

Biomass burning aerosols and climate – a 19th century perspective

STEFAN BRÖNNIMANN^{1*}, ESTHER VOLKEN², KATRIN LEHMANN³, and MARTIN WOOSTER⁴

¹Institute of Atmospheric and Climate Science, ETH Zürich, Switzerland

²Proclim, Bern, Switzerland

³Scripps Institution for Oceanography, La Jolla, CA, USA

⁴King's College London, Department of Geography, Strand, London, UK

Abstract

We recall an almost visionary, but largely forgotten paper on biomass burning aerosols and climate, which dates back to the 19th century but anticipates much of the current perspective. Here we summarize the main points of the paper and embed it into the context of the current scientific discussion. This short paper accompanies an English translation and edition of the original article (which was published in German) in this issue.

Zusammenfassung

Wir möchten einen beinahe visionären Artikel über Biomassenverbrennungs-Aerosole und Klima in Erinnerung rufen, der im 19. Jahrhundert erschienen ist, aber viele Aspekte der heutigen Diskussion vorwegnimmt. Wir fassen die wichtigsten Punkte des Artikels zusammen und beleuchten sie vor dem Hintergrund der aktuellen Diskussion. Dieser kurze Artikel begleitet eine englische Übersetzung und Bearbeitung des in Deutsch erschienenen Originalartikels.

1 Introduction

Biomass burning aerosols are considered an important, though still not well quantified climate factor (FORSTER et al., 2007). For instance, RAMANATHAN et al. (2007) report that “Atmospheric Brown Clouds” (ABCs), which result from fossil fuel combustion and biomass burning (RAMANATHAN and CRUTZEN, 2003), have a substantial effect on climate on a continental scale through changing solar absorption. Other studies have shown that biomass burning aerosols also affect cloud properties and precipitation (e.g., LOHMANN and FEICHTER, 2005; KAUFMAN and KOREN, 2006; LIN et al., 2006). Interestingly, the view that biomass burning aerosols affect solar radiation, clouds, and precipitation on a large scale was already held by some 19th century scientists. Here we focus on one particularly insightful paper from this period, which was written by Alexander Freiherr von Danckelman and published in the *Meteorologische Zeitschrift* in 1884 (VON DANCKELMAN, 1884a; see BRÖNNIMANN, 2007).

2 Biographical notes

Alexander von Danckelman (born 24 November 1855, died 30 December 1919) was an influential geographer and scientist (SCHNEE, 1920; KEIL, 1957; BORSODORF and ELLGER, 2003). He had studied mathematics and

natural sciences and had worked as a meteorologist before travelling to the Congo region in the context of Stanley's expedition. His observations as head of the scientific station in Vivi (Congo) and reports compiled from other observers resulted in a book on climate of southwest Africa (VON DANCKELMAN, 1884b). The paper discussed here is a translation and extension of the section in this book dealing with cloud cover. Von Danckelman prepared it upon request of the editors of the *Meteorologische Zeitschrift*.

After returning from Africa, von Danckelman became secretary general of the International Polar Commission at the Deutsche Seewarte (the German Oceanic Administration) and of the Gesellschaft für Erdkunde zu Berlin (Geographical Society of Berlin). He had scientific positions in the Colonial Administration and published articles on meteorology and geography of Africa and the Indian Ocean region.

3 The 1884 paper in MetZet

The paper discussed here deals with cloud cover in Africa, but has a strong focus on biomass burning haze. Impressed by the huge savannah fires that were very common in the region during the dry season, and being aware of Aitken's and Coulier's pioneering work on cloud microphysics (AITKEN, 1880a–d; COULIER and MASCART, 1875), von Danckelman realised the climatic and environmental significance of African biomass burning. In order to estimate the amount of dry biomass burned in these fires he weighed

*Corresponding author: Stefan Brönnimann, Institute for Atmospheric and Climate Science, ETH Zürich, CHN, Universitätstrasse 16, 8092 Zürich, Switzerland, e-mail: stefan.broennimann@env.ethz.ch