Supporting Information for "The overlooked role of westerly moisture as a source of summer rainfall in the hyperarid Atacama Desert"

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1. Figures S1 to S6

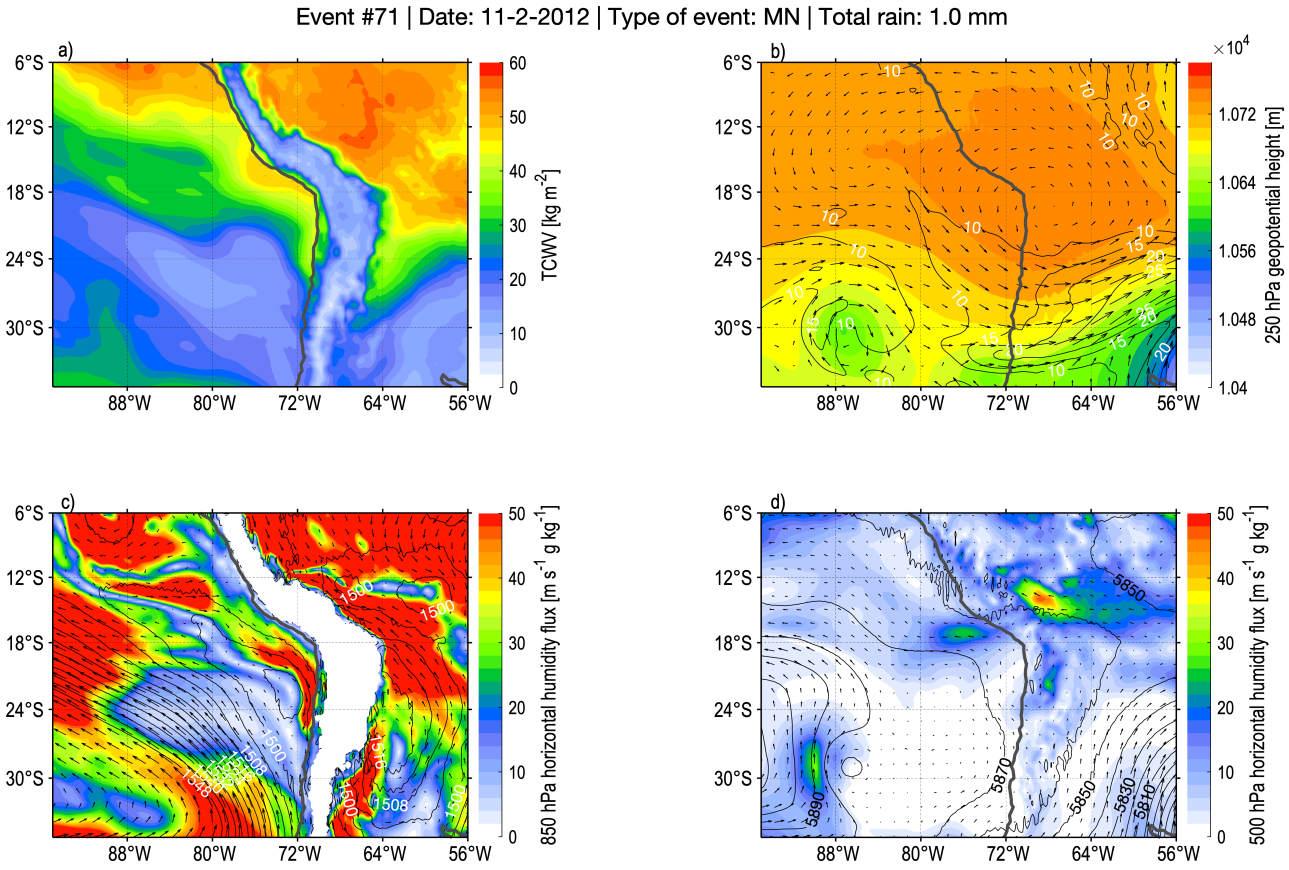

Figure S1. Example a composite for a rainfall day in the Atacama and the synoptic maps used for the classification. The figures for the 96 identified rainfall days are available in Supporting Information 1. At the top of the figure, it is shown the position of the event in chronological order (oldest to recent, according to Table S1), the date (day-month-year), the type of event (MN: Moist Northerlies, BH: Bolivian High, COL: Cut-off Low, and TT: Tropospheric Trough), and the total rainfall as the sum of the four weather stations. (a) TCWV; (b) 250 hPa geopotential height (shaded color) and horizontal wind (arrows), including intensity contours every 10 m s; (c) 850 hPa geopotential height (contour lines) and horizontal humidity flux; and (d) 500 hPa geopotential height (contour lines) and horizontal humidity flux. Data from ERA5.

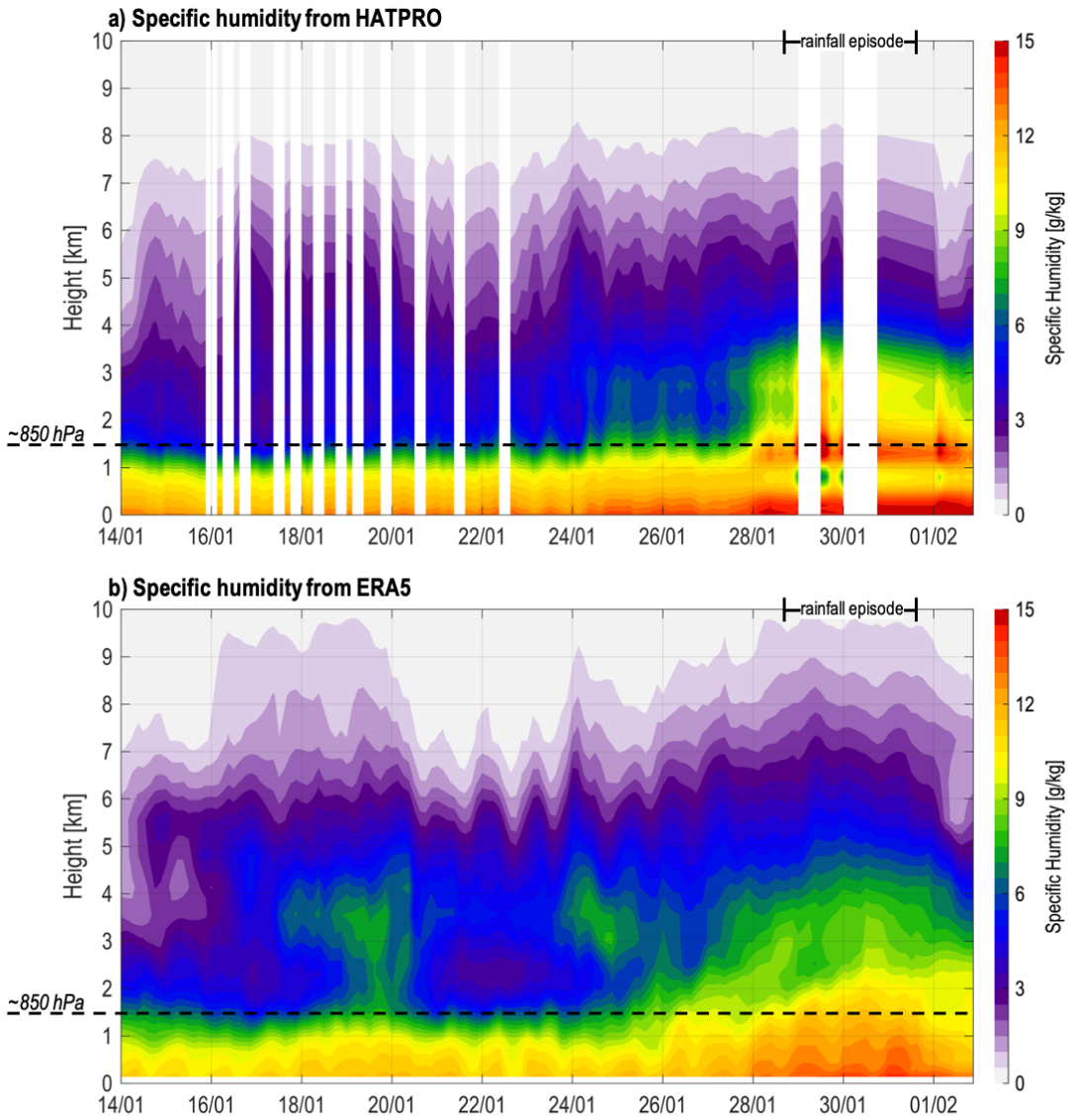

Figure S2. Time-vertical evolution of the specific humidity derived from (a) HATPRO at Iquique Airport (IQQ) and (b) ERA5, averaged from the nearest four grid points around Iquique. The 850 hPa level is shown in a black dashed horizontal line. In (a), vertical white strips show no data in HATPRO.

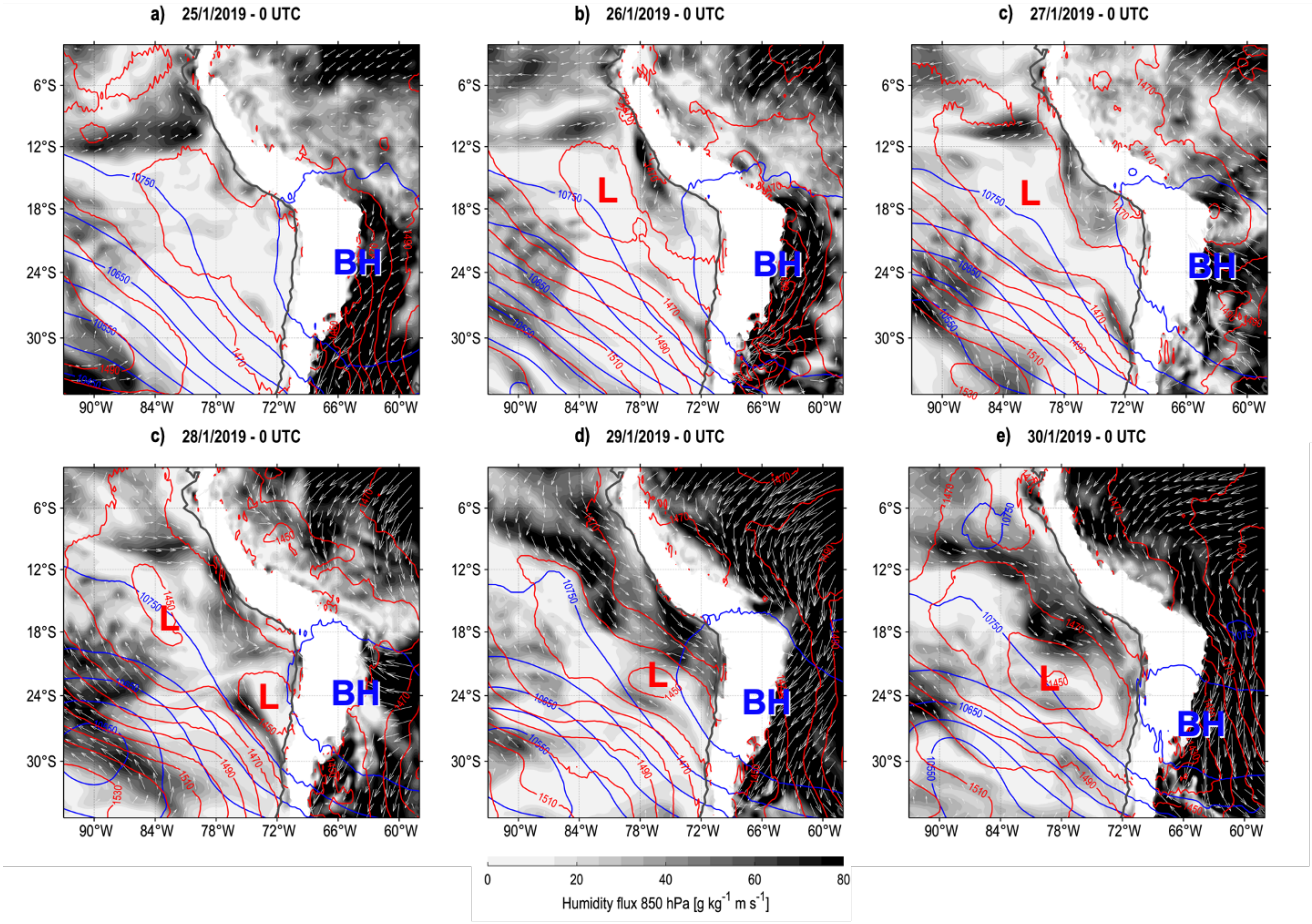

Figure S3. Synoptic evolution from 00 UTC 25 January 2019 to 00 UTC 30 January 2019 of 850 hPa humidity flux (shaded color and arrows above 30 g kg m s), 850 hPa geopotential height (red lines, every 10 m) and 250 hPa geopotential height (black lines, every 50 m). The topography is patched white for altitudes above 850 hPa. 850 hPa low pressure (L) and the 250 hPa Bolivian High (BH) are shown. Data from ERA5.

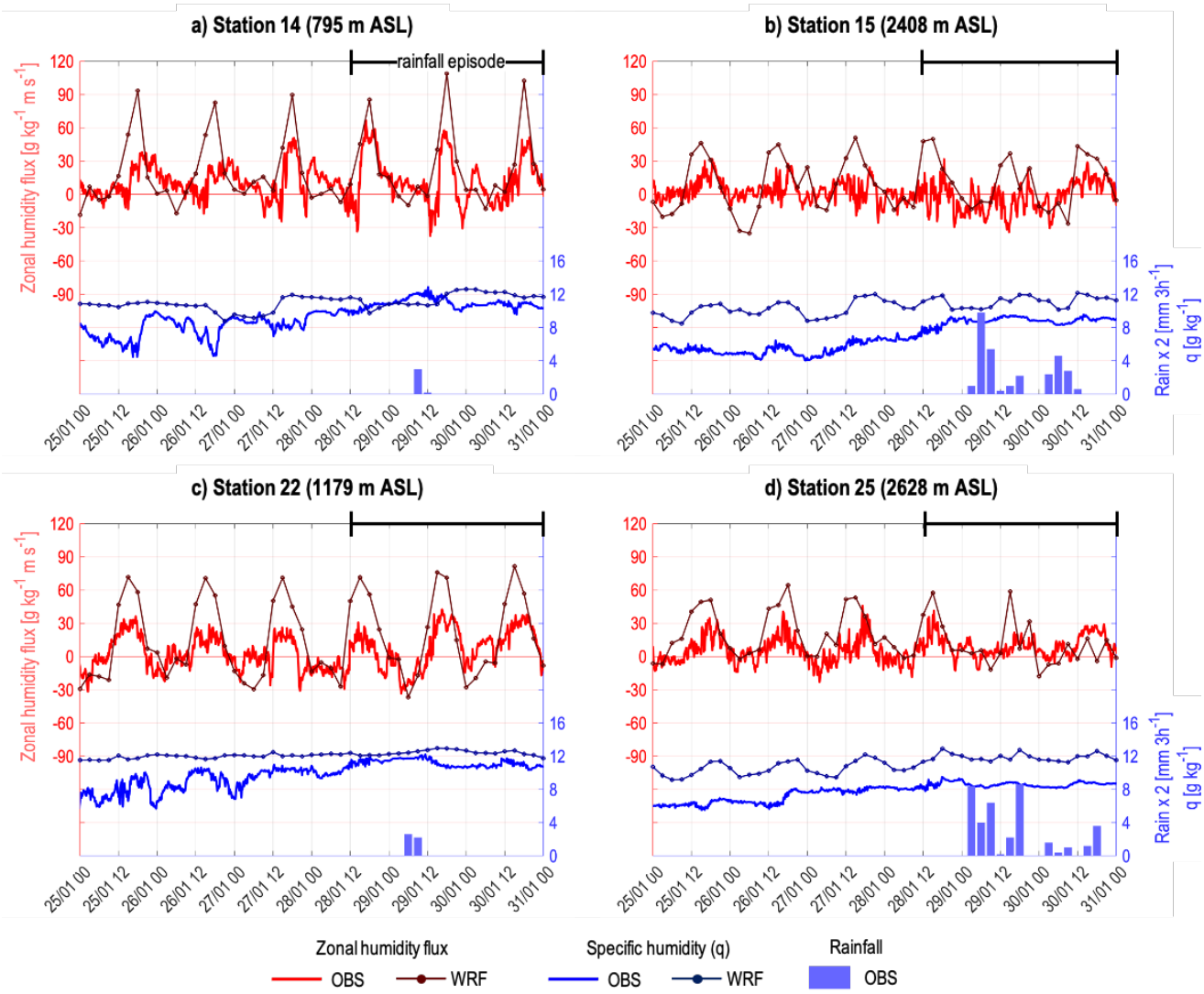

Figure S4. Time series between 25 January 2019 at 00 UTC and 31 January 2019 at 00 UTC of zonal moisture flux (red line) and specific humidity (blue line) from observations (OBS) and WRF nearest grid-point for the CRC1211 weather stations (a) 14, (b) 15, (c) 22 and (d) 25. Precipitation is included only for observations in blue bars. The location of the weather stations is presented in Fig. 1b.

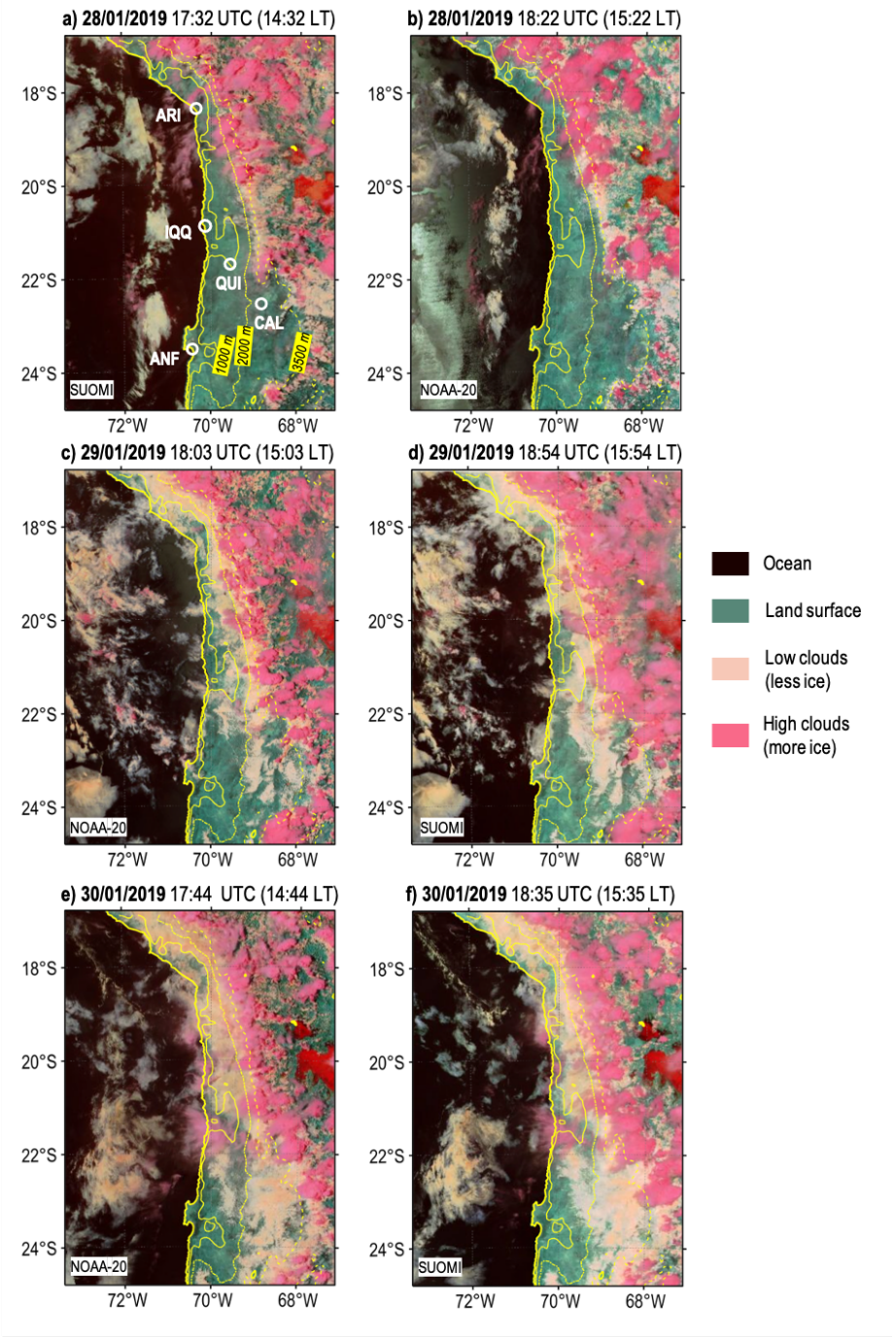

Figure S5. Cloud snow-ice product (Bands M3-I3-M11) from NOAA-20/VIIRS and SUOMI NPP/VIIRS for (a,b) 28 January, (c,d) 29 January and (e,f) 30 January 2019. The same altitude contours are shown in yellow lines at 0 m ASL (thick solid line), 1000 m ASL (thin solid line), 2000 m ASL (thin dotted line) and 3500 m ASL (thin dashed line). In (a), we included the location of the main stations used in this study. Data obtained from https://worldview.earthdata.nasa.gov/

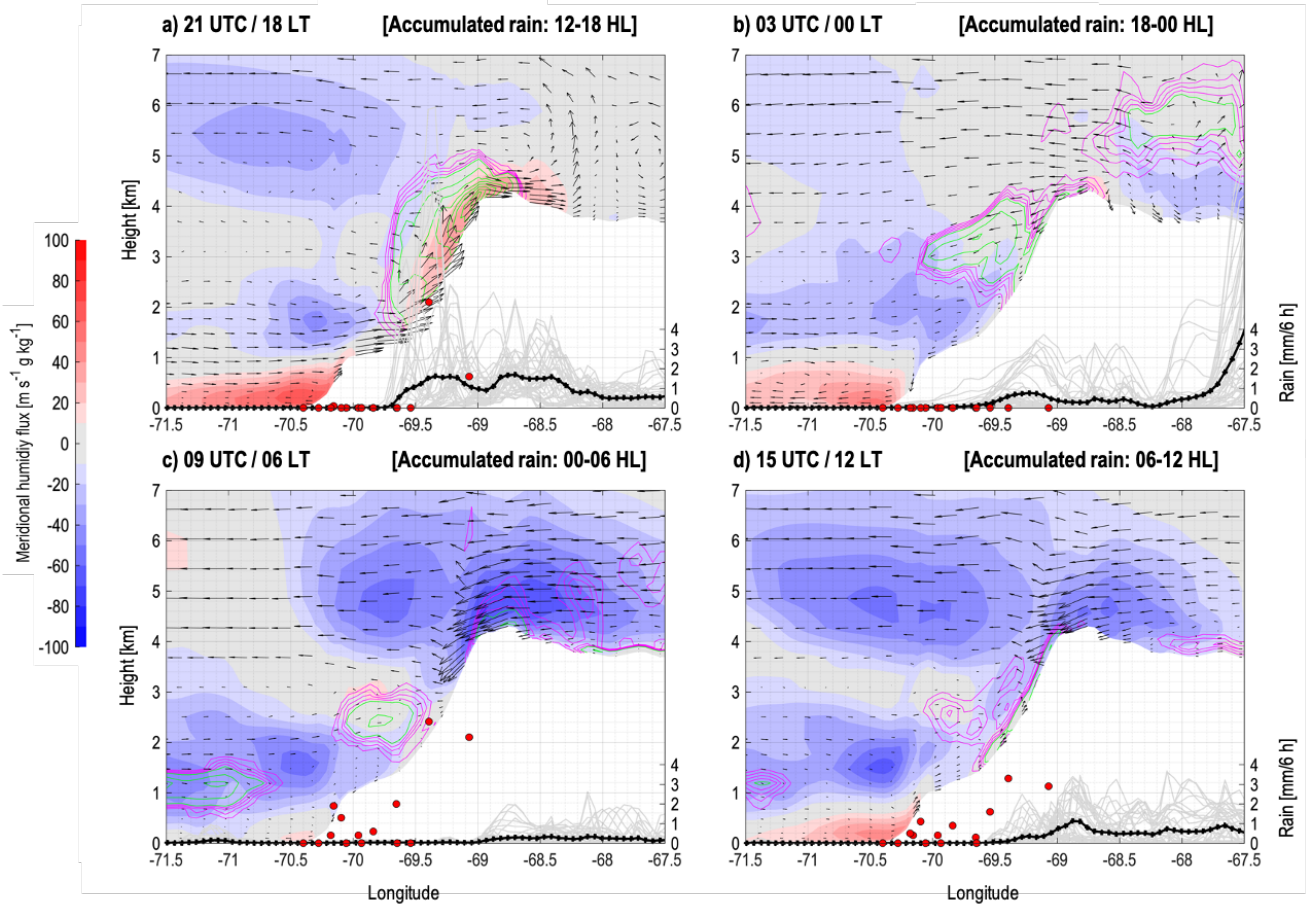

Figure S6. WRF cross-section (average between 19-21°S) evolution from 28 January to 29 January 2019 at 18 LT (a), 00 LT (b), 06 LT (c) and 12 LT (d) of meridional humidity flux (shaded colors), zonal humidity flux (black arrows), cloud liquid water content (magenta for values between 0–0.1 g kg^{-1} every 0.02 g kg^{-1}, and green contours from values between 0.2–0.9 g kg^{-1} every 0.1 g kg^{-1}). The accumulated rainfall (past 6 hours, as indicated in the squared bracket in every panel title) per longitude is plotted in the bottom averaged on x-y latitude (thick black dotted line) and individual latitudes (thin gray lines). Red dots represent observed accumulated rainfall from weather stations in the same period.