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Calving and rifting on McMurdo Ice Shelf, Antarctica

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On March 2, 2016, a series of small en échelon tabular icebergs calved from the seaward front of the McMurdo Ice Shelf, and a previously inactive ice-shelf rift suddenly widened and propagated by ∼3km, ∼25% of its previous length, setting the stage for future calving of an approximately 8 km2 segment of the ice shelf. Immediately prior to these events, perhaps within 24 hours, all remaining land-fast sea ice buttressing the ice shelf broke up and drifted away. The events were witnessed by time-lapse cameras at nearby Scott Base giving a unique opportunity to document the timing of the events and conditions leading up to them. In addition, the events can be put into context using nearby seismic and automatic weather station data, satellite imagery, and ground observation made 8 months later. Although the observations cannot be used definitively to identify the exact trigger of calving and rifting, the seismic records reveal superimposed sets of long-period (>10 s) sea swell, propagating into McMurdo Sound from distant storm sources in the Pacific Ocean, at the time of, and immediately prior to, the break-up of sea ice and associated ice shelf calving and rifting. This conspicuous presence suggests that sea swell should be studied further as a proximal cause of ice-shelf calving and rifting; if proven, it suggests that ice-shelf stability is tele-connected with far-field storm conditions at lower latitudes, adding a global dimension to the physics of potential ice-shelf breakup.