1B.2 IDENTIFICATION OF A CONGO BASIN WALKER CIRCULATION

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The Gulf of Guinea in the equatorial Atlantic is characterized by the presence of strong subsidence at certain times of the year. This subsidence, which suppresses convection over the region, appears in June and is well established from July–September. Since much of the West African monsoon flow originates over the Gulf of Guinea, this subsidence is important for determining the moisture sources for the West African monsoon. Despite its potential implication for rainfall across West Africa, this has been rarely explored. Some recent studies suggest that this subsidence is associated with a subsiding branch of a regional-scale meridional circulation, such as a shallow, from the surface–700 hPa, meridional overturning circulation, which has a rising branch over the Sahel and a subsiding branch over the Gulf of Guinea (Hagos and Zhang 2010). Based only upon the observations and reanalyses products, we propose a new regional-scale mechanism likely to contribute to the subsidence over the Gulf of Guinea in the eastern equatorial Atlantic and contribute to a physical understanding of what maintains this seasonal subsidence and how it relates to precipitation distributions across West Africa.

We identify a seasonal Walker circulation with upward branch over the Congo Basin and downward branch over the eastern Gulf of Guinea in the ERA Interim, ERA40, NCEP2, and MERRA reanalyses. The subsiding branch diverges at 2°W near the surface, with winds to the east flowing toward the Congo Basin to complete the overturning circulation. The Walker circulation is driven and maintained by surface temperature

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differences between the eastern Gulf of Guinea and the Congo Basin. The Congo Basin surface temperature remains almost uniform throughout the year, for example, the average monthly surface temperature over the Congo Basin varies between 296K and 298K. But Gulf of Guinea sea surface temperatures have pronounced seasonality characterized by rapid cooling from May-August, in association with the formation of the Atlantic cold tongue. These sea surface temperature changes increase the ocean/land temperature contrast and drive the Congo Basin Walker circulation.

We hypothesize that when the Walker circulation is anomalously strong, the Gulf of Guinea subsidence, the monsoon flow, and moisture transport across West Africa are also strong. This hypothesis is supported by the ERAI reanalysis. Composites of years with strong Walker circulations have anomalously strong southerly monsoon flows, and the northward moisture transport associated with the monsoon flow is also strong. The opposite is true of years with weak Walker circulations. However, the effects on precipitation are not clear in the TRMM data.

References

Hagos, S., and C. Zhang 2010: Diabatic heating, divergent circulation and moisture transport in the African monsoon system. *Quart. J. Roy. Meteor*. Soc., **136**, 411–425.