REPUBLIQUE DE CÔTE D'IVOIRE
UNION-DISCIPLINE-TRAVAIL

MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR
ET DE LA RECHERCHE SCIENTIFIQUE

UNITE DE FORMATION ET DE RECHERCHE
SCIENCES DES STRUCTURES DE LA MATIERE
ET DE TECHNOLOGIE

Estimating the daytime vertical E×B drift velocities in the equatorial F-region ionosphere using the IEEY and AMBER magnetic data in West Africa

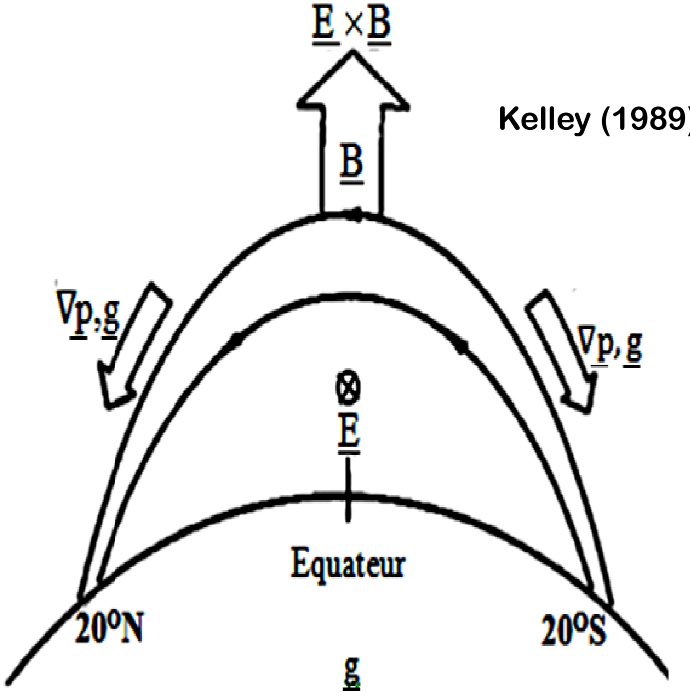
A.A. Diaby Kassamba, V. Doumbia, O.K. Obrou, F.O. Grodji, Z. Tuo, N. Kouassi and E. Yizengaw

Abdel Aziz Diaby Kassamba
diabyaziz@yahoo.fr
LAboratoire des Sciences de la Matière, de l'Environnement et de l'Energie Solaire (LASMES), UFR-SSMT, Université Félix Houphouët Boigny, Abidjan, Côte d'Ivoire

4th Eddy Cross-Disciplinary Symposium

Introduction

- Equatorial E×B drift velocity is a significant input parameter used in many ionospheric models, to describe vertical plasma motions near the magnetic equator.
- At low / equatorial magnetic latitudes, ionosphere presents the Equatorial Ionization Anomaly that consists of two crests of high electron densities (and TEC) around 20 degrees (North and South) of magnetic latitude.



Kelley (1989)

Methodology

- The EEJ is a narrow band of intense eastward ionospheric current flowing at 100-120 km altitude within ±3° latitude of the geomagnetic dip equator
- The H field measurements from a pair of magnetometer stations near dip equator and another located at 6–9° off dip equator provide an estimate of EEJ and thus daytime $\vec{E} \times \vec{B}$ drift (Anderson et al., 2004)
- Anderson et al. (2004) have established an empirical drift velocity formula as shown below:

$$Vd = 1989,51 + 1,002 \times Year - 0,00022 \times DOY - 0,0222 \times F10,7 - 0,0282 \times F10,7A - 0,0229 \times Ap + 0,0589 \times Kp - 0,3661 \times LT + 0,1865 \times \Delta H + 0,00028 \times \Delta H^2 - 0,00000 \times \Delta H^3$$

- This relationship was suggested to be applicable at all equatorial latitudes as has been demonstrated in Peruvian, Indian and African sectors (e.g. Anderson et al., 2004; Anghel et al., 2007; Yizengaw et al., 2012)

Data sets and processing

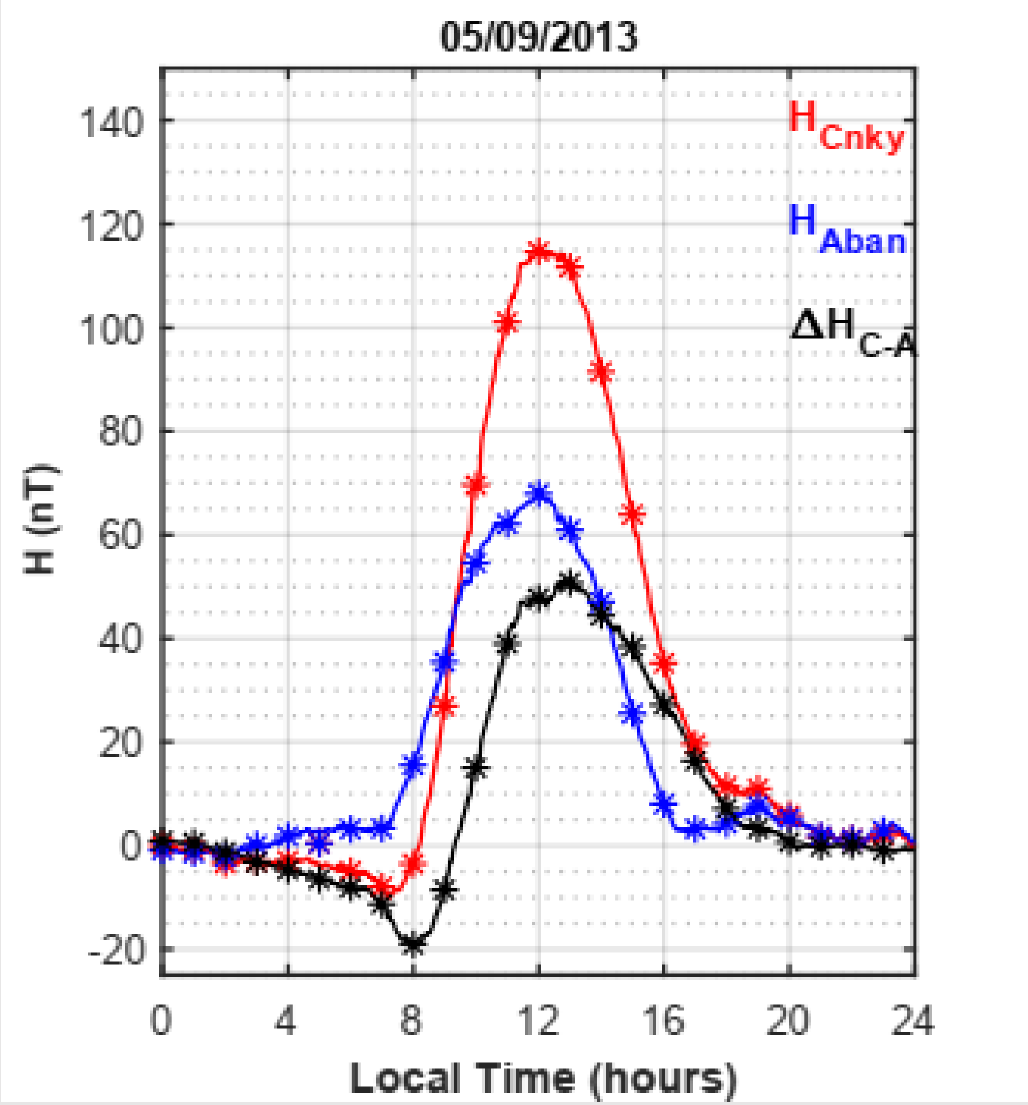
- Sikasso (0,12° Dip), Lamto (-6,27° Dip) and Tombouctou (6,76° Dip) from the International Equatorial Electrojet Year (IEEY) for year 1993 (SC22)
- Conakry (-0.46°, 60.37°) and Abidjan (-6°, 65.82°) from the African Meridian B-field Education and Research (AMBER) network for year 2013 (SC24)
- The night-time baseline H0 was obtained for each day and then subtracted from H to give the daytime value. This produce daytime H component at each station.

$$H0 = (H_{23} + H_{00} + H_{01}) / 3$$

$$\Delta H_{S-T} = H_{SIK} - H_{TOM}$$

$$\Delta H_{S-L} = H_{SIK} - H_{LAM}$$

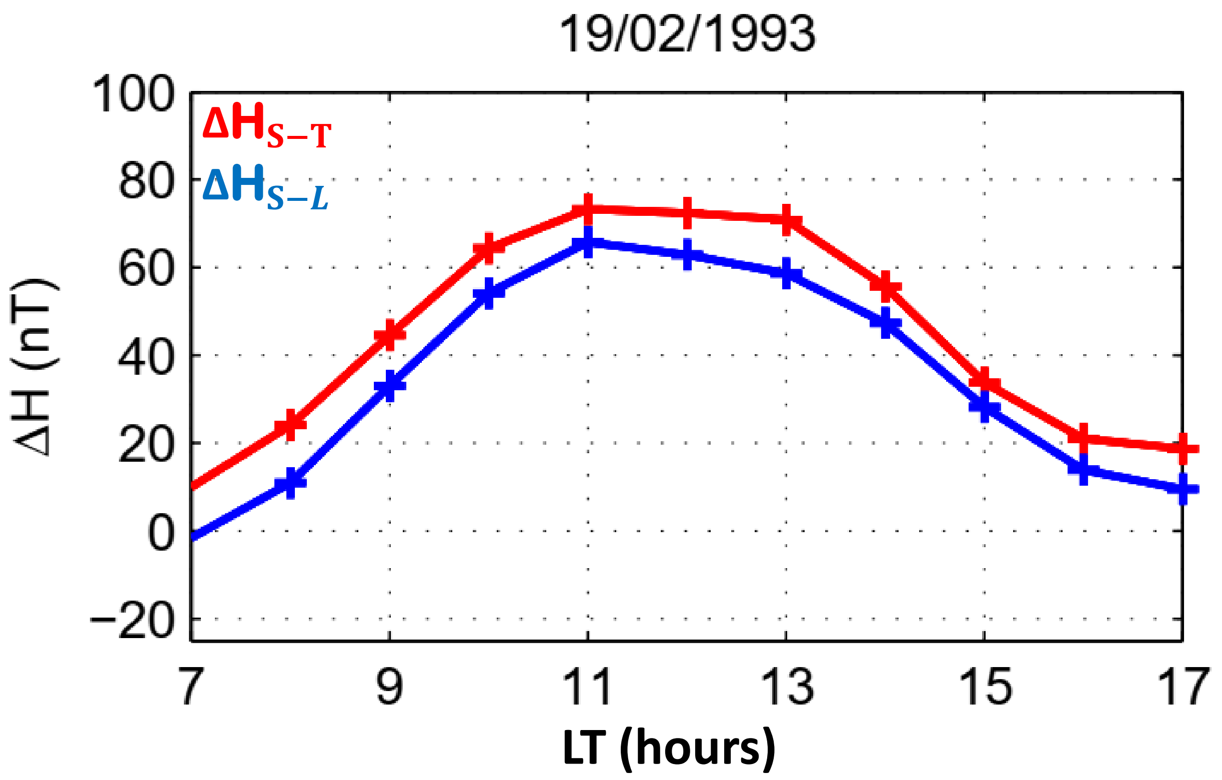
$$\Delta H_{C-A} = H_{CNKY} - H_{ABAN}$$

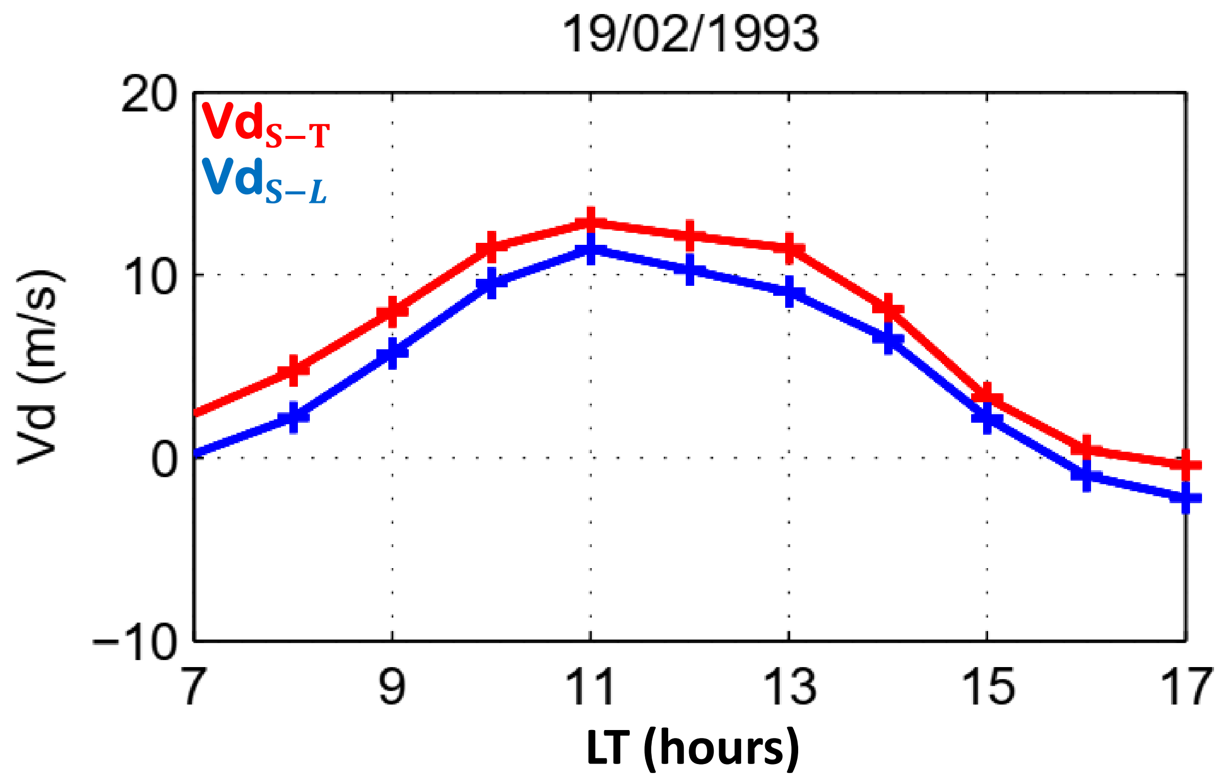


Daily variations of the EEJ magnetic effect

Some results

- Diurnal variation of EEJ and its related drift velocity





19/02/1993 noon peak values

ΔH_{S-T}= 73.35 nT ⟹ Vd_{S-T} = 13 m/s

ΔH_{S-L}= 65.80 nT ⟹ Vd_{S-L}= 11,5 m/s

SIK-LAM latitudinal separation is about 6.18° latitudes while SIK-TOM is 6.64° latitudes.

Conclusion

- **The values of ΔH_{S-T} and its corresponding Vd are slightly higher than those of ΔH_{S-L} and its related Vd.**
- **The pair with the largest latitudinal separation exhibits the strongest EEJ while, the one with the smallest latitudinal separation presents the weakest EEJ.**

Thank you