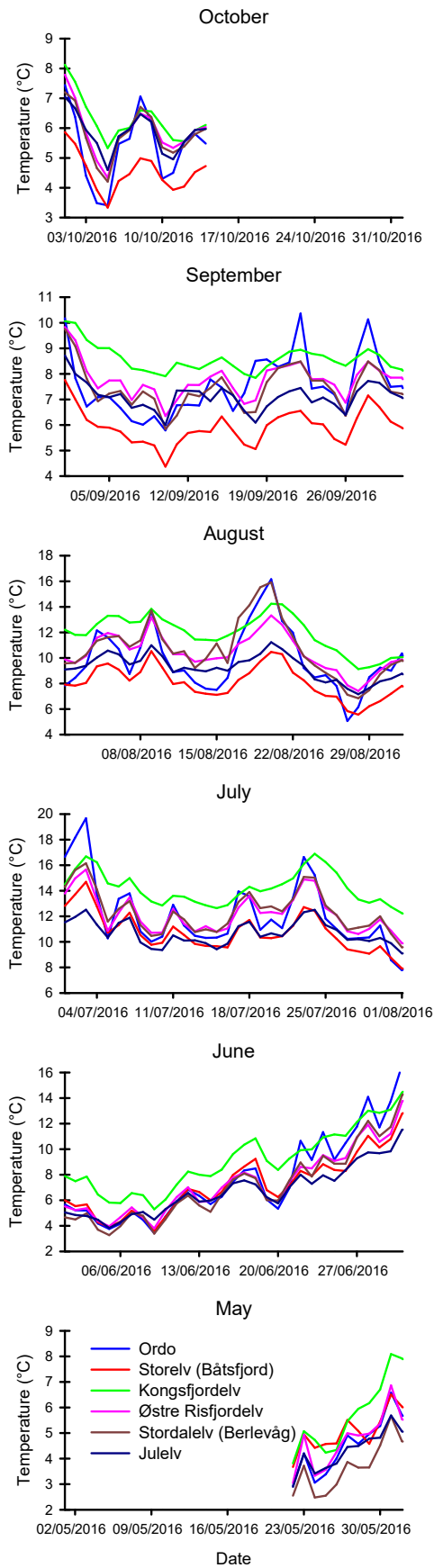


Figure 13. Daily mean water temperatures in the year 2016 during summer months in the northern Varangerfjord Peninsula from River Ordo (Syltefjordelv) to the River Julelv in Tanafjord. Source; County Governor in Troms and Finnmark (Norway), Luke (Finland).



### 3. Hourly simultaneously variations in the water temperature between large rivers with different distances from each other

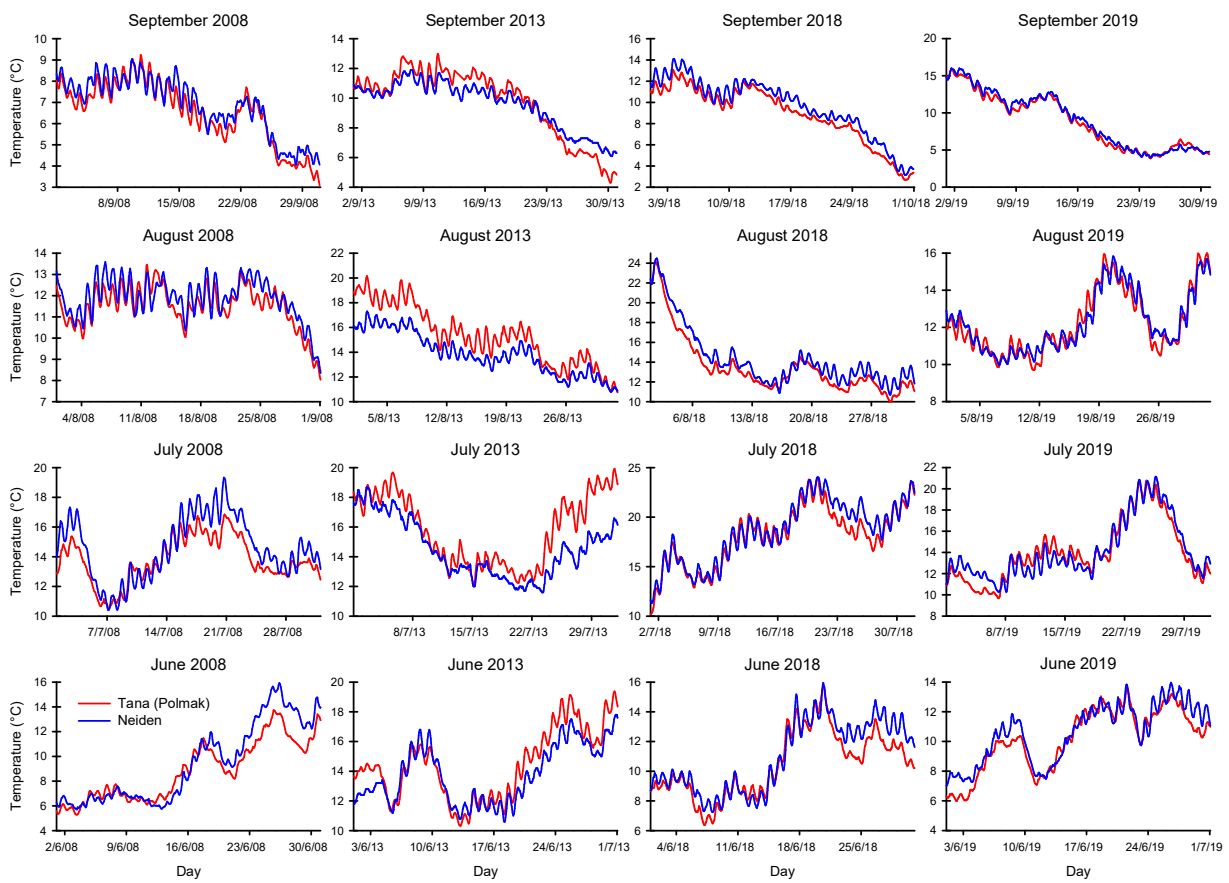


Figure 14. Hourly simultaneous fluctuations during summer months between the rivers Tana and Neiden. Source; NVE (Norway).

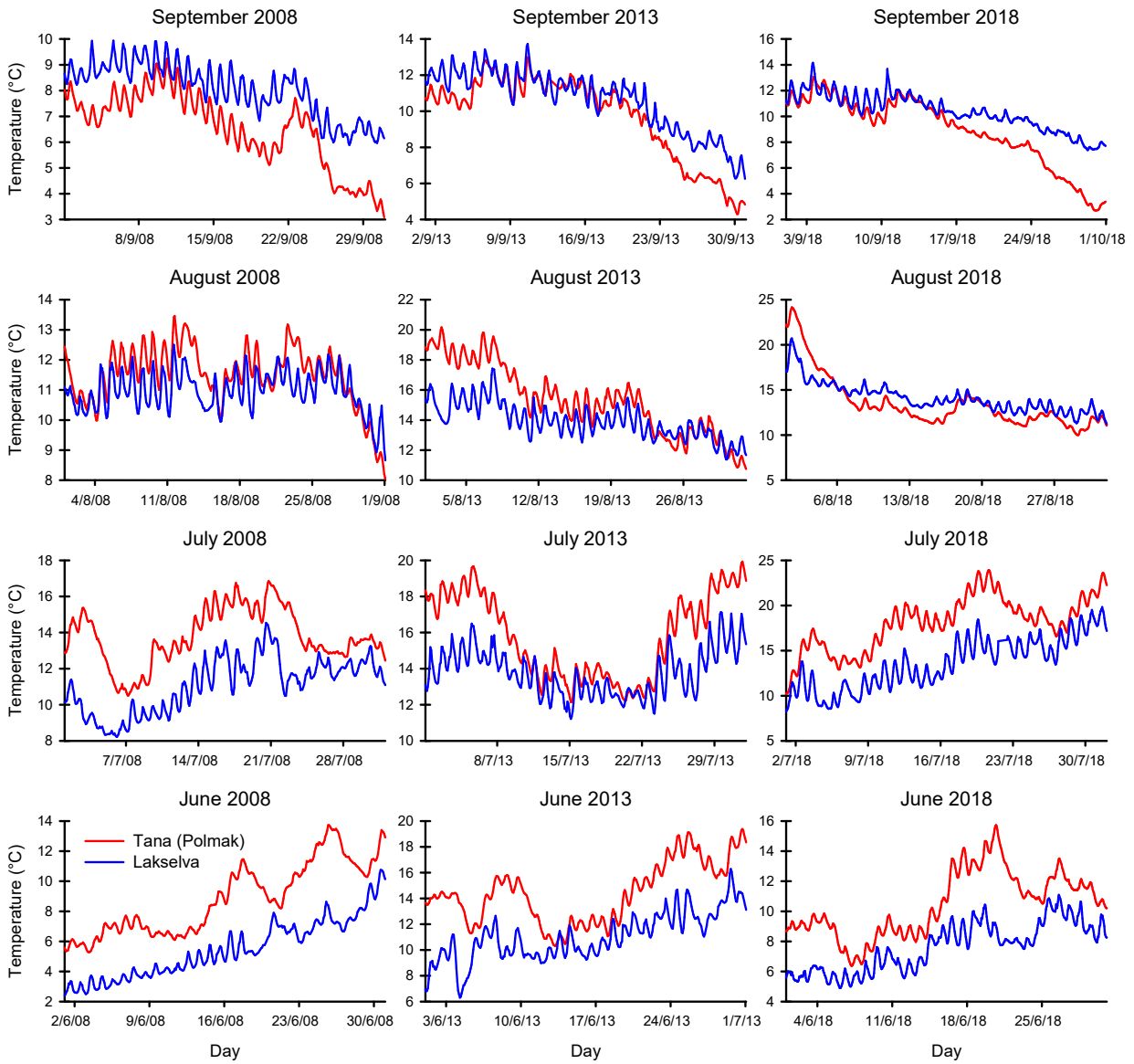


Figure 15. Hourly simultaneous fluctuations during summer months between the rivers Tana and Lakselva (Porsanger). Source; NVE (Norway).

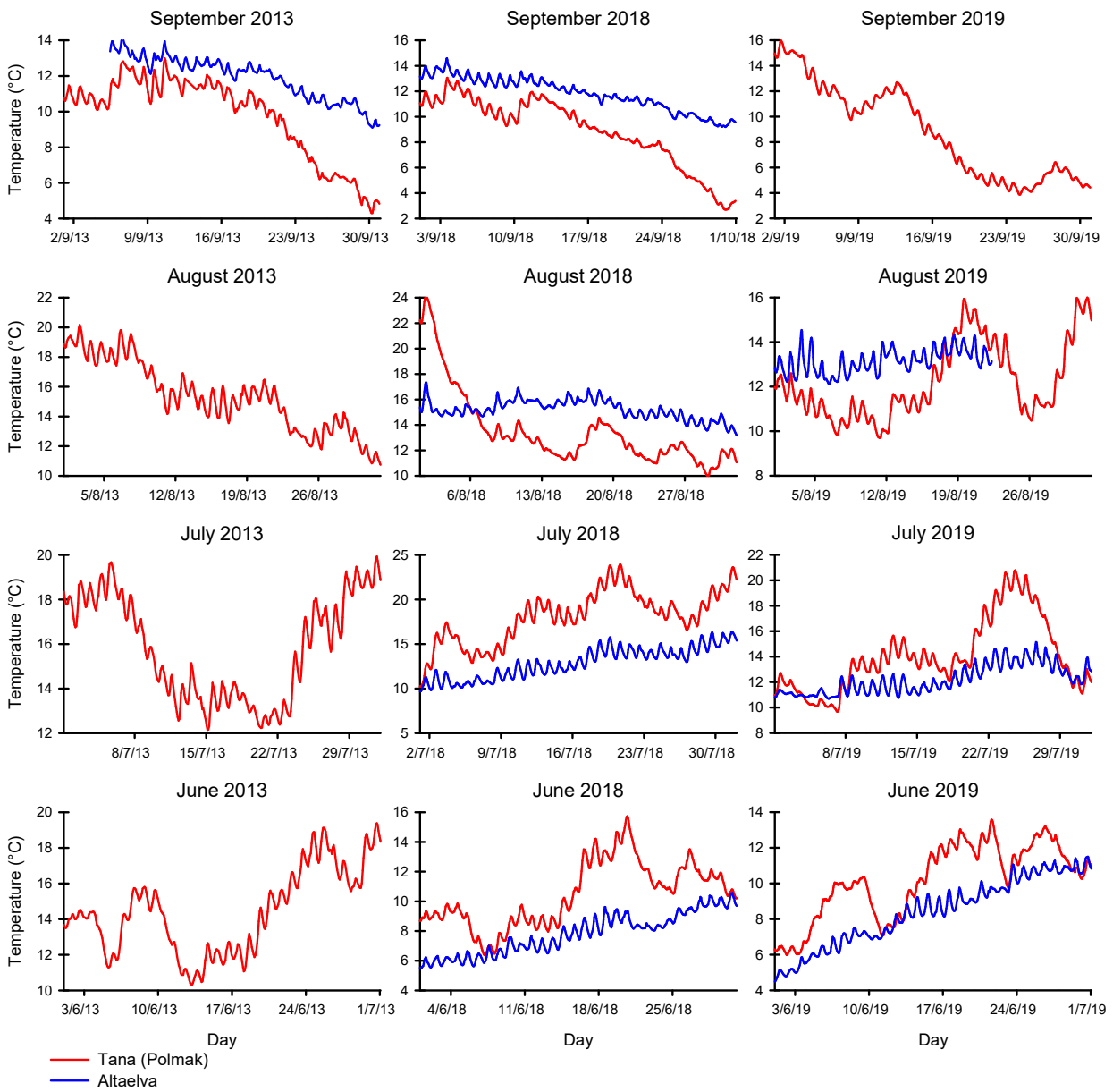


Figure 16. Hourly simultaneous fluctuations during summer months between the rivers Tana and Alta. Source; NVE (Norway).

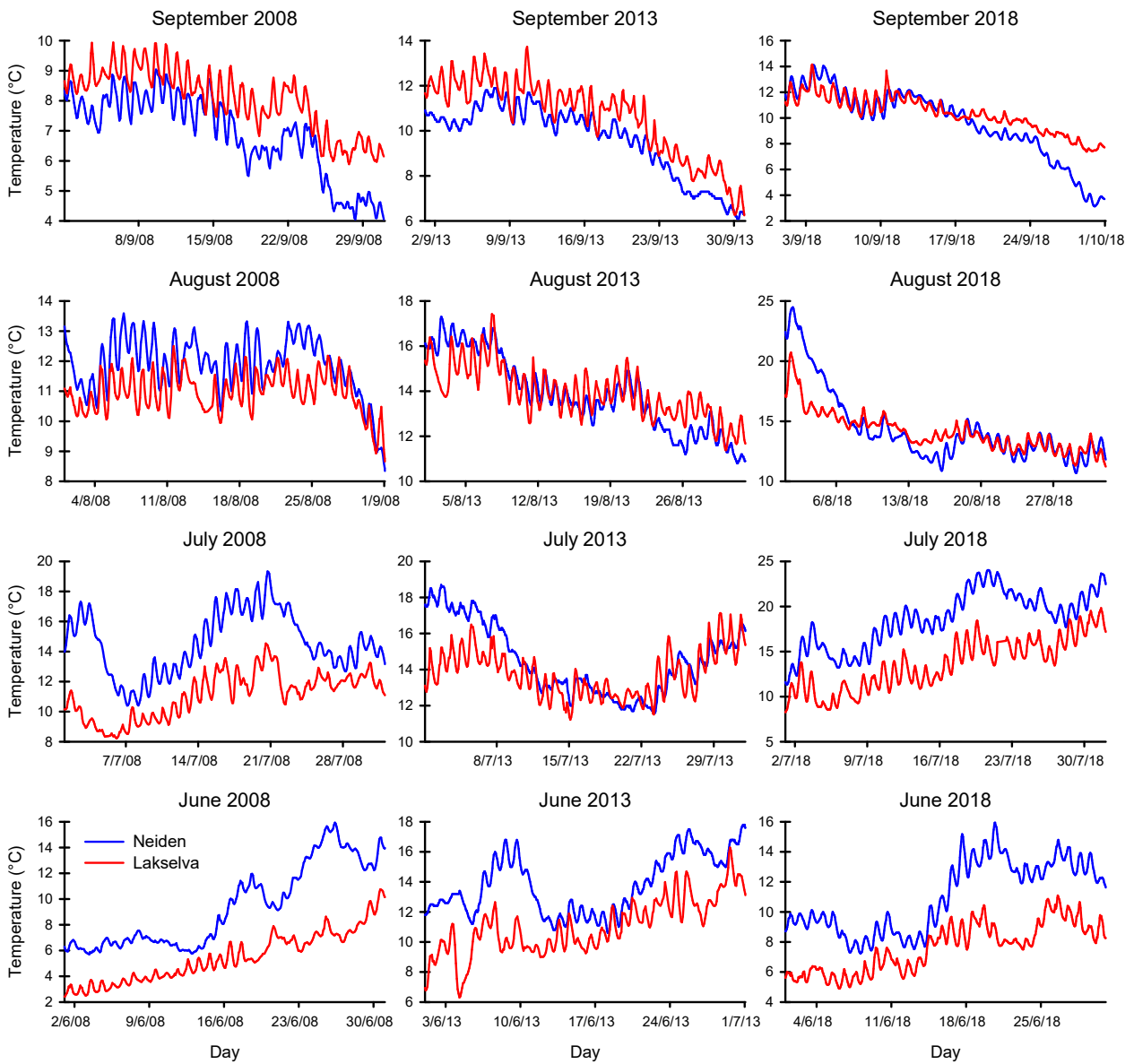


Figure 17. Hourly simultaneous fluctuations during summer months between the rivers Neiden and Lakselva. Source; NVE (Norway).

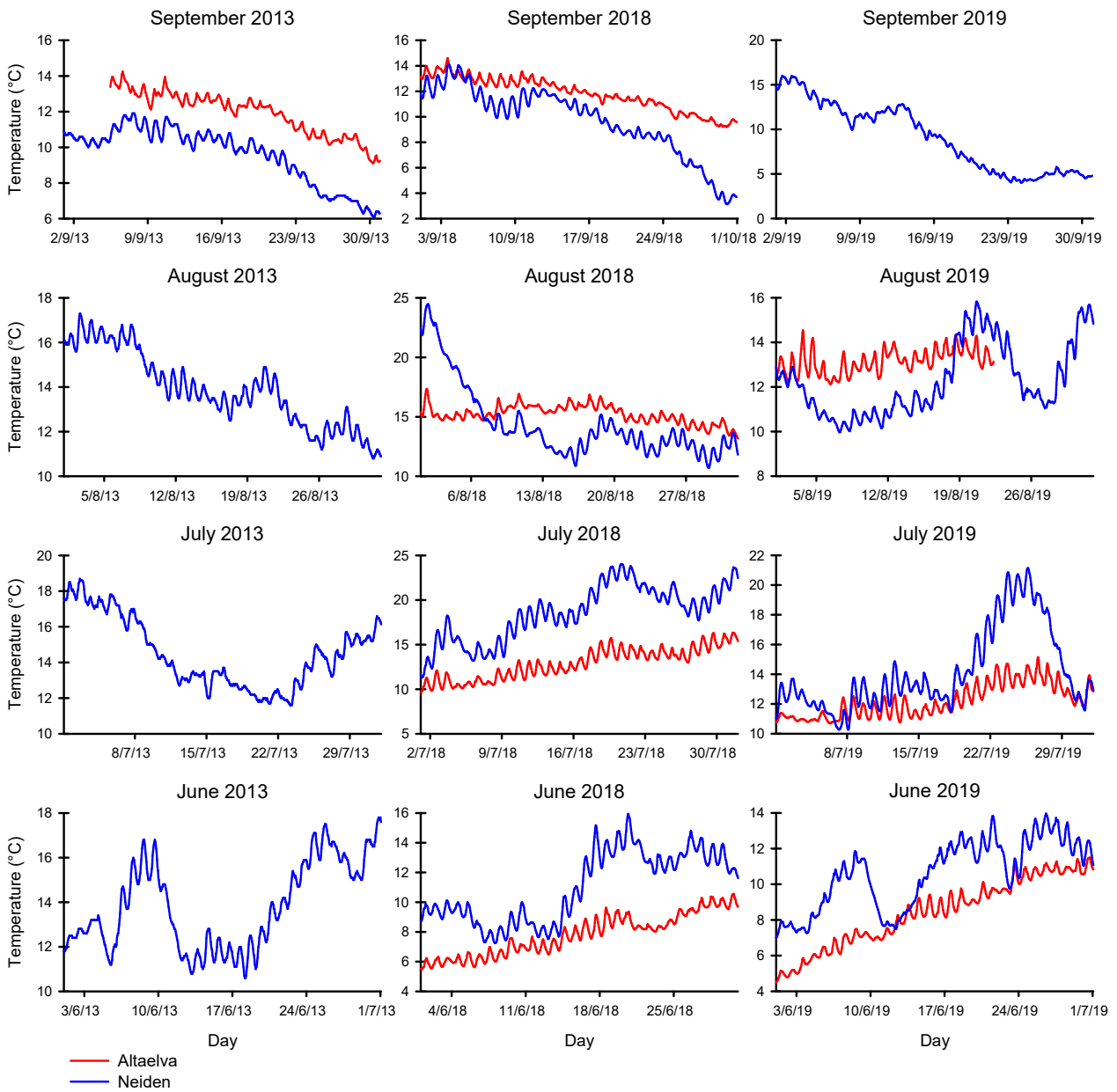


Figure 18. Hourly simultaneous fluctuations during summer months between the rivers Neiden and Alta. Source; NVE (Norway).

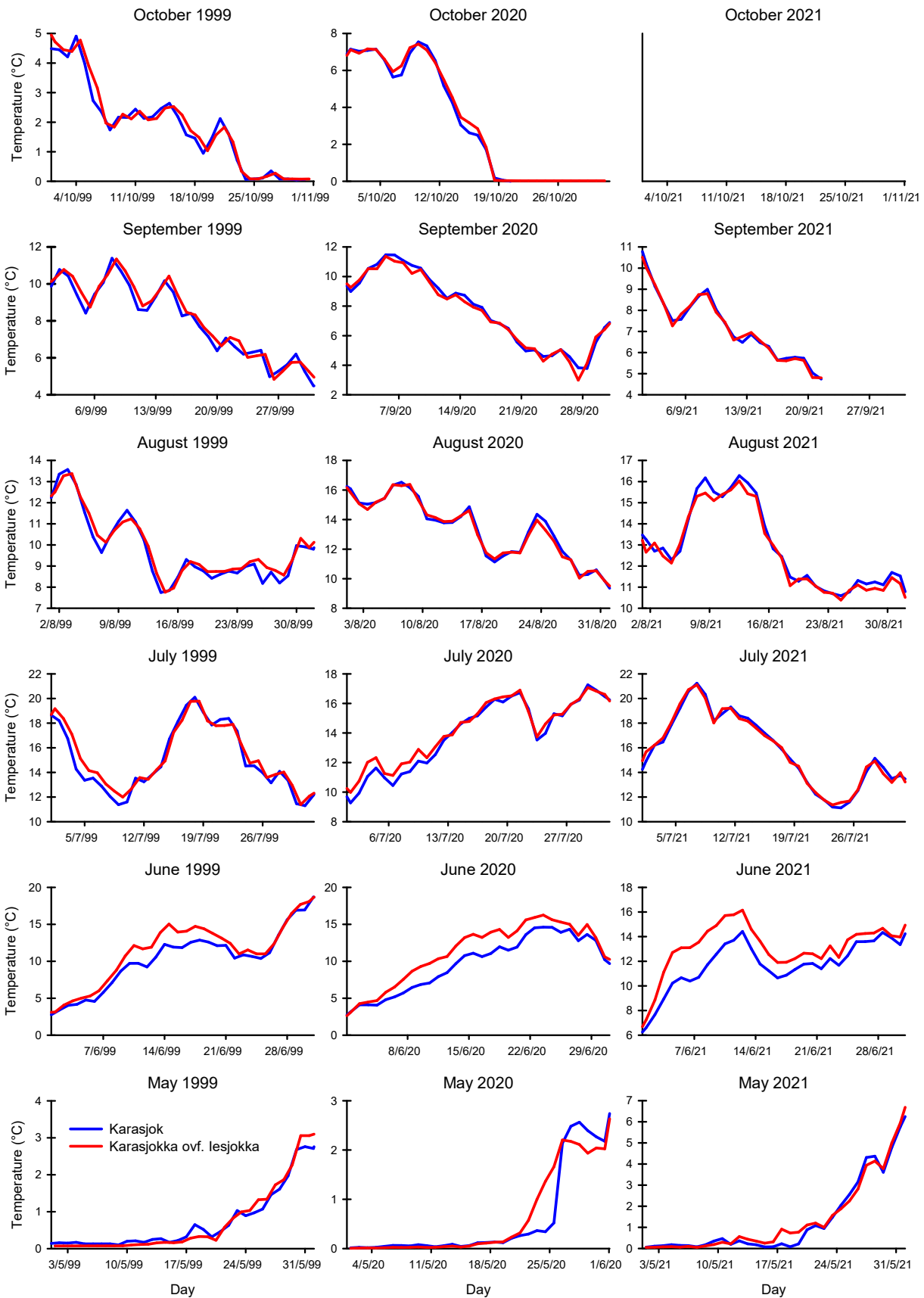


Figure 19. Hourly fluctuations during summer months in the River Karasjokka mainstem (below the River Iesjokka confluence into the River Karasjokka) and in Karasjokka above the River Iesjokka confluence. Source; NVE (Norway).

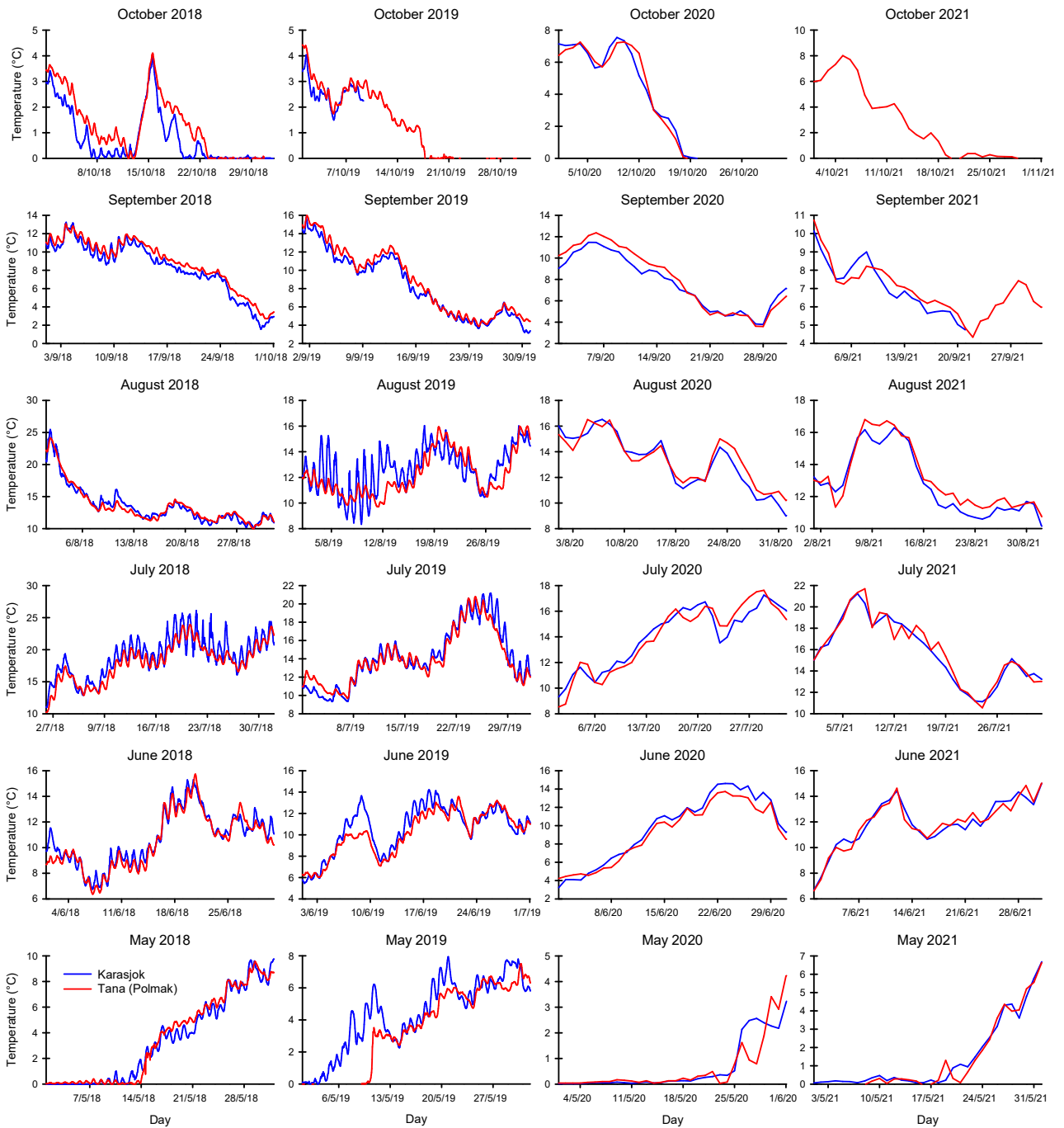


Figure 20. Hourly simultaneous fluctuations in the River Karasjohka and in the River Tana in the years 2018-2019 (on the left) during summer months and mean daily water temperature fluctuations in the years 2020-2021 (on the right). Source; NVE (Norway).

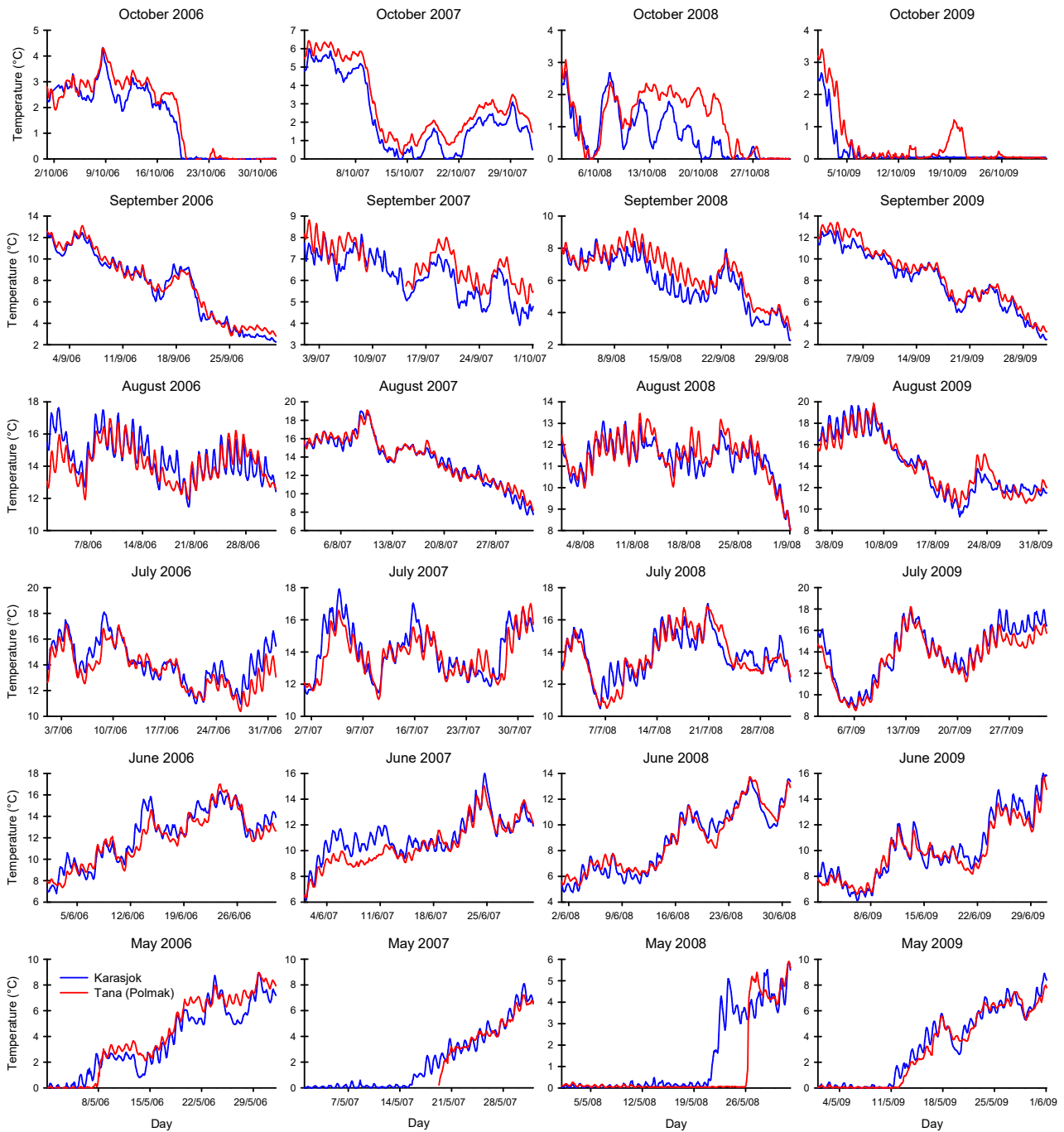


Figure 21. Hourly simultaneous fluctuations during summer months in River Karasjohka and in River Tana in the years 2006-2009. Source; NVE (Norway).



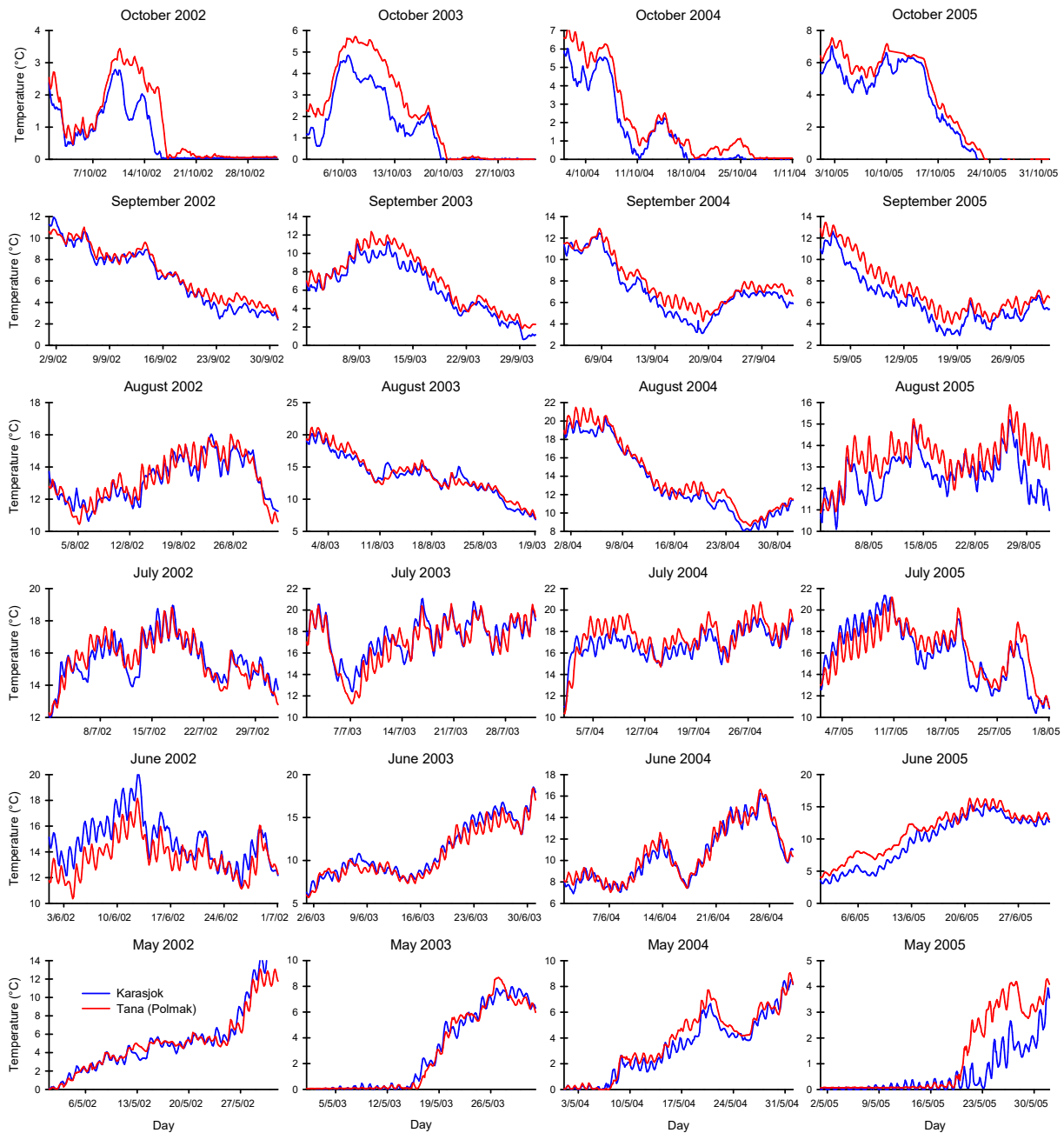


Figure 22. Hourly simultaneous fluctuations during summer months in River Karasjohka and in River Tana in the years 2002-2005. Source; NVE (Norway).

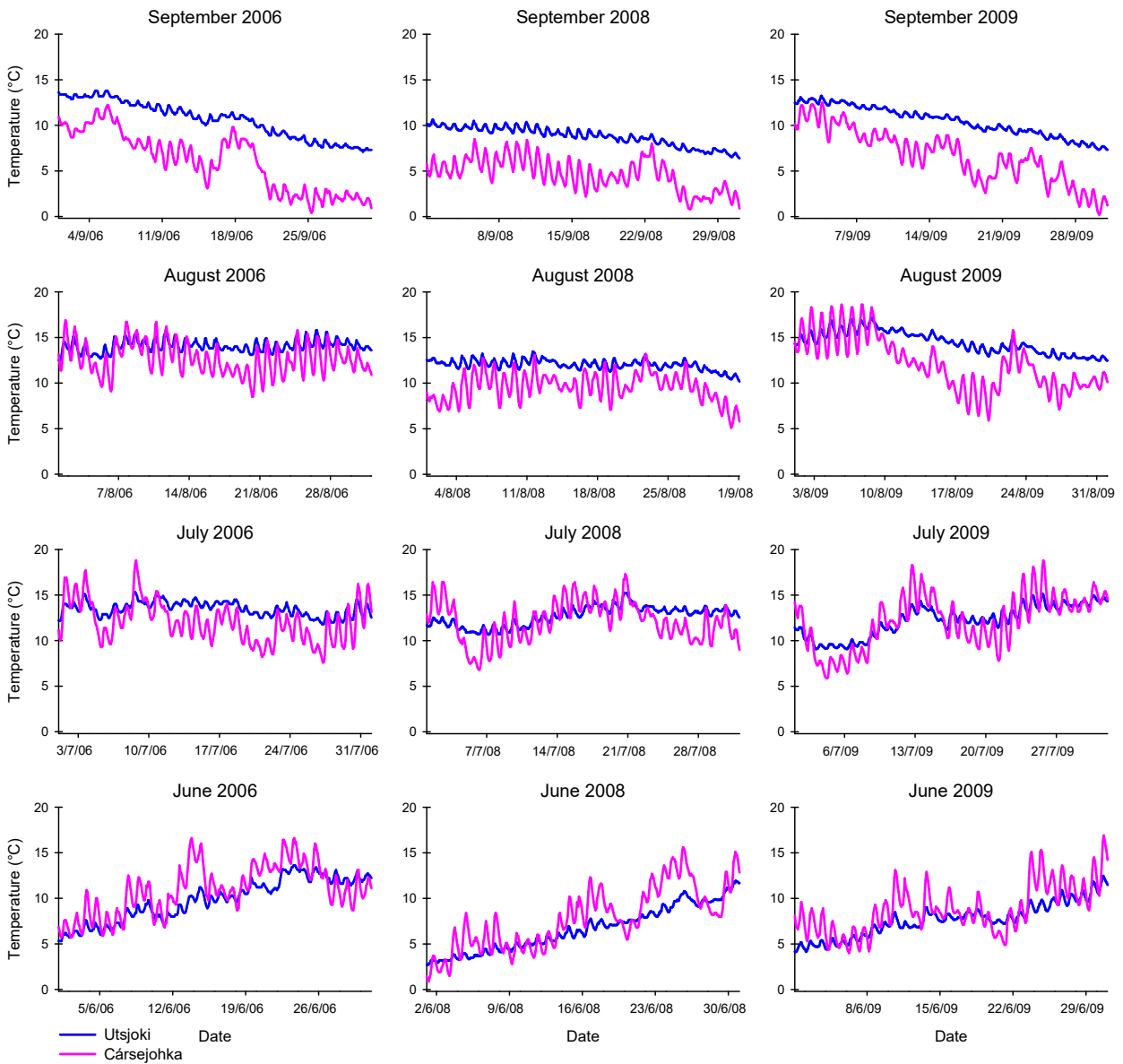


Figure 23. Hourly simultaneous fluctuations during summer months of 2006, 2008 and 2009 between the rivers Utsjoki and Tsarsejoki. Source; Luke (Finland), County Governor in Troms and Finnmark (Norway).

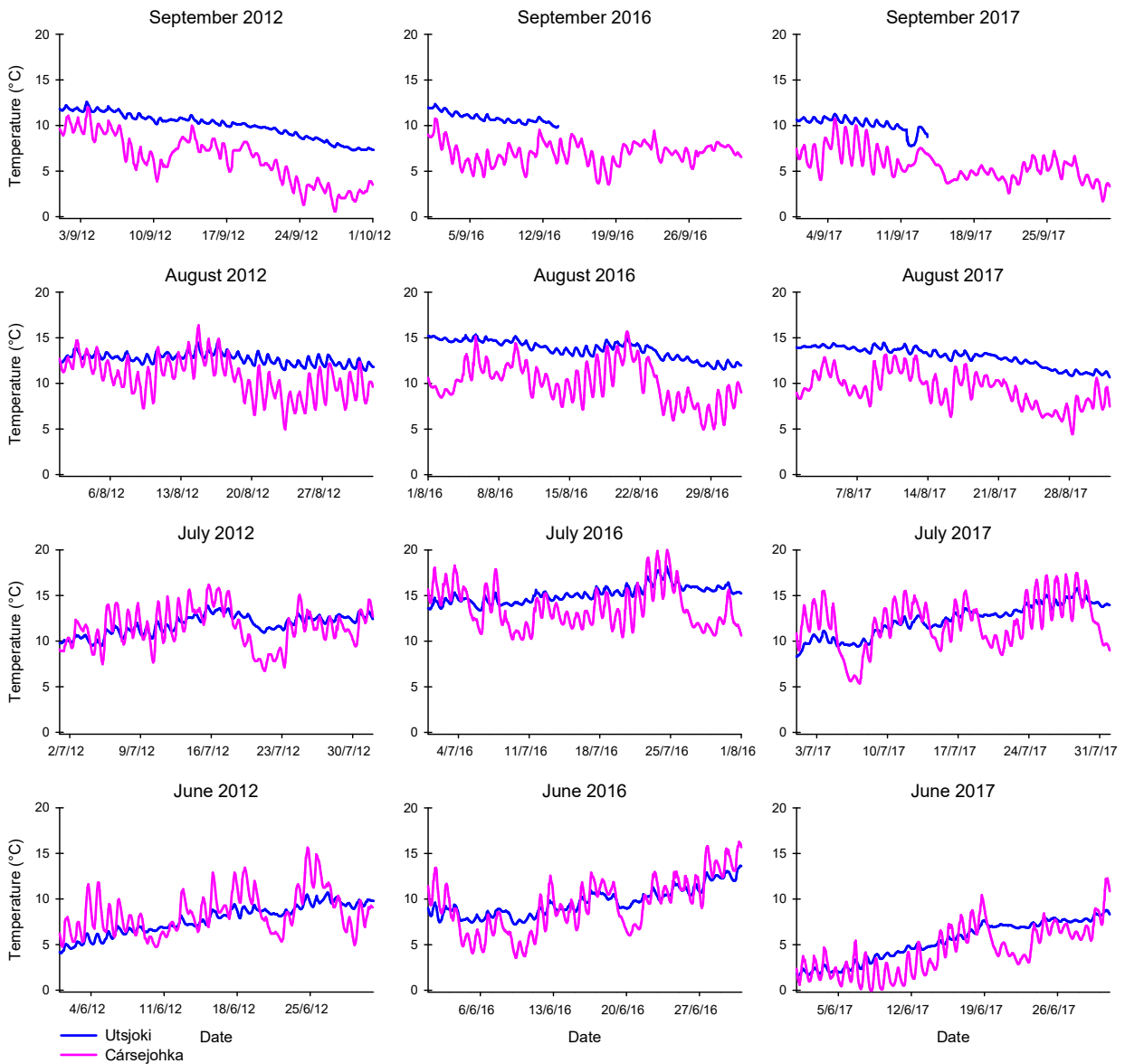


Figure 24. Hourly simultaneous fluctuations during summer months of 2012, 2016 and 2017 between the rivers Utsjoki and Tsarsejoki. Source; Source; Luke (Finland), County Governor in Troms and Finnmark (Norway).

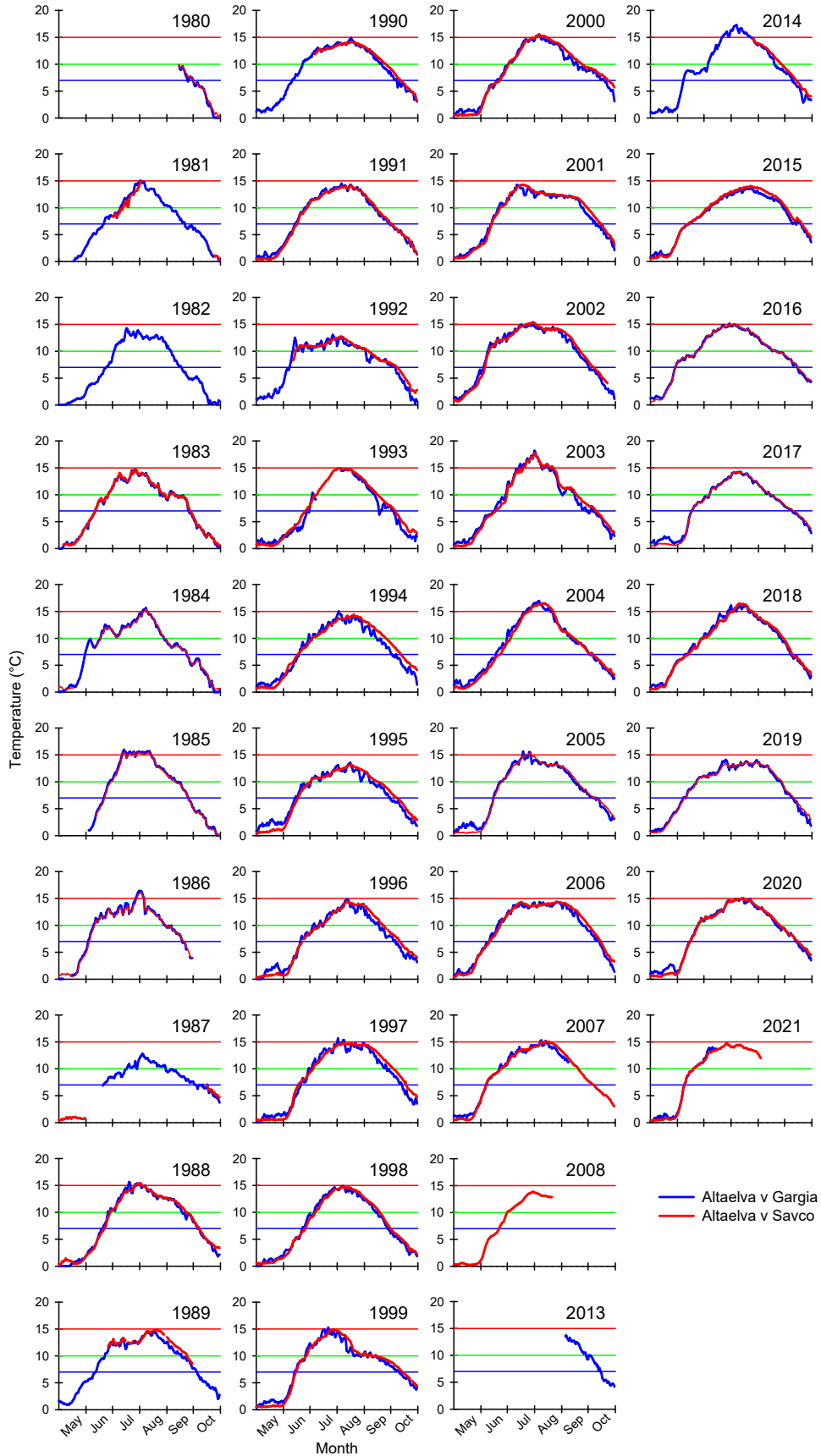


Figure 25. Simultaneous fluctuations in the daily mean (at 12 PM) water temperatures during summer months in the years 1980-2021 between two observations stations in the River Alta. Source; NVE (Norway).

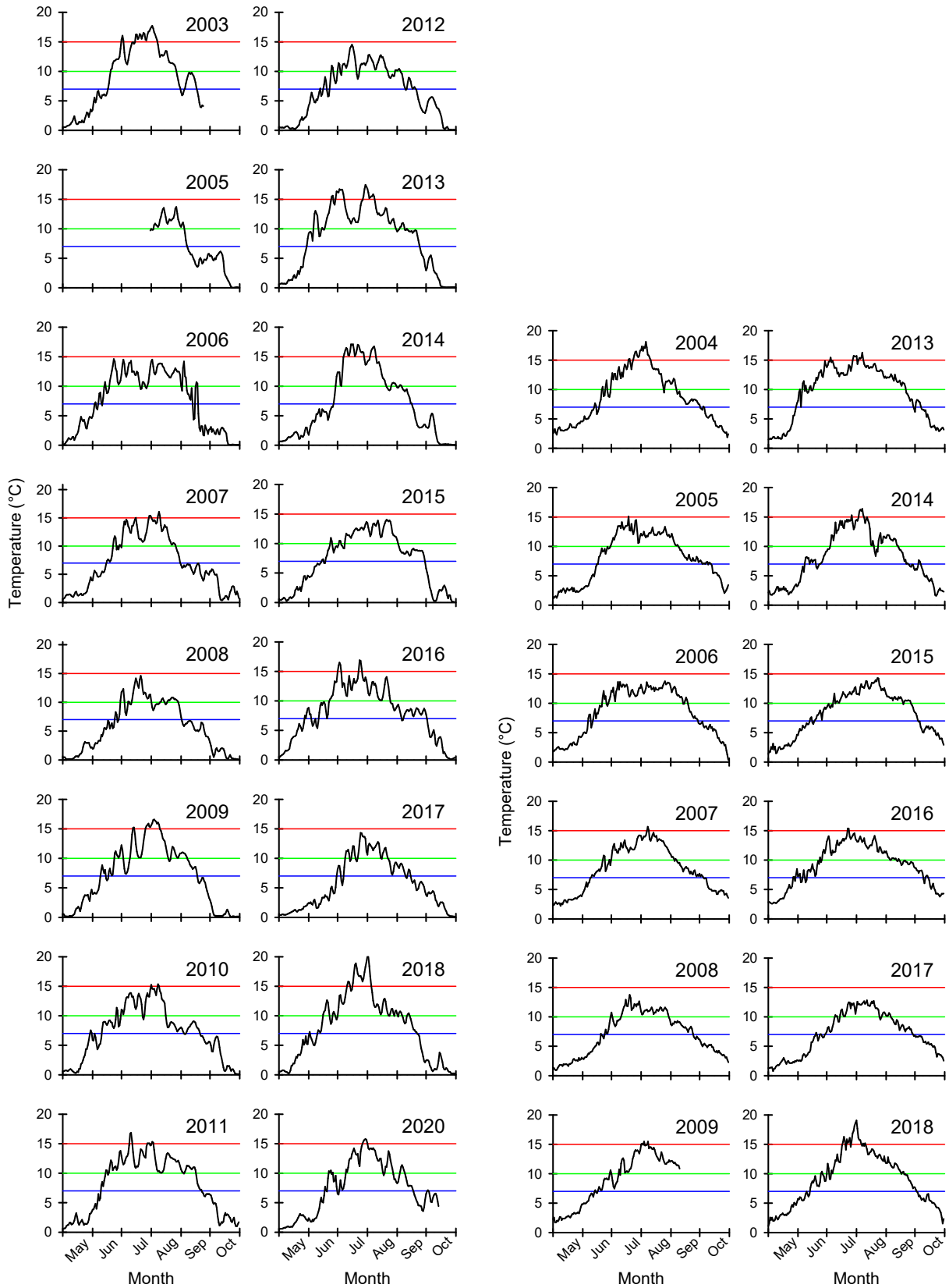


Figure 26. Annual fluctuations in the daily mean water temperatures during summer months of 2003-2020 in River Stabburselv (Lombola) (on the left) and of 2004-2018 in River Lakselv (bottom, on the right). Source; NVE (Norway).

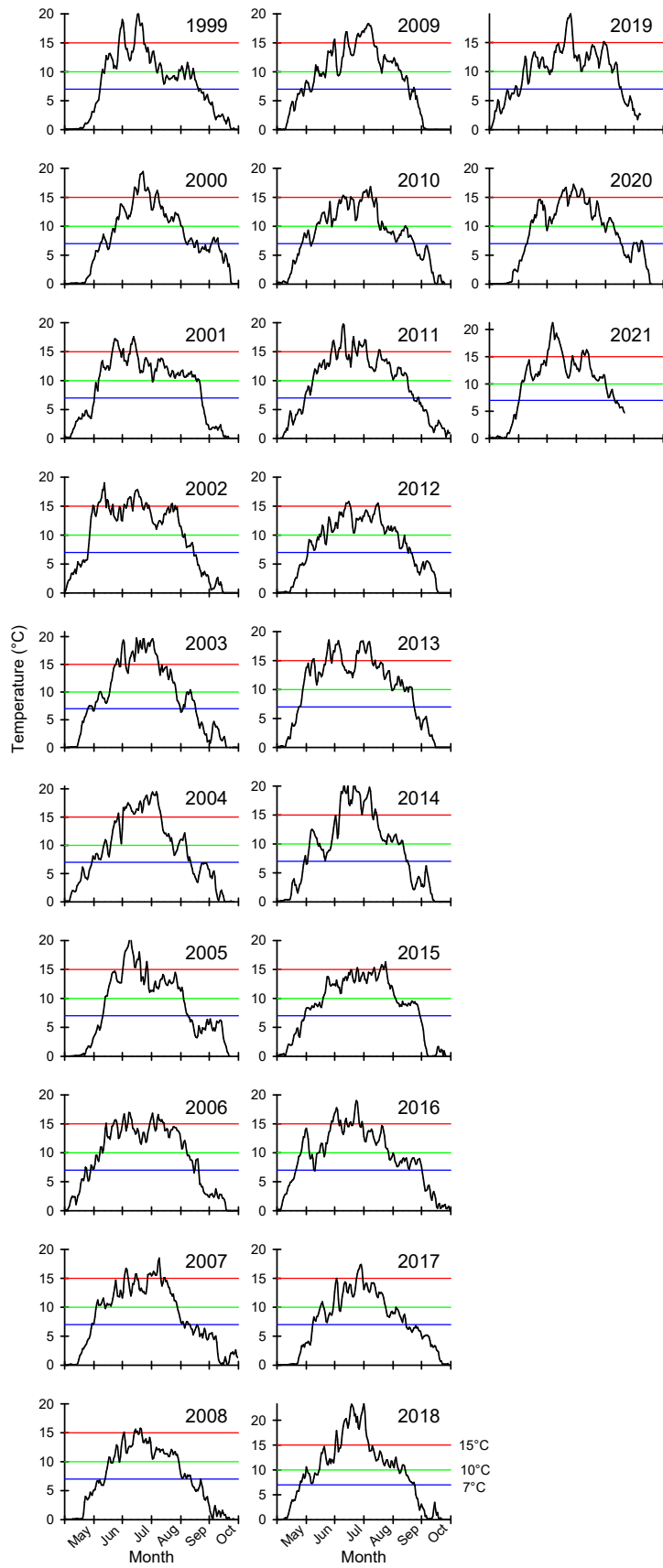


Figure 27. Annual fluctuations in the daily mean water temperatures during summer months of 1999-2021 below the confluence of River Karasjohka and River Iesjohka. Source; NVE (Norway).

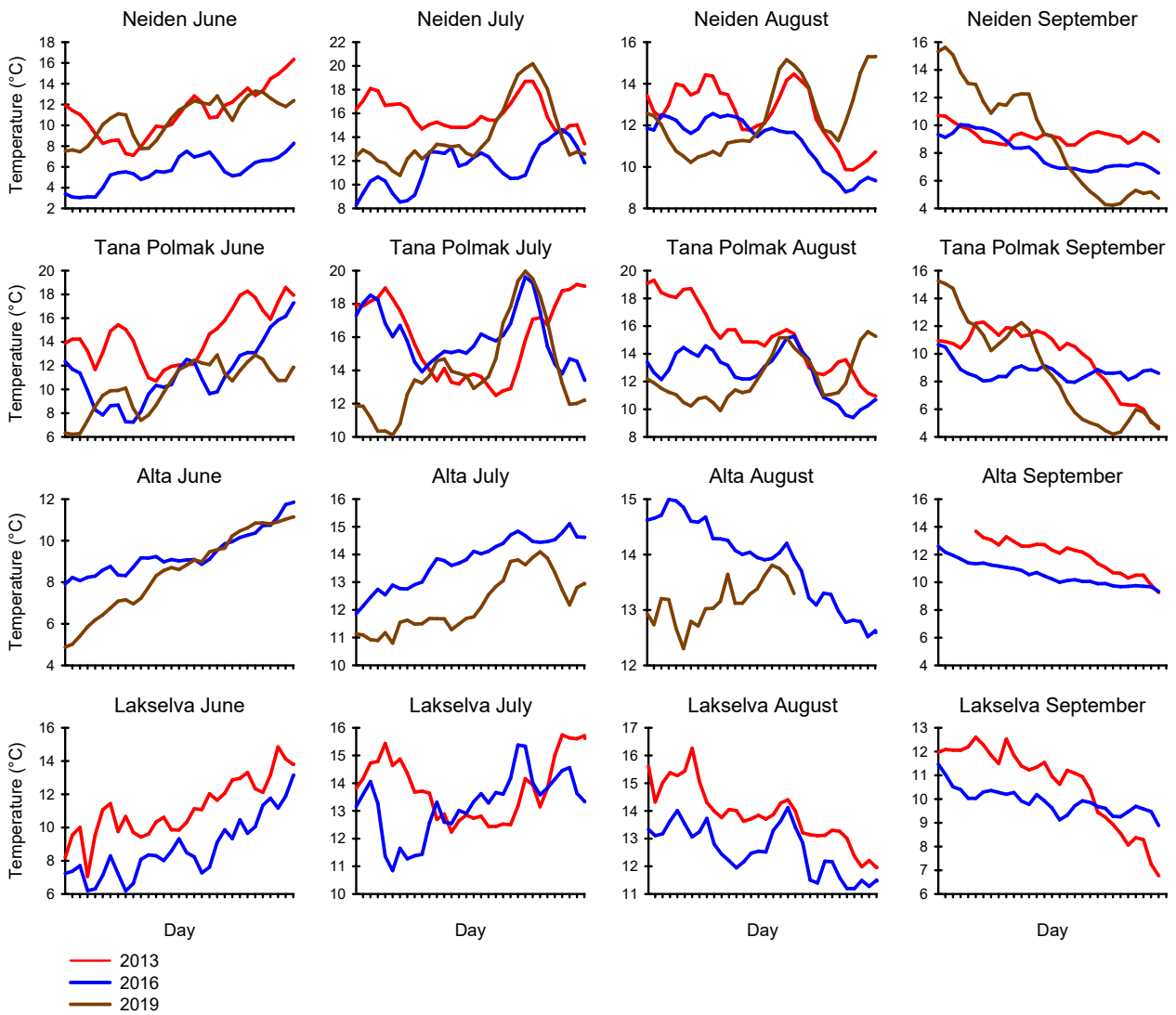


Figure 28. Differences in the mean daily water temperatures between the years 2013, 2016 and 2019 in the rivers Lakselv, Alta, Tana and Neiden. Source; NVE (Norway).

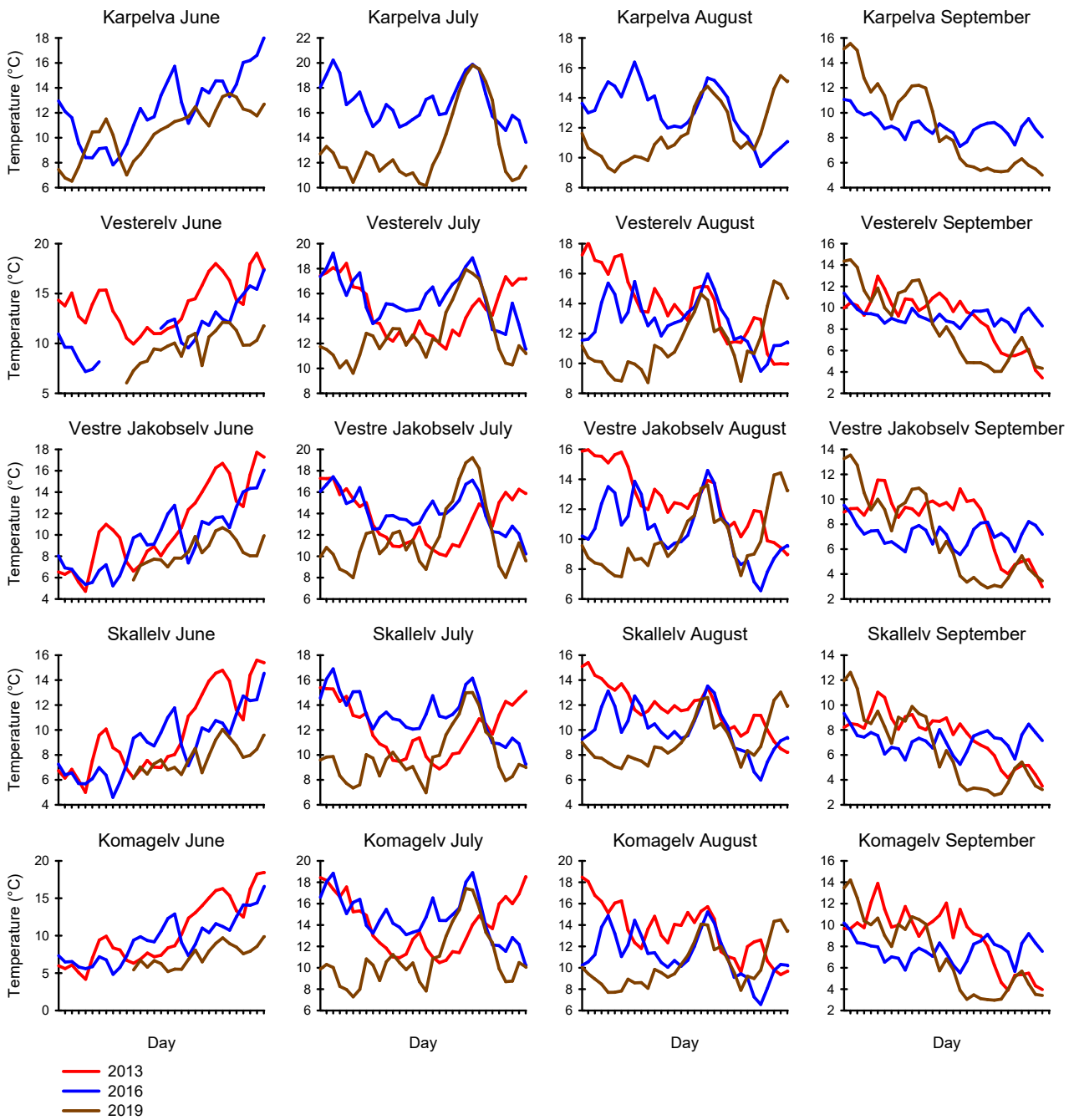


Figure 29. Differences in the mean daily water temperatures between the years 2013, 2016 and 2019 in the rivers Komagelv, Skallelv, Vestre Jakobselv, Vesterelv and Karpelva. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway), Luke (Finland).



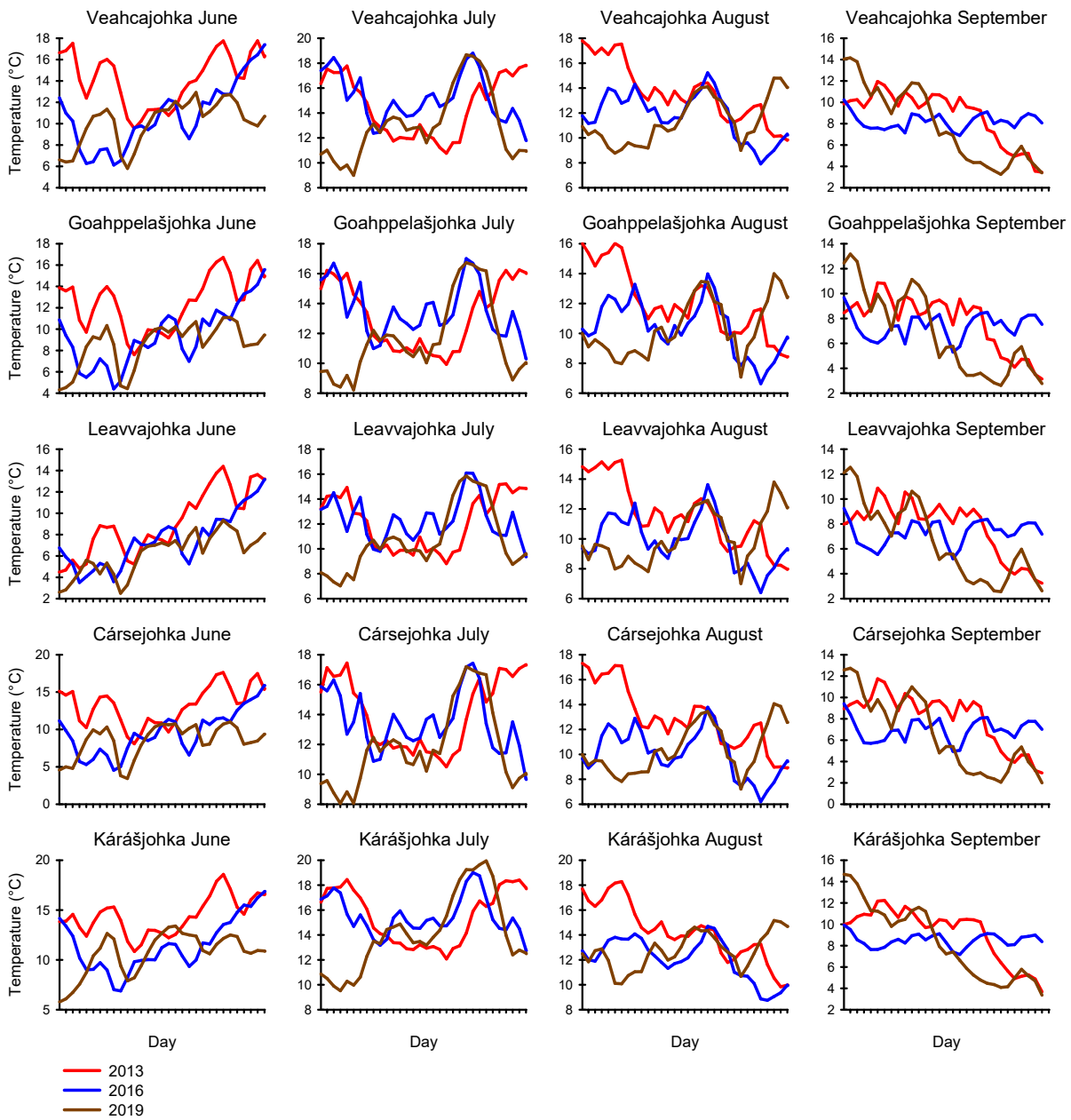


Figure 30. Differences in the mean daily water temperatures between the years 2013, 2016 and 2019 in the rivers Karasjohka, Tsarsejoki, Leavvajohka, Kuoppilasjoki and Vetsikkojoki. Source; NVE (Norway), County Governor in Troms and Finnmark (Norway), Luke (Finland).