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Data Analysis of Weather Prediction to Solve Natural Problems by using Ai

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***Abstract* :The rain prediction using AI technology.By using deep learning mathematical models, AI couldlearnfrom past weather records to predict the future. Identifying patterns in collected data to predict the future. we have to keep a lot of effort for best results,it also needs to be done in real time. AI is developed for flood control Management. The accuracy of weather prediction is has increased over time,but is still not 100% accurate.forecast is about 80% reliable. with a five-day weather forecast about 90% correct. Longer than seven days or ten days forecasts about 50% accurate This is where AI could be improve the accuracy and reliability of weather forecasting. Scientists are now using AI for weather forecasting to obtain accurate results fast.AI can use the computer generated mathematical programs and computational problem-solving methods to identify patterns and make a relevant hypothesis**

Index Terms:- Satellite link,Total attenuation, Effectivepath length, Rain cell.

1 INTRODUCTION

Weather balloons have been used for climate and meteorological research for more than 100 years. The first instrumented, unmanned “free” balloon was launched by Gustave Hermite in 1892. His waxed-paper balloon, inflated with illuminating gas (mostly hydrogen and methane), carried a minimum-registering mercury barometer (Hermite, 1892). Some radiosondes are now capable of capturing and transmitting data from other balloon-borne instruments, greatly expanding the measurement capabilities of balloon payloads.

With strong evidence of climate change and a refined knowledge that atmospheric composition in the upper troposphere and lower stratosphere (UTLS) plays an important role in radiative effects in Earth’s climate system. However, this long data record is limited to only one location in the northern midlatitudes and should not be used to assess global trends. The Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) is designed to produce long-term, climate-quality records of essential climate variables in the troposphere and stratosphere.

Here we describe two novel ballooning techniques that allow instruments to make high-quality measurements while ascending and descending at similar controlled rates of speed. The main reasons for controlled ballooning are to prevent pendulum motions during ascent, to measure clean, unperturbed air during descent at speeds similar to ascent and to obtain two vertical profiles at slightly different locations and times with a single balloon launch. The first method uses one balloon and a simple automatic valve to release helium from the balloon once it reaches a preset ambient pressure. Where a stable pendulumfree ascent is required to keep the instruments as horizontal as possible. The double balloon method also allows highquality measurements to be made during controlled descent. In the following we also discuss in detail the contamination problems of ascent measurements, demonstrate some advantages and disadvantages of controlled ascent and descent measurements and compare temperature and humidity profiles obtained during traditional (burst) and controlled descents.

2 THE MODEL FOR TRADITIONAL BALLOONING AND ASSOCIATED PROBLEMS

Weather Balloon experiments are the backbone for the vertical profile measurements of pressure, temperature, humidity, ozone and horizontal winds in the troposphere and stratosphere. Weather balloon start with ascent at a fairly steady vertical velocity of $5ms^{-1}$ up to the altitude of balloon burst.

This uncontrolled, high-velocity descent significantly reduces the vertical resolution of measurements and is often detrimental to the quality of measurements. Almost all balloon soundings are performed in this traditional way and, consequently, only the ascent data are considered useful. Some very sensitive and fast response humidity sensors affected by contamination during ascent have measured quite successfully during the high-speed descent after balloon burst of traditional balloon flights.

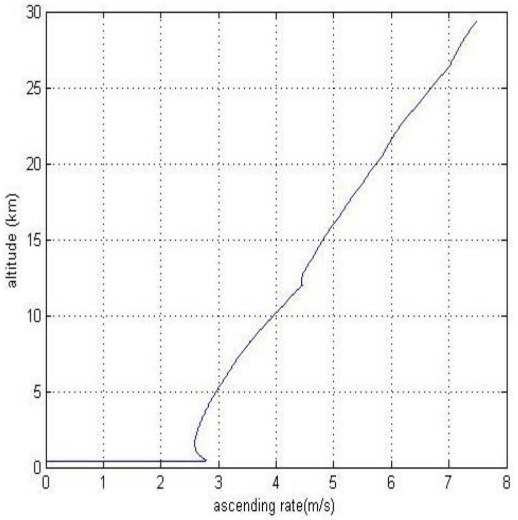

Figure 1. Weather balloon vertical velocities during ascent (blue) controlled descent using the automatic valve method (green) or descent after balloon burst (red).The first reducing the ascent rate to zero (float) then establishing a slow and fairly steady descent rate<10ms^{-1} (green).

After balloon burst the payload falls at high speed (40–60ms^{-1}) to about 20km, where the parachute begins to reduce the rate of descent to <40ms^{-1} (Fig. 1).This uncontrolled, high-velocity descent significantly reduces the resolution of measurements and the quality of measurements. Almost all balloon soundings are performed in this traditional way. Some are very sensitive and fast response humidity sensors affected by contamination during ascent have measured quite successfully.

Some specific problems are associated with the exclusive use of ascent measurements of temperature and humidity for climate research.Especially in the UTLS,ascent measurements are prone to contamination by the balloon and flight train that lead to sen- sor payload.Sensors with high sensitivities and rapid response times are also susceptible to the pendulum motion of the payload that moves sensors in and out of the balloon's wake.

2.1 Temperature measurement contamination

Instrument payloads are typically suspended 30–50m below the balloon by a string. During the balloon ascent, the gas inside expands adiabatically if there is no heat exchange with the surrounding air. Within the troposphere this cooling of the balloon gas closely tracks the near-adiabatic temperature gradient of the external air. Above the troposphere, where temperature generally increases with height, the balloon gas continues to cool adiabatically but is also heated by the warmer external air. During nighttime this heat transfer cools the air that touches the balloon skin by several degrees, while keeping the temperature of the balloon gas close to the external temperature. During daytime the direction of heat transfer is reversed because solar radiation strongly heats the balloon skin and gas. In both cases the temperature of the air stream that comes in contact with the balloon is altered by heat exchange with the balloon gas.

Figure 2 shows temperature profiles measured by the thermo sensor of a radiosonde and the adverse effects of the nighttime cooling and daytime heating of air that touched the balloon skin .

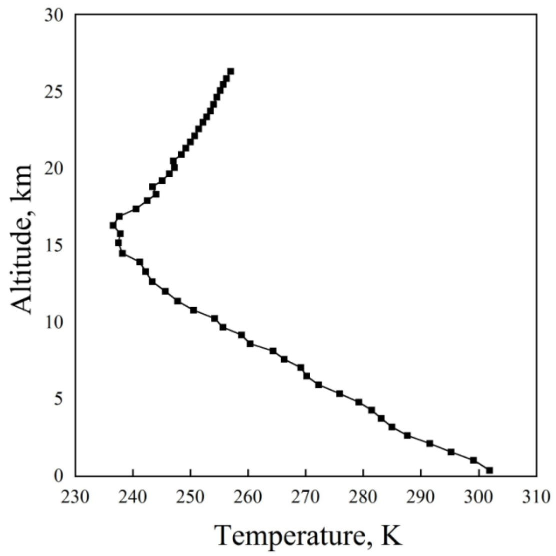

Figure 2. Stratospheric temperature profiles measured from ascending balloons during nighttime (left panel) and daytime (right panel) .

Difficult to overcome the bad conditions, especially in very dry regions of the atmosphere.

Because temperature and solar irradiance increase with altitude above the troposphere (Fig. 3). In uncontaminated conditions the performance of the FPH during ascent and descent is similar because the direction of sample flow through the instrument is different (i.e., the air intake and exhaust paths are identical). For these reasons FPH measurements made during controlled descent are preferable to ascent measurements in the UTLS. The high-resolution controlled descent data can be used to identify and flag ascent measurements affected by contamination, especially in the UTLS(Upper troposphere/lower stratosphere). FPH measurements are made after balloon burst, as the payload falls at >20ms^{-1} through the stratosphere.

3 TEST FOR THE NOVEL BALLOONING TECHNIQUES OF THE PROPOSED

The contamination of temperature and humidity measurements during balloon ascent makes it desirable to utilize con-

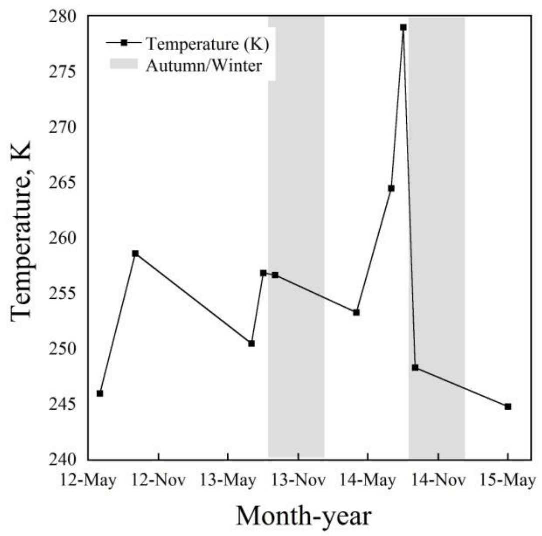

Figure 3. Stratospheric water vapor mixing ratio profiles measured by the NOAA FPH during balloon ascent (blue) and controlled descent (green) over Boulder, Colorado. The two profiles are similar except above 25.5km where the ascent measurements become contaminated by the persistent outgassing of moisture from the balloon and flight train. High-quality, uncontaminated FPH measurements (those passing quality control) resume during controlled descent at ~27km, approximately 1km below the altitude of balloon turnaround (float).

trolled descent of the balloon to obtain high-accuracy and high-precision measurements. The implementation of controlled descent in a balloon sounding is quite a departure from traditional ballooning methods and has required the development and refinement of novel techniques. Here we describe two such techniques.

2.2 Automatic valve technique

The FPH has measured humidity profiles during ascent and controlled descent using a single balloon configuration similar to the traditional method. The only deviation from traditional ballooning is the addition of an automatic valve that releases helium gas from the balloon at a preset pressure, preventing balloon burst and inducing descent at a controlled rate similar to that of ascent .

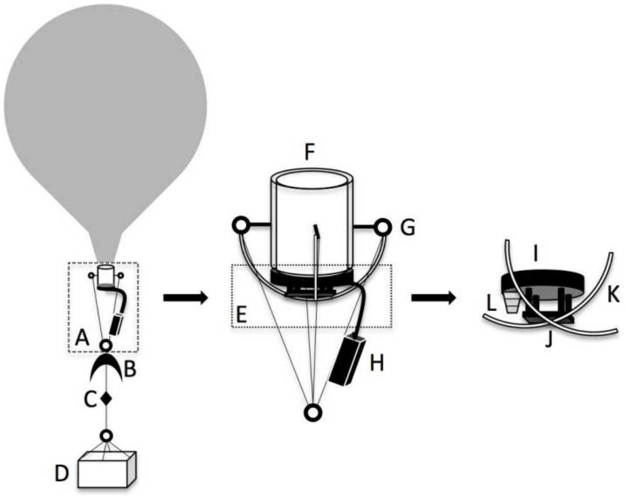

Figure 4. For the single balloon method of controlled descent the balloon flight train consists of (A) the automatic balloon valve and pressure sensor assemblies, (B) a parachute, (C) a 52m string unwinder and (D) the instrument payload. The valve and pressure sensor assemblies include (E) a valve cap assembly, (F) a PVC pipe segment, (G) four screw-in eyelets and (H) a pressure sensor, logic board and batteries. The pipe cap assembly includes (I) a pipe cap, (J) a hot wire string cutter, (K) two cap anchoring strings and (L) a helium fill port.

set for the desired activation pressure, connected a 3V battery to a short length of Nichrome wire to burn the retaining string. The aluminum disk would release from the Lucite ring, allowing helium to flow from the balloon. Over the years the valve materials have been changed from Lucite and aluminum to phenolic to PVC, for savings of both weight and cost, and the pressure sensor was modernized.

Logic board sends current to a Nichrome wire bridge that burns through the cap anchoring strings. The cap falls away and helium flows out of the balloon through the uncapped pipe. Note that only helium is used to fill balloons outfitted with this valve because hydrogen would be ignited by the heated Nichrome wire.

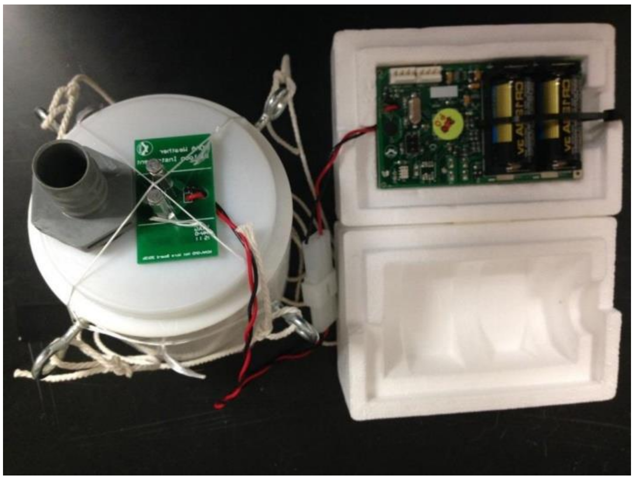

Figure 5. Automatic balloon valve (left) and pressure sensor assembly (right). Two thin strings anchoring the white circular pipe cap to the pipe are stretched across the hot wire string cutter. The foam box houses the pressure sensor, logic board and batteries. A cork is inserted in the gray helium fill port on the white pipe cap after the balloon is filled.

Ballon floats then begins to descend as more helium is released. As the balloon descends the controlled rate slows from 5.4±0.4ms^{-1} at 22–25km to 3.1±0.3ms^{-1} below 14km (Fig. 1) for two reasons. First, the balloon's downward movement causes a ram air pressure to develop at the valve opening.. Second, as the balloon descends the internal gas is warmed by solar heating and the intake of warmer air, increasing its buoyancy. The greatest risk of failure for this method of controlled descent is an early burst before the valve opens. To keep this risk low, the pressure threshold is cautiously set to 16hPa (29km). controlled descents have been achieved for 75% of the about 250 balloons outfitted with a valve; most of the failures occurred because balloons burst prematurely. A parachute is employed in the flight train as a safeguard in case the balloon bursts (Fig. 4).

2.3 Double balloon technique

The double balloon technique uses a carrier balloon to lift the payload and a second smaller balloon that acts like a

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parachute once the carrier balloon is released. Each balloon is fixed to a vertex of a triangular frame of lightweight aluminum that connects them to the payload below (Fig. 6). The triangle is equipped with a release mechanism to cut the 20m string of the carrier balloon at a preset altitude. An emergency parachute is fixed between the triangle and the parachute balloon in case the smaller balloon bursts. The large carrier balloon is inflated with enough hydrogen to lift the payload at 5ms^{-1} during ascent while the smaller

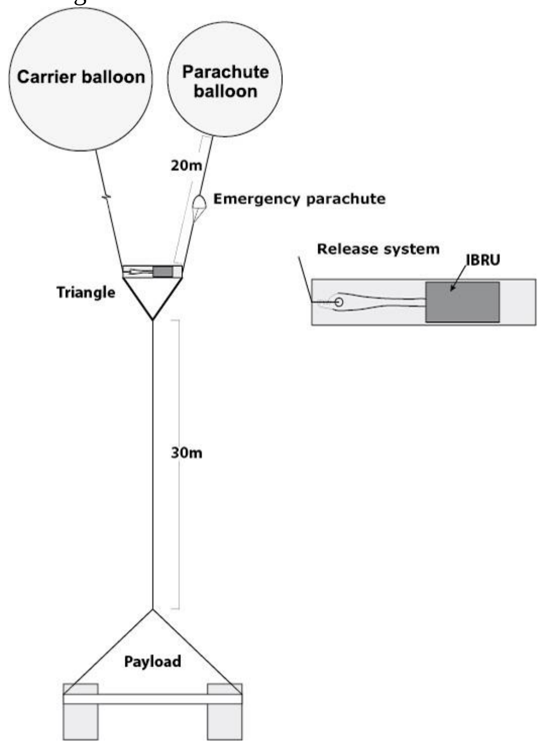

Figure 6. Double balloon sounding configuration with carrier and parachute balloon connected to the payload via the triangle that includes the IBRU release mechanism.

parachute balloon is inflated with enough helium to maintain a descent rate of ~5ms^{-1} once the carrier balloon is released.

The Intelligent Balloon Release Unit (IBRU) (Figs. 6 and 7) is housed in a rectangular Styrofoam box mounted on the horizontal triangle edge between the attachment rings of the two balloons. The IBRU system is based on a microcontroller that controls the GPS and the release mechanism for the carrier balloon. The tether string of the carrier balloon is attached to a bolt inside the release mechanism. In front of the bolt a tungsten wire is wrapped around the string. The hot wire which burns the tether string reaches temperatures of over 1000°C (red-hot). At the preset GPS altitude the IBRU burns the string, releasing the carrier balloon. The ideal situation is if they are only 2 to 3m apart from each other. The initial descent velocity can reach up to 10ms^{-1} but within a few seconds it slows down to the desired speed. At a descent altitude of 3000ma.s.l. the IBRU switches on a mobile phone, finds a network and starts transmitting its coordinates via text message at regular intervals until the payload reaches the ground.

The launch process for the double balloon method has been improved over the last several years and is now comparable in effort to performing a regular radio sounding.

Figure 7. The IBRU consists of a microcontroller that controls the GPS, the release mechanism and a mobile phone to send text messages with the coordinates of the payload before landing.

Nevertheless, there are several different steps that require extra care. The gas amount for the two balloons is first determined in a spreadsheet, where the weights of all parts are maintained and the correct gas amounts for 5ms^{-1} ascent and descent are calculated. The two balloons are then filled as their lifting capacity is measured with a scale. The IBRU system is configured using a PC to set the release altitude and the mobile phone number. Once the balloons are filled they are attached to the triangle. The payload is then attached to the third vertex of the triangle and the entire flight train is lifted up and affixed to a launching pole prior to release (Fig. 8).

The triangle between the two balloons acts as a fix point stabilizing the payload. Comparisons have clearly shown that the pendulum motion usually observed on single balloon flights is strongly reduced with the double balloon technique. Figure 9 shows the horizontal travel of the payload over the first 2000m of ascent during two simultaneous radiosonde flights, one using the traditional single balloon configuration (blue) and the other utilizing the double balloon (red) method. The two radiosondes travel in the same general direction but the single balloon payload moves in circles of up to 10m radius due to pendulum motion while the double balloon payload does not. The reduced pendulum motion of the double balloon method is very important for radiation measurements where instruments need to remain as horizontal as possible during flight.

The double balloon method also improves the stability of descent rates compared to ascent rates .

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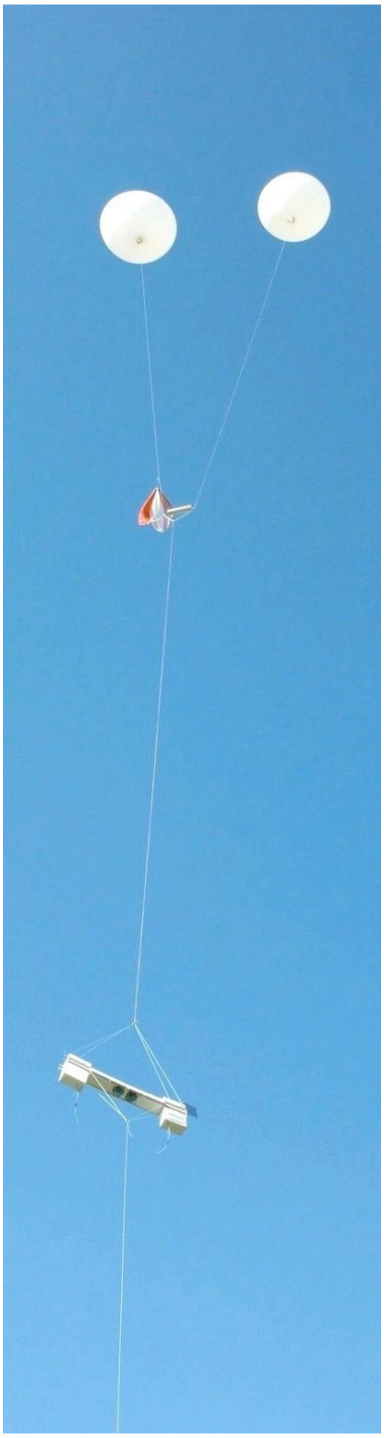
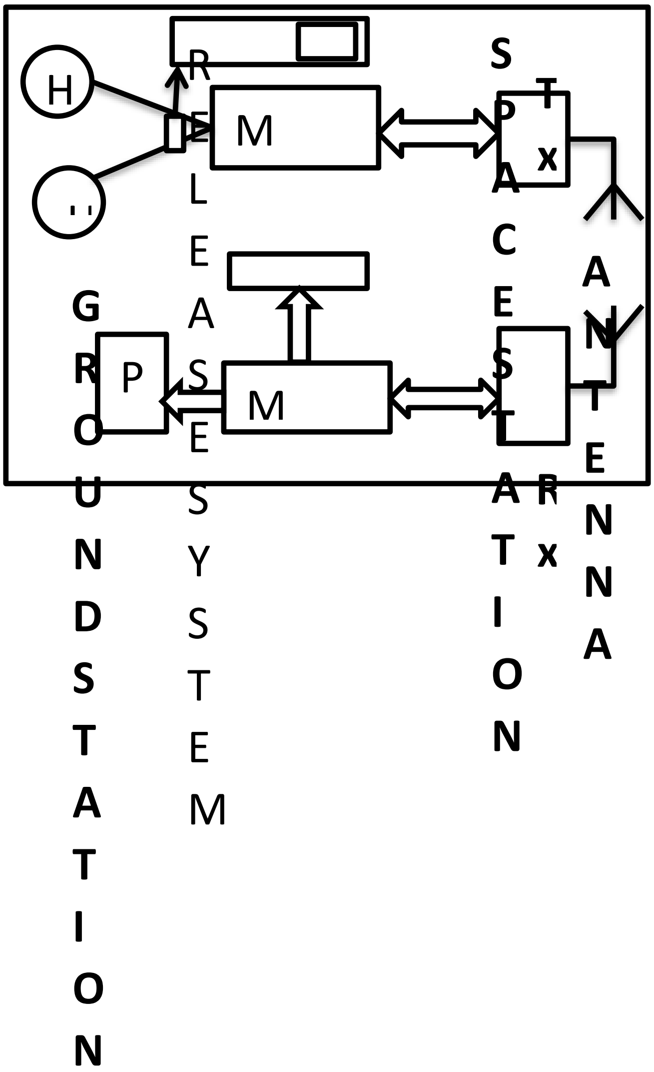


Figure 8. Flight configuration for the double balloon method. Each of the two balloons and payload are attached to a vertex of a triangular aluminium frame outfitted with the Intelligent Balloon Release Unit that releases the carrier balloon at a preset altitude. The configuration is shown attached to the launching pole just prior to release.

BLOCK DIAGRAM.1. Double in satellite communication between space station and ground station



3 ADVANTAGES AND DISADVANTAGES OF DOUBLE BALLOON METHOD

As described above the main advantage gained using controlled balloon descent for temperature and humidity measurements is the decreased potential for measurement contamination compared to ascent measurements. Double ballooning further strongly reduces the pendulum motion of the payload, an important factor for radiation measurements. It should be noted here that there are also some disadvantages when making measurements with certain types of instruments during controlled balloon descent.

Some radiosonde sensors do not perform as well during descent because their orientations are optimized for best performance during ascent. There are three main factors for sensors that differ between ascent and descent: the direction and strength of ventilation flow past the sensor, the vertical structure of the parameter being measured and the vertical gradient of environmental parameters such as temperature. For example, some radiosondes have thin wire temperature sensors mounted on a sensor boom oriented to receive maximum ventilation flow towards the radiosonde during ascent. Reversing the direction of travel changes the direction of ventilation flow from the radiosonde package over the sensor

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boom towards the temperature sensor. During controlled descent these flow path differences are exacerbated by the weaker ventilation flow; the rapid

CONCLUSION

In this paper, a new global effective path-length model, which can be used for total attenuation prediction in satellite link, is proposed. The proposed model is a physical model based on the rain-cell concept. The prediction accuracy of the proposed model for total attenuation was tested against the measurement data in the ITU-R SG3 DB, and the validity of the model was verified by comparing the prediction errors with those of the ITU-R model. The test results show that the propose model works well. In addition, there are key advantages compared to the ITU-R model that the proposed model is a physical model and the prediction method is simple.

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