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Solid precipitation estimation during summer snowfall events at a coastal site of the Terra Nova bay area, Antarctica

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Knowledge of the spatial and temporal variability of snowfall in Antarctica and its impact on the Antarctic Ice sheet mass balance is essential to define the impact of the ice sheet on sea level rise. State of the art model projections assess an increase in snowfalls in the next century, but large uncertainties in current estimates prevent a reliable long term forecasts. Moreover, in situ continuous observations of precipitation are rare and sparse over Antarctica due to experimental difficulties and harsh climatic conditions.
In order to increase the understandings of snowfall on surface mass balance, a project using a multidisciplinary methodology has been carried out over the Antarctic coastal area of Terra Nova Bay (TNB) the Italian summer Antarctic campaigns of 2015-2016 and 2016-2017.
Several summer snowfall events were observed at the Mario Zucchelli station (MZS, 74°41′42″ S, 164°07′23″ E) using a comprehensive set of instruments including: meteorological observations from preexisting automatic weather station (AWS), a celiometer, a laser pluviometer, daily radiosonde profiles (provided by Meteo-Climatological Observatory), a GPS system for columnar water vapor measurements (provided by Geodetic Observatory), two small radar sensors, an infrared pyrometer, a net radiometer. Other instrumentations (AWSs and stake farms), spread over the area, provide observations of snow accumulation and meteorological conditions over the region.

During the 2015-2016 summer the precipitation events were concentrated between the end of December and first days of January, while during 2016-2017 snowfalls arise also during November and December. Each event lasted on average from about 12 to 48 hours and was related mainly to large low pressure systems off shore Ross Sea, which established a local instability and/or cyclonic circulation over TNB area. First estimations of total precipitation for the period range between 40 and 60 mm water equivalent depending on instrumentation and parametrization used. Collected data in specific examples are discussed and compared with model data.