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# DO4 Models: A new generation of model dust emission schemes based on source area process data

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Numerical models need to include dust in order to avoid large radiative and associated dynamical errors as these are the only tools we have to predict future weather and climate. The simulation of the dust cycle depends on a wide range of earth system components but begins with realistic representation of source areas. At a global scale, attention to source areas has improved modeling, despite most of the improvements have come through simple, large-scale, source area representation that is likely highly parameterized and generalized. Notable is the absence of any real source area observations at model resolution in almost any previous studies. This research outlines the beginnings of the DO4 project, which through the novel approach of using the regional model as a test-bed for global high resolution models aims to undo the enduring problem of lack of suitable dust source area data. From July to October, 2011 the source area was chosen as a 12 km by 12 km area within the Makgadikgadi Pans, Botswana to be ultimately characterized as one grid cell within the HadGEM3 model. A deployment of 11 meteorological stations consisting of anemometry, sediment transport traps and detectors, high-frequency dust monitors, soil moisture meters, net radiometers, shallow well networks, and photometers in addition to on-site surface characteristic monitoring throughout the field campaign resulted in 90 days of source area data. The temporal and spatial variation of erodibility amongst these sites and the whole grid cell exceeded any previous expectation. A combination of surface moisture, surface roughness created through salt crystal formation, antecedent rainfall, and prior flooding history describes the majority of the variation in surface erodibility. Surface salt crust development is hypothesized as having a distinct time line and continuity combined into a cyclical model governed by moisture availability, radiation, and chemistry that for this area could predict potential erodibility. The variation is surface roughness explains the majority of the erosivity distributions although this range is not very large and could be unimportant when compared to the range of erodibility. This dataset provides an excellent starting point in a new approach to dust emission schemes that will potentially unlock the improvements in other parts of the dust cycle, many of which cannot currently be fully realized given the large uncertainties in modeled source region emissions.