Climatology of bora types at Dubrovnik airport

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Strong bora events have a significant influence on air traffic at Dubrovnik airport. During the time, forecasters learned to differentiate three main bora types: standard bora, deep bora, and nocturnal gap flow. Standard bora is a typical hydraulic flow that is generally associated with bora flows. Usually, mean wind speeds are higher than 10 ms^{-1}, with occasional gusts. Deep bora is typical for measured average wind speeds <10 ms^{-1}, but occasionally gusts can reach 20 ms^{-1}. Contrary to the standard bora, deep bora is characterized by a variation of wind speed and direction, which is often more than 180°. Nocturnal gap flow is steady wind during the nighttime with mean speed up to 12,5 ms^{-1}, a small variation of wind direction, and absence of gusts.

An algorithm that automatically classifies bora types is developed. Inputs are data of 10 min wind from standard METAR reports. For every METAR reports, each class is estimated from thresholds for mean wind speed, occasional gusts, a variation of wind direction and time of day. Smoothing of individual class bora is applied with M of N method. Finally, the time series of bora class is given in final order: deep bora, standard bora, nocturnal gap flow, unclassified bora, and no bora. Within one bora episode, several types of bora can be classified.

During 11 years, 20 % of all METAR reports reveal bora type, and among them, 42 % reports are weak bora, 32 % nocturnal gap flow, 21 % standard bora and 5 % deep bora. Standard and deep bora are more frequent during the cold part of the year and have an impact on air traffic (cross-wind gust >17,5 ms^{-1}). Standard bora is more frequent during nighttime and deep bora during daylight. Although empirical, this classification could be useful in nowcasting.

Key words: bora, classification, METAR reports, Dubrovnik