

6B.2 ENHANCEMENTS OF THE DATA SET OF SOUNDING PARAMETERS DERIVED FROM THE INTEGRATED GLOBAL RADIOSONDE ARCHIVE

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1. INTRODUCTION

This presentation will provide a brief summary of enhancements to the collection of sounding parameters which is maintained at the National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC). Originally released in 2007 to facilitate studies of variations in the vertical structure of the lower troposphere, the parameters are derived from the Integrated Global Radiosonde Archive (IGRA, Durre et al. 2006) and are available for over 1100 stations from around the globe. The product is updated daily and contains information for the full available period of record which extends back to as early as 1946 at some stations. Compiled with input from experts at NOAA's Air Resources Laboratory and the University of Massachusetts, the first version of this product contained reported temperatures and geopotential heights; derived potential temperature, relative humidity, actual and saturation vapor pressure, and zonal and meridional wind components; and vertical gradients of temperature, potential temperature, relative humidity, and wind components (Durre and Yin 2008). Furthermore, calculated geopotential heights were included to fill in missing heights in the original reports.

Version 2, currently in the final stages of development, is being created in order to both respond to user feedback and expand the set of parameters provided. Three groups of parameters are being added: special levels, convective stability indices, and user-requested parameters. A brief summary of the newly added parameters follows.

2. PRESSURE AND HEIGHT ABOVE THE SURFACE OF VARIOUS SPECIAL LEVELS

The following levels are included:

- Equilibrium level, the level at which an air parcel, rising or descending adiabatically, attains the same density as its environment.
- Freezing level, the level where temperature first decreases to 0°C.

- Level of free convection, the level at which the temperature of the environment decreases faster than the moist adiabatic lapse rate of a saturated air parcel at the same level.
- Level of the warmest temperature in the sounding (when not found at the surface), a proxy for the height of a surface-based temperature inversion that appears to be less sensitive to vertical resolution than corresponding indicators based on changes in lapse rate.
- Lifting condensation level, the level where a parcel lifted dry adiabatically from the surface, first reaches saturation.
- Mixing height, the lowest level where the virtual potential temperature is greater than or equal to the virtual potential temperature at the surface (Morris et al. 1990).

3. CONVECTIVE STABILITY INDICES

These indices are frequently used by meteorologists to evaluate the potential for convective activity from operational sounding data. Of the many indices that have been defined, we have chosen those that appear to be most commonly used and most widely applicable. These include the following:

- Convective available potential energy, an indicator of the potential strength of updrafts within a thunderstorm (Bluestein 1993) that is equal to the amount of energy available to a parcel as it freely rises between the Level of Free Convection and the Equilibrium Level.
- Convective inhibition, the energy needed to lift an air parcel vertically and pseudoadiabatically from its originating level to its level of free convection.
- K Index, an index based on lapse rate and the vertical extent of the moisture content in the lower atmosphere and is calculated directly from mandatory-level temperature and dew point temperature (George 1960).
- Lifted Index, the difference between a sounding's 500 hPa temperature and the temperature of a parcel lifted from at or near the surface to 500 hPa (Galway 1956).

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- Showalter Index, the difference between a sounding's 500 hPa temperature and the temperature of a parcel lifted adiabatically from 850 hPa to 500 hPa (Showalter 1947).
- Total Totals Index, an indicator of low-level moisture and 850-to-500-hPa lapse rate (Miller 1972).

4. USER-REQUESTED PARAMETERS

To round out the set of new parameters, we have also added surface-to-500-hPa precipitable water (Durre et al. 2009) as well as virtual temperature, virtual potential temperature, and the refractivity index (Smith and Weintraub 1953) at each level in response to various forms of user feedback.

The methods for calculating these quantities were selected based on techniques accepted in the peer-reviewed literature, sensitivity to the varying vertical resolution of the sounding data, and applicability to a wide range of atmospheric conditions. A full description of the computational methods as well as a discussion of the utility and limitations of the parameters will be provided in a future peer-reviewed manuscript. It is hoped that by making available these parameters for the full historical record for stations from around the world and updating them on a daily basis, we will further simplify efforts to fully characterize the climatology of the lower troposphere (e.g., Derubertis 2006; Seidel et al. 2010) and enable users to place the stability and moisture characteristics associated with individual meteorological events in historical perspective.

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