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Volumes of geodesic balls and spheres associated to a metric connection with torsion.

(English) [Zbl 1005.53012](#)

Fernández, Marisa (ed.) et al., Global differential geometry: the mathematical legacy of Alfred Gray. Proceedings of the international congress on differential geometry held in memory of Professor Alfred Gray, Bilbao, Spain, September 18-23, 2000. Providence, RI: American Mathematical Society (AMS). Contemp. Math. 288, 119-128 (2001).

Let (M, g) be a Riemannian manifold. In a highly influential paper [Acta Math. 142, 157-198 (1979; [Zbl 0428.53017](#))], A. Gray and L. Vanhecke computed the first terms of the asymptotic expansion of the volume function for small geodesic balls and small geodesic spheres in terms of their radius. These balls and spheres are taken with respect to the Levi-Civita connection of (M, g) and the coefficients in the expansion are suitable combinations of Riemannian curvature invariants. Later, the present author in [*V. Miquel*, Compos. Math. 46, 121-132 (1982; [Zbl 0489.53043](#))] calculated the first few terms of the Taylor series for the volume of D -geodesic balls for an arbitrary metric connection D , allowing for torsion. The corresponding results for the volume of D -geodesic spheres are presented only now in this paper. Further, the author derives bounds for the volume of D -geodesic balls in a two-dimensional manifold satisfying a certain curvature restriction involving the sectional curvature and the torsion of the metric connection D . For the entire collection see [[Zbl 0980.00033](#)].

Reviewer: [Eric Boeckx \(Leuven\)](#)

MSC:

[53B20](#) Local Riemannian geometry

[53C20](#) Global Riemannian geometry, including pinching

[53C21](#) Methods of global Riemannian geometry, including PDE methods; curvature restrictions

Keywords:

[geodesic balls](#); [geodesic spheres](#); [volume](#); [metric connection with torsion](#)