

TABLE III
HPL AND VPL STATISTICS FOR ARTK AND CRTK ("PART" REFERS TO THE CONVERGED PART OF THE TIME SERIES)

	whole (cm)		part (cm)	
	HPL	VPL	HPL	VPL
ARTK	1.67	3.44	1.46	2.77
CRTK	3.26	6.67	2.91	5.51

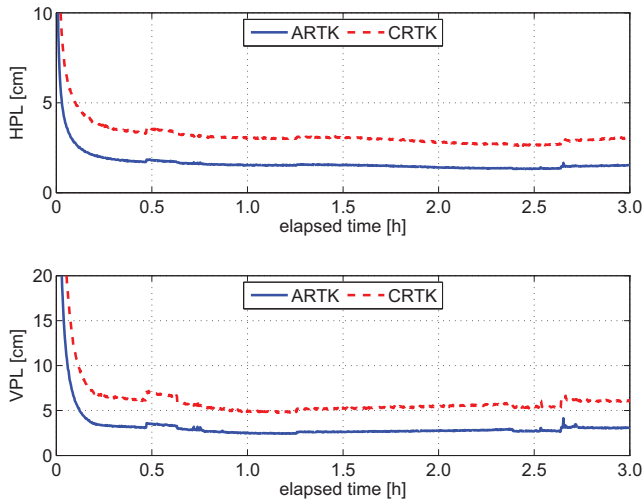


Fig. 8. The HPL and VPL of ARTK and CRTK

whole time series and also for the part after convergence, i.e. after 10 minutes. From Table III, both HPLs and VPLs of ARTK are basically half the counterparts of CRTK.

V. CONCLUSION

A-PPP provides a new concept that uses GNSS measurements, from an array of antennas on a platform, to realize a strengthened GNSS model with improved positioning capabilities. In this contribution, the benefits of A-PPP have been explored for long-baseline RTK positioning using antenna-array equipped baseline stations. The underlying theory was formulated and the results of a real-data experiment was presented. The results from an 80 km baseline experiment, with 4-antenna equipped stations, suggests that conventional RTK can indeed be improved by means of the A-PPP concept. This holds true for the speed with which successful IAR can be done, as well as for the accuracy of positioning.

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REFERENCES

- [1] P. J. G. Teunissen, P. DeJonge, and C. Tiberius, "The volume of the GPS ambiguity search space and its relevance for integer ambiguity resolution," *Proceedings of ION GPS*, vol. 9, pp. 889–898, 1996.
- [2] S. Han and C. Rizos, "Single-epoch ambiguity resolution for real-time GPS attitude determination with the aid of one-dimensional optical fiber gyro," *GPS Solut*, vol. 3, pp. 5–12, 1999.
- [3] B. Wang, L. Miao, S. Wang, and J. Shen, "A constrained LAMBDA method for GPS attitude determination," *GPS Solut*, vol. 13, pp. 97–107, 2009.
- [4] P. J. G. Teunissen, "Integer least-squares theory for the GNSS compass," *J Geodesy*, vol. 84, pp. 433–447, 2010.
- [5] —, "An optimality property of the integer least-squares estimator," *J Geodesy*, vol. 73, pp. 587–593, 1999.
- [6] P. J. G. Teunissen, P. de Jonge, and C. C. J. M. Tiberius, "The least-squares ambiguity decorrelation adjustment: its performance on short GPS baselines and short observation spans," *J Geodesy*, vol. 71, pp. 589–602, 1997.
- [7] B. Li and P. J. G. Teunissen, "High dimensional integer ambiguity resolution: A first comparison between LAMBDA and Bernese," *J Navigation*, vol. 64, pp. S192–S210, 2011.
- [8] P. J. G. Teunissen, "A-PPP: Array-aided precise point positioning with global navigation satellites systems," *IEEE Transactions on Signal Processing*, vol. 60, no. 6, pp. 2870–2881, June 2012.
- [9] P. J. Buist, P. J. G. Teunissen, G. Giorgia, and S. Verhagen, "Multivariate bootstrapped relative positioning of spacecraft using GPS L1/Galileo E1 signals," *Adv Space Res*, vol. 47, pp. 770–785, 2011.
- [10] B. Li and P. J. G. Teunissen, "Array-aided CORS network ambiguity resolution," in *LAG symposia*, Melbourne, Australia, 28 June - 7 July 2011.
- [11] G. Giorgi, P. J. G. Teunissen, S. Verhagen, and P. Buist, "Testing a new multivariate GNSS carrier phase attitude determination method for remote sensing platforms," *Adv Space Res*, vol. 46, no. 2, pp. 118–129, 2010.
- [12] B. Li, Y. Shen, and P. Xu, "Assessment of stochastic models for GPS measurements with different types of receivers," *Chinese Sci Bull*, vol. 53, pp. 3219–3225, 2008.