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Historical celestial observations for meteorology and astronomy

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Historical celestial observations are used in historical climatology. The various sources (e.g. Babylonian Diaries, European and Near Eastern chronicles, East Asian compilations) do not distinguish principally between meteorological and astronomical phenomena: descriptions of transient appearances, e.g., comets, (super-)novae, aurora borealis, or halo effects, stand side by side. Nature and height of these unusual rare phenomena – neither purely astronomical nor meteorological in character – was disputed at least until the (Early) Modern Period: e.g., from Aristotle's Meteorology over Abū Ma^{c}shar (AD 787-886) to Tycho Brahe, it was not clear whether comets originated in sub- or supra-lunar sphere (e.g. R. Neuhäuser et al. 2016, J. Hist. Astron. 47, 136).

Modern attempts to identify such transient celestial phenomena are found since the 17th century (beginning with de Mairan 1733, Pingré 1783), but the interest in historical observations rose again in the last few years, e.g. for studying the long-term evolution of solar activity and its impact on the Earth climate – and in connection with a 14-C variation around AD 775 (D.L. Neuhäuser & R. Neuhäuser 2015, Astron. Notes, arXiv:1508.07955; J. Chapman, D.L. Neuhäuser, R. Neuhäuser, M. Csikszentmihalyi, Astron. Notes, arXiv:1508.06627).

For the categorization of the various historically observed phenomena a critical reflection of methods is neccessary, see e.g. discussion in D.L. Neuhäuser & R. Neuhäuser 2018, Astron. Notes, arXiv:1711.05132).

In a new transdisciplinary project in collaboration with philologists (Chinese, Akkadian, Arabic, Syriac, Latin, Greek) and a set of clear criteria for all phenomena, we have started to compile and categorize anew: e.g., what was called "rainbow" or "comet" in the past does inform us phaeno-typically on form and/or colour of the observed phenomenon, but do not apply today's narrow definition of certain meteorological or astrophysical phenomena.

Local weather conditions help identifying historical astronomical transients, e.g. cloud cover in case of unusual naked-eye sunspot records; temporal offsets in first detections of (super-)novae or comets between, e.g. East Asia and the Arabic desert, may be due to weather (e.g. an early monsoon, e.g. R. Neuhäuser et al. 2017, Astron. Notes, arXiv:1607.02915).

Many catalogues of historical polar lights (but also of comets) contain a large amount (hundreds) of misidentified halo observations, which in former times were very popular all over the world (e.g. R. Neuhäuser & D.L. Neuhäuser 2015, Astron. Notes, arXiv:1503.01581). In dubious cases, information on local weather would be useful for distinguishing between true aurorae and true halo displays. The other way around, halo observations deliver significant data for historical climatology: e.g. the 22° halo serves as indicator for an incoming depression and rain within some 2 days, while parhelia and paraselene indicate turbulence and strom; extended halo displays are followed by a change in the general weather situation (EGU2017-7336).

Both astronomy and meteorology use the same old sources with celestial observations for studying their current scientific problems. Synergy effects could advance both fields.