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Calculation Formulas for Circulation Atmosphere

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Abstract

This paper provides the calculation formulas used to circulate the atmosphere, including the horizontal type of wind speed equation, the vertical type of wind speed equation, the circulation cyclone, and an example. The results have been used for disaster-linked problems, including "new way of solving Naiver—Stokes equation" and "Air Crash and Pressure". The goal of this paper is to show the work of a certain type. The solution of a certain type can be expressed by formulas. Formulas are the value of this paper.

Keywords

Circulation Atmosphere, Wind Speed Equation, Wind-Pressure/Density Equation, Circular Cyclone Equation, Wind-Wave Equation, Naiver-Stokes Equation

1. Introduction

1.1. Circulation Rank

The circulation of the Earth on its orbit motion around the Sun is here termed "Top circulation".

The circulation of the atmosphere is Second. The second circulation depends on the top circulation.

The circulation of life is third. It depends on the second.

1.2. Two Kinds of Methods of "Certain Type" and "In-Certain Type"

There are two kinds of methods: one of them belongs to a certain type. They use a continuous model or media to solve a problem and solve the problem by calculus, differential equation, integral equation, etc. Its solution is certain and can be expressed by formulas. The other type belongs to the "in-certain type", where they treat huge data using methods like statistic theory and probability and involve random factors. The obtained results are expressed numerically.

For the atmospheric field, how much do people use "certain type" or "in-certain type"?

For the origin articles in atmospheric journals, it seems that the use of "in-certain type" is more than the use of "certain type". Why? (see Section 2 for the answer).

1.3. Use of "a Point (Mass) in Air"

From the visible video of the atmosphere, e.g., due to a blast, the rising up of a group of masses moving together at the same time like a single mass, thus, we can use a point (mass) in the air to represent the motion of the group of masses. In the following, a point (mass) in the air represents a group of masses.

Any motion can be completed by a serious combination of vertical/horizontal motion. Vertical motion or horizontal motion only exists at the same time t.

Why do we often use a point (mass) in the air?

Like in solid mechanics, the solution of a point force in the elastic space (Kelvin), or the solution of force at the point in the interior of a semi-infinite solid (Mindlin) has been used. The point (mass) in the air will play an important role.

In the following, we discuss:

Section 2 Horizontal type of wind speed equation of a point (mass) in air.

Section 3. Vertical type of wind speed equation of a point (mass) in air.

Section 4. The special type of a point (mass) in rotating air.

Section 5. Circulation of atmosphere.

Section 6. Linked problems.

Section 7. Conclusion.

Section 8. Discussion.

Section 9. References.

2. Horizontal Type of Wind Speed Equation of a Point (Mass) in Air

2.1. The Story of "Wind Speed Equation of a Point in Air"

"In 2015 winter, it was very cold. I wondered where the source of the cold was. How powerful it was! Such that it swept the whole of North America, Europe, and Asia! I tried to find the "wind equation", or "wind speed equation" on the net. However, nothing could be found on the net. It was well known that "moving air forms wind" was common sense in primary school. Why not thing can be found? I told myself that perhaps this is a very difficult problem, because the air has no shape, no boundary, and no volume. How to set up an equation? That was easy, I replied to myself. Giving the air wrapped by a "zero-weighted membrane", then, it has shape and volume and thus scientific laws can be used. Meanwhile, it didn't change the stress field, since there was nothing wrapped in the air. Based on this idea, I published two papers [1] [2]. That is my story on "Wind Speed Equation" (see "preface" of [3]).

2.2. The "Wind Speed Equation of a Point in Air"

The "Wind Speed Equation" (simple form) (or called "wind-temperature equation"):

$$\dot{\boldsymbol{u}} = k\nabla \boldsymbol{T}, \quad (k = c/m = \text{const}) \tag{2-1}$$

where $\boldsymbol{u}$ = wind speed, $\nabla = i\frac{\partial}{\partial x} + j\frac{\partial}{\partial y} + k\frac{\partial}{\partial z}$, Hamilton operator, $\boldsymbol{T}$ is temperature, k, c, m (mass) are constants.

The solution of (2-1) is:

$$\boldsymbol{u}(\boldsymbol{s},t) = \exp\left[k\left(\boldsymbol{s} - t^2\right)\right], \tag{2-2}$$

where $\boldsymbol{u}$ = wind speed, $\boldsymbol{s} = xi + yJ + zK$ = position vector.

(2-1) is a PDE (Partial Differential Equation). It states that the derivative of wind speed respective to time is proportional to the derivative of temperature with respect to trace. This result can be viewed as a rule that strong wind companies with temperature sharp dropping. Or, temperature sharp differed between positions in the track, causing strong wind. Because it has a simple form, suits for wide use. Its method has copied to vertical type, to rotation air (circulation cyclone), etc. Thus, it becomes a base for the description of certain types of wind.

Wind is invisible. How can you prove the correctness of (2-1)?

Confirm the truth by fact, comparing,

- Every winter, the weather forecast (China Weather Net) alerts people to be cautious because cold waves come with strong winds and temperatures sharply dropping.
- By visible mushroom clouds [4].

The motion equation of [4], derived by different models based on modifying the Naiver-Stoles equation, with the result well agreed with (2-1).

3. Vertical Type of Wind Speed Equation of a Point (Mass) in Air

3.1. The Vertical Type of Wind Speed Equation of a Point (Mass) in Air [5]

The vertical type of wind speed equation is shown as:

$$\dot{\boldsymbol{u}} = \nabla\left(p/\rho_{air}\right) = k_z \nabla p, \quad \left(k_z = \rho_{air}^{-1}\right) \tag{3-1}$$

where $\boldsymbol{u}$ = wind speed, k_z = constant, depending on z (highness).

(3-1) means that the derivative of wind speed $\boldsymbol{u}$ with respect to time t proportions to the derivative of $\left(\boldsymbol{p}/\rho_{air}\right)$ respect to track (space).

The solution of (3-1) is:

$$\boldsymbol{u}(\boldsymbol{s},t) = \exp\left[k_z\left(\boldsymbol{s} - t^2\right)\right], \quad \left(k_z = \rho_{air}^{-1}\right), \tag{3-2}$$

where $\boldsymbol{u}$ = wind speed, $\boldsymbol{s} = xi + yJ + zK$ = position vector.

3.2. Calculation of ρ_{air}

Traditionally. methods, tools for calculation of $\rho_{air} = \rho_{air}(p,z)$ as functions of p and z [6] [7], based Boyle's law and Charles law for static description. *i.e.*, they have no connected wind speed. However, our treatment of ρ_{air} is different from that of traditional. It connects with wind speed by " $w - p/\rho_{air}$ equation" (3-1), based on Boyle's law, Charles law and together with the Newton's second law. The calculation of ρ_{air} , can be found in Appendix of [5].

3.3. Comparing Two Methods of Calculating for Vertical Motion of Formulas

The traditional method obtains static (fixed) results, while our method gets variable results. Both method have their use for different goals.

4. Special Type of a Point (Mass) in Rotating Air [8]

4.1. Rotating Air Described by Rotation Equation [8]

Rotating air is a natural phenomenon seldom seen. Sometimes, it can be seen in buildings' corners, but it soon disappears. Only strong rotating wind can last.

Mathematical description of rotating motion [9].

$$\boldsymbol{rot}\,\boldsymbol{s} = \nabla \otimes \boldsymbol{s}, \tag{4-1}$$

where $\boldsymbol{s}$ = position vector. $\otimes$ = vector product, or outer product.

Use (4-1) to (2-1), we have Rotation Equation.

$$\boldsymbol{Rot}(m\dot{\boldsymbol{u}}) = Rot(c\boldsymbol{T}), \tag{4-2}$$

The necessary and sufficient conditions for existence of (4-2) is:

$$\boldsymbol{s} \neq \boldsymbol{0}, \boldsymbol{s} \neq \boldsymbol{I}, \boldsymbol{s} \neq \nabla, \boldsymbol{I} = \text{unit vector}, \tag{4-3}$$

If

$$\boldsymbol{s} \parallel \nabla, \text{ or } \boldsymbol{s} \parallel \boldsymbol{I}, \text{ or } \boldsymbol{s} = \boldsymbol{0}, \tag{4-4}$$

then, $\boldsymbol{Rot}\,\boldsymbol{s} = \nabla \otimes \boldsymbol{s} = \boldsymbol{0}$. *i.e.*, Rotation disappears.

4.2. Wind Speed Equation of Circular Cyclone [10]

Using the method similar to the wind speed equation but for cylindrical coordinates and for UCM (uniform circular motion), of rotation around z-axis, calculated by method of section. We got two set non-linear PDE of a point in UCM of steady flow. These PDFs to be solved.

4.3. Solution of Wind Speed Equation of Circulation Cyclone and Its Application [11]

The above paper obtained PDF with 4 unknown functions, 2 independent variables, used the method of dimension analysis and method of separating variables. Complimentary equation derived by iteration method. After two round iterations, using g-contraction mapping theorem for stopping iteration. We got 4 solutions

(2-51 - 2.54).

Application of (2-51 - 2.54). We have something useful. Maximum wind speed is located on the edge of the cyclone r_1, minimum wind speed is located on the center of the cyclone. Staying at the center of the cyclone should be safe. Other solutions have a similar distribution.

5. Circulation of Atmosphere

There are numeral circulations. We just show one of them in the following.

An Example Designed for a Round Trip of a Point (Mass) in Northern Semi-Sphere

The trip starts from $A(x_0, y_0, z_0, t_0) = A(0,0,0,0)$,

$$\begin{aligned} &A(x_0, y_0, z_0, t_0) \longrightarrow d_1 \longrightarrow B(x_0, y_0, z_1, t_1) \longrightarrow d_2 \longrightarrow C(x_1, y_1, z_1, t_2) \\ &\longrightarrow d_2 \longrightarrow D(x_1, y_1, z_0, t_3) \longrightarrow d_1 \longrightarrow E(x_0, y_0, z_0, t_4) \end{aligned} \quad (5\text{-}1)$$

where $d_1 = |z_1 - z_0| = z_1 = \text{distance}$, $d_2 = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2} = \sqrt{x_1^2 + y_1^2}$. Since the expression of position (highness) z_1 is different. In our formula (3-2) is variable, while in traditional expression the highness is fixed. It suits for use as a standard. Therefore, we use z_1 to represent the standard form of highness by red color.

In (5-1), we show a round trip of one year. It starts from A. t_0 = 0 = 2023/06/01. The trip ended in E. t_4 = 2024/06/01. We set z_1 = 100 km. Dividing 100 Km into 10 equal units, *i.e.*, z_1 (9/10) - 90 km. etc. Using (3-2) for 10 units, one can calculation t_1 by the sum of 10 unit's. Similarly, calculation for t_2, t_3, t_4. Note that $t_1 \neq t_3$, and t_2, t_4 use (2-2).

During this one-year trip, the sun played an important role. In summer, it heats the sea level hot, and hot air rises up. But in winter, without the sun heating. The sea level becomes colder, and air drops down from the sky to sea level.

6. Linked Problems

◆ Linked "New Way for Solving Naiver—Stokes Equation" [12].

The "wind-pressure/density equation", and "wind-wave equation" have been used in [12].

◆ Linked "New Way for Solving Naiver—Stokes Equation" [12].

"Non-Existence of Solution of Rotation Flow in N-S Equs" [13].

◆ Linked "Air Crash and pressure" [5] to disasters due to atmosphere.

◆ Linked "Equilibrium Equation of Thermal Radiation of Earth and Solution" [14] to clime change, disasters, and atmosphere.

◆ Linked "A Method for Seeking Range of Missing Plane Based on Law of Energy Conservation" [15] to disasters due to atmosphere.

◆ Linked "Rotation equation", "Wind speed equation of circular cyclone", "Solution of wind speed equation of circulation cyclone and its application" to huge disasters.

7. Conclusions

- Wind Speed Equation is a PDE. It states that the derivative of wind speed respective to time is proportional to the derivative of temperature with respect to trace. It can be viewed as a rule that strong wind companies with temperature sharp dropping. Or, temperature sharp differed between positions in the track, causing strong wind. Because it has a simple form, suits for wide use. Its method has copied to vertical type, rotation air (circulation cyclone), etc. Thus it becomes a base for wind description of certain types.
- Heat (measured by temperature) is the locomotive of air motion. For circle motion, temperature $\boldsymbol{T}$ is a vector. Circle motion can store more energy with less space compared with straight motion. The circulation cycle stores $\boldsymbol{T}$ instead of $\boldsymbol{s}$ (position vector), therefore, the circulation cycle stores huge amounts of energy and becomes a huge disaster.
- Since the expression of position (highness) $\boldsymbol{z}_1$ is different. In our formula (3-2) is variable, while in traditional expression the highness is fixed. It is suited for use as a standard. Therefore, we use $\boldsymbol{z}_1$ to represent the standard form of highness by red color. Both highness expressions have different uses.
- Other model used.
- "Motion Equation and Solution on Mushroom Cloud" [4].

Models like hot air bloom with zero-weighted membrane were used. Scientific laws such as Boyle's law, Charles' law, modified N-S equation, Mass-Energy equation, etc., have the result in agreement with (2-1).

- "New Dynamic Equation of Aerosol in Air of Certain Type" [16]. The equation has not been solved yet.

8. Discussion (Question and Answer, Q & A)

Q1, Air is invisible. How can you prove the existence of a circular atmosphere?

A1, Air is invisible, but the motion of air can be tracked by temperature T. T changes follow the circular atmosphere.

Q2, Is there accordance for calculating high level z_1 problem by horizontal formula?

A2, No, since no other work on a high level can be founded, we have no choice but to use the horizontal type for calculation, as an assumption.

Conflicts of Interest

Author has declared that no competing interests exist.

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