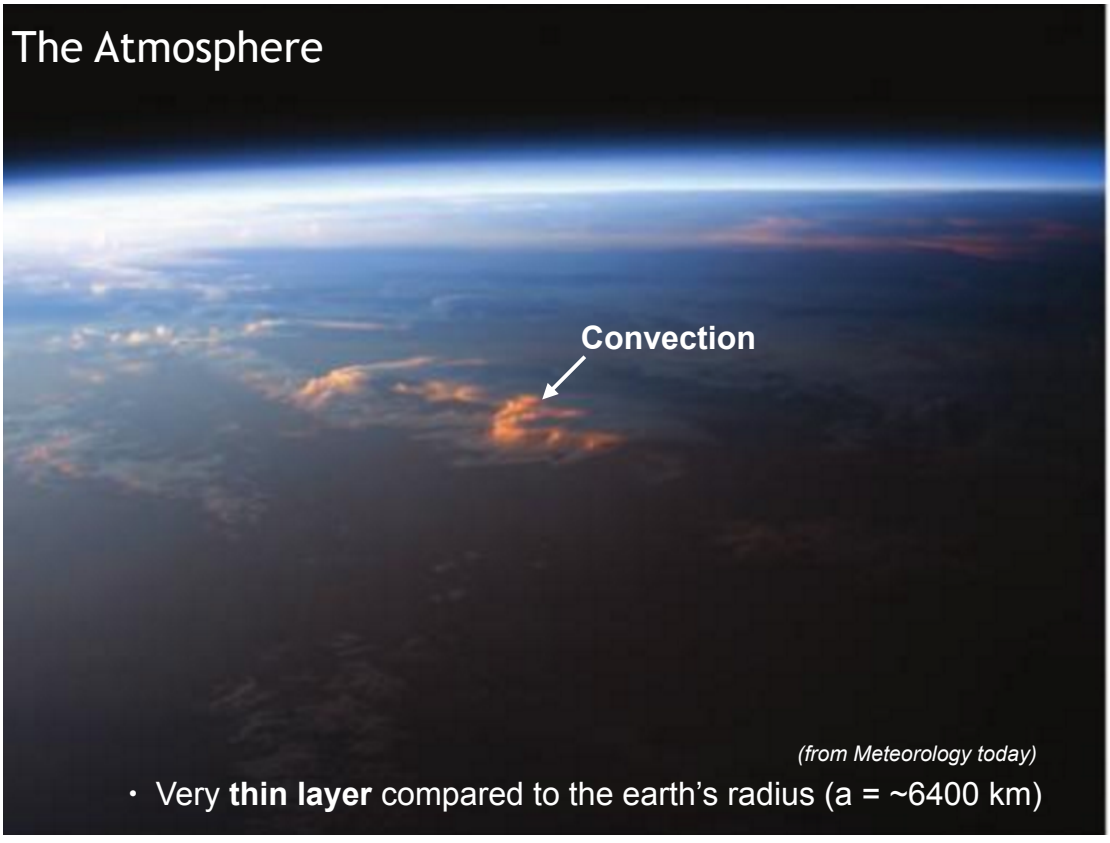
대기역학개론 1

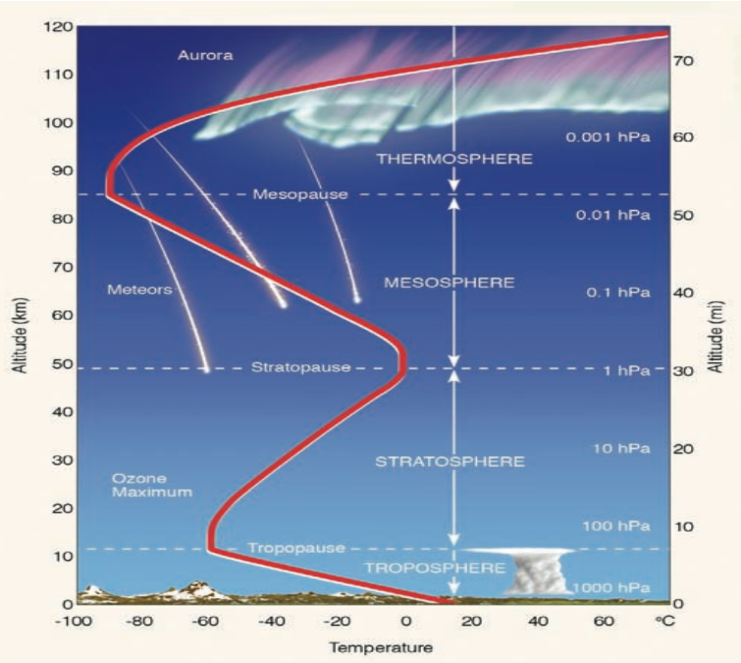
대기과학과
김주완

The Atmosphere



- Very **thin layer** compared to the earth's radius (a = ~6400 km)

Temperature profile

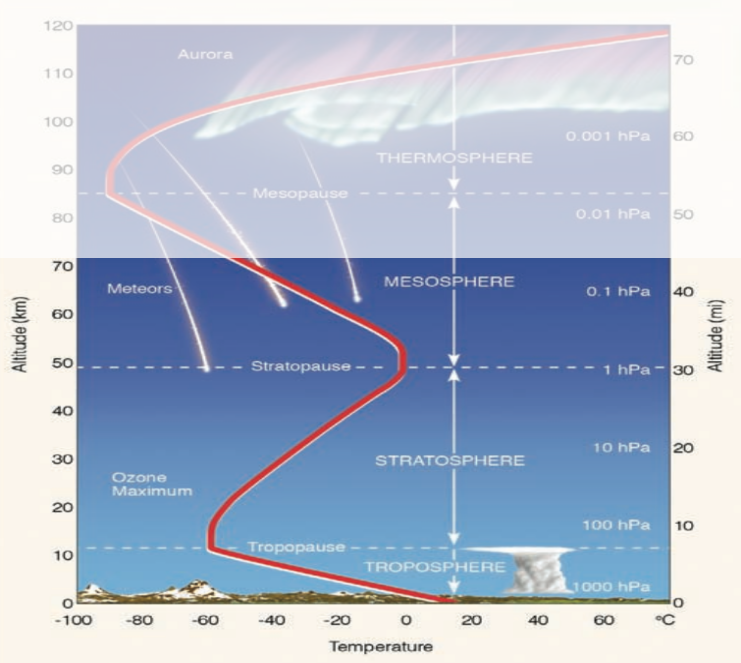


Rocketsonde
(~20-100 km)

Radiosonde
(~10-40 km)

(from Meteorology today)

Temperature profile

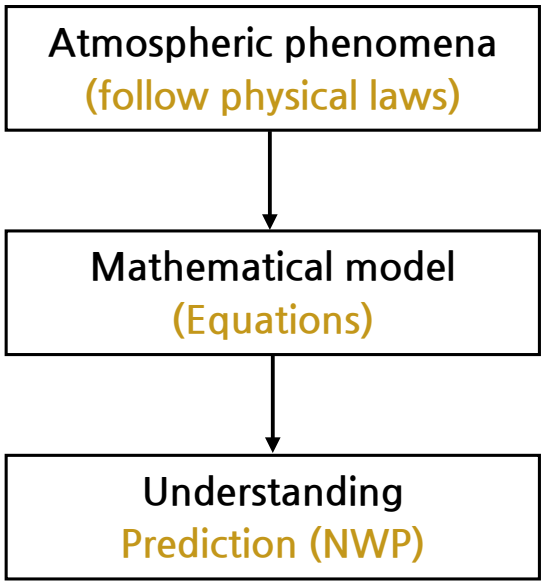


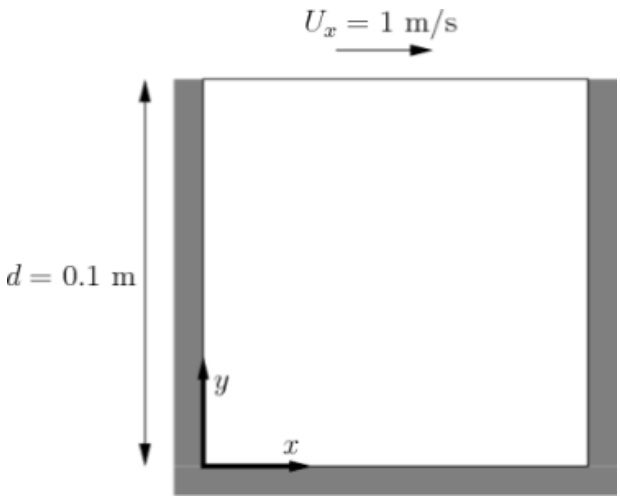
Rocketsonde
(~20-100 km)

Radiosonde
(~10-40 km)

(from Meteorology today)

“대기역학”은 무엇이며
어디에 쓰는가?





$$\frac{\partial \mathbf{U}}{\partial t} + \mathbf{U} \cdot \nabla \mathbf{U} = \nu \nabla^2 \mathbf{U}$$

Global Circulation

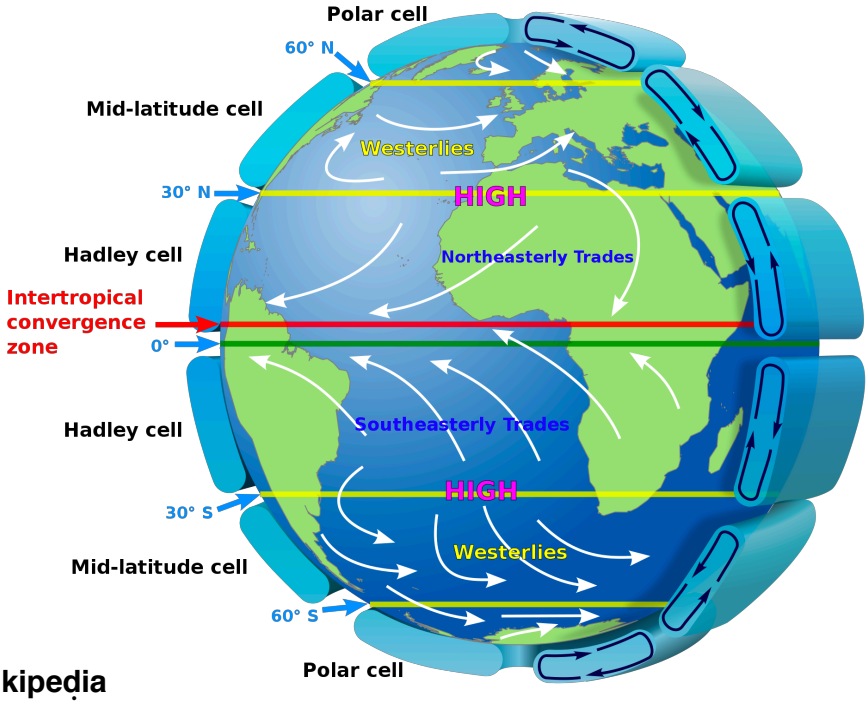


Image: Wikipedia

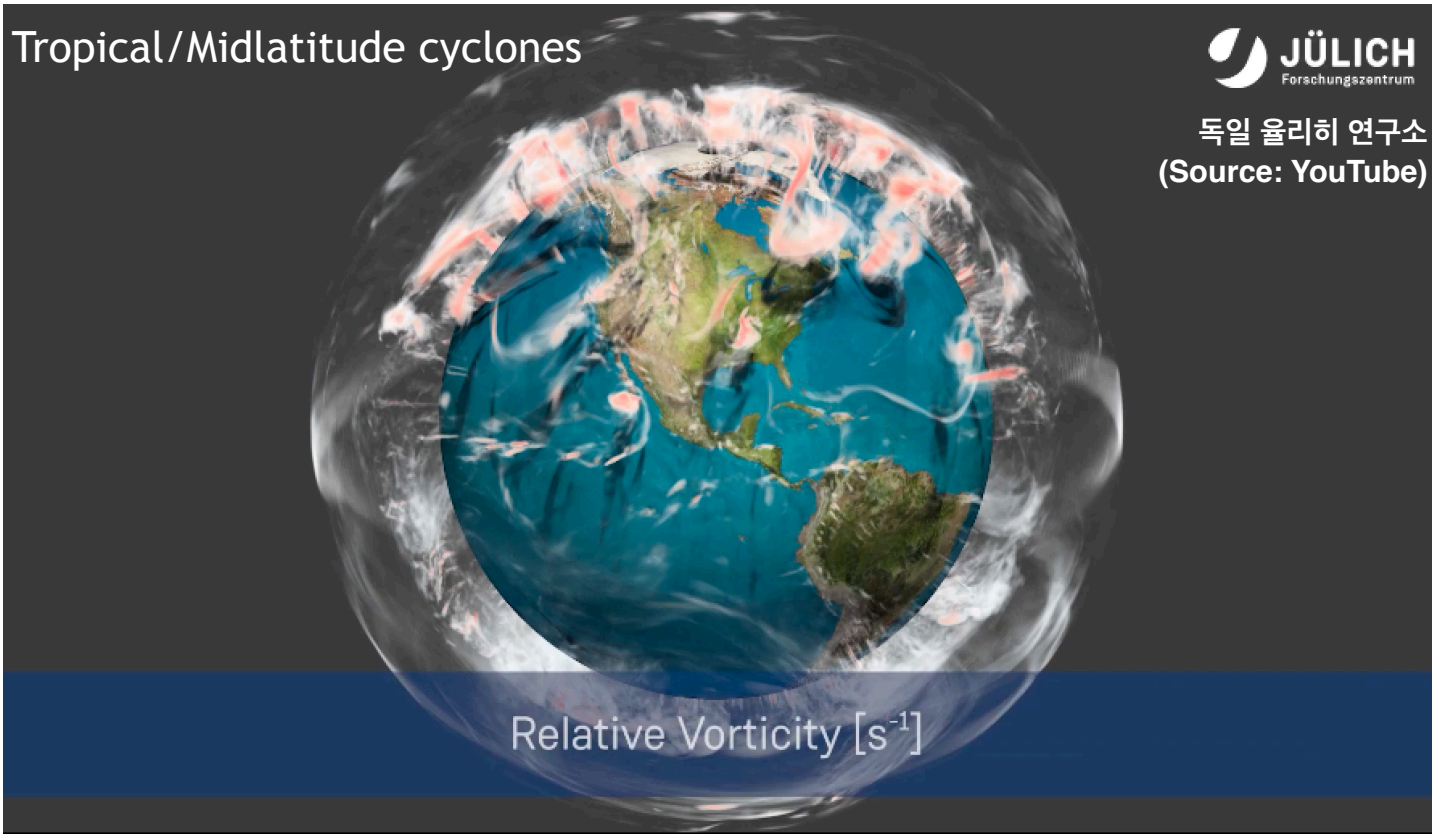
Equations of motion

$$\frac{D\vec{\mathbf{v}}}{Dt} = -\frac{1}{\rho}\nabla p - 2\vec{\boldsymbol{\Omega}} \times \vec{\mathbf{v}} - \mathbf{k}g + \nu\nabla^2\vec{\mathbf{v}}$$ (momentum eq. for u, v, w)

$$\frac{DT}{Dt} - \frac{1}{c_p\rho}\frac{Dp}{Dt} = \frac{J}{c_p}$$ (thermodynamic energy eq. for T)

$$\frac{D\rho}{Dt} + \rho\nabla\cdot\vec{\mathbf{v}} = 0$$ (continuity eq. for ρ)

$$p = \rho RT$$ (equation of state for p)



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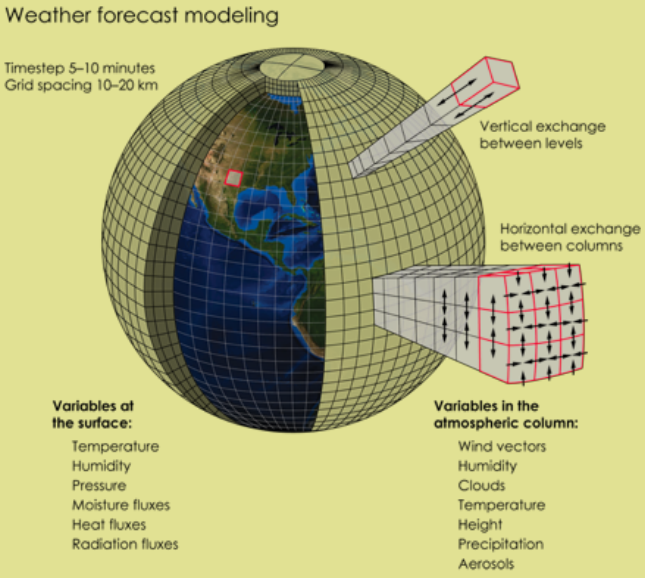
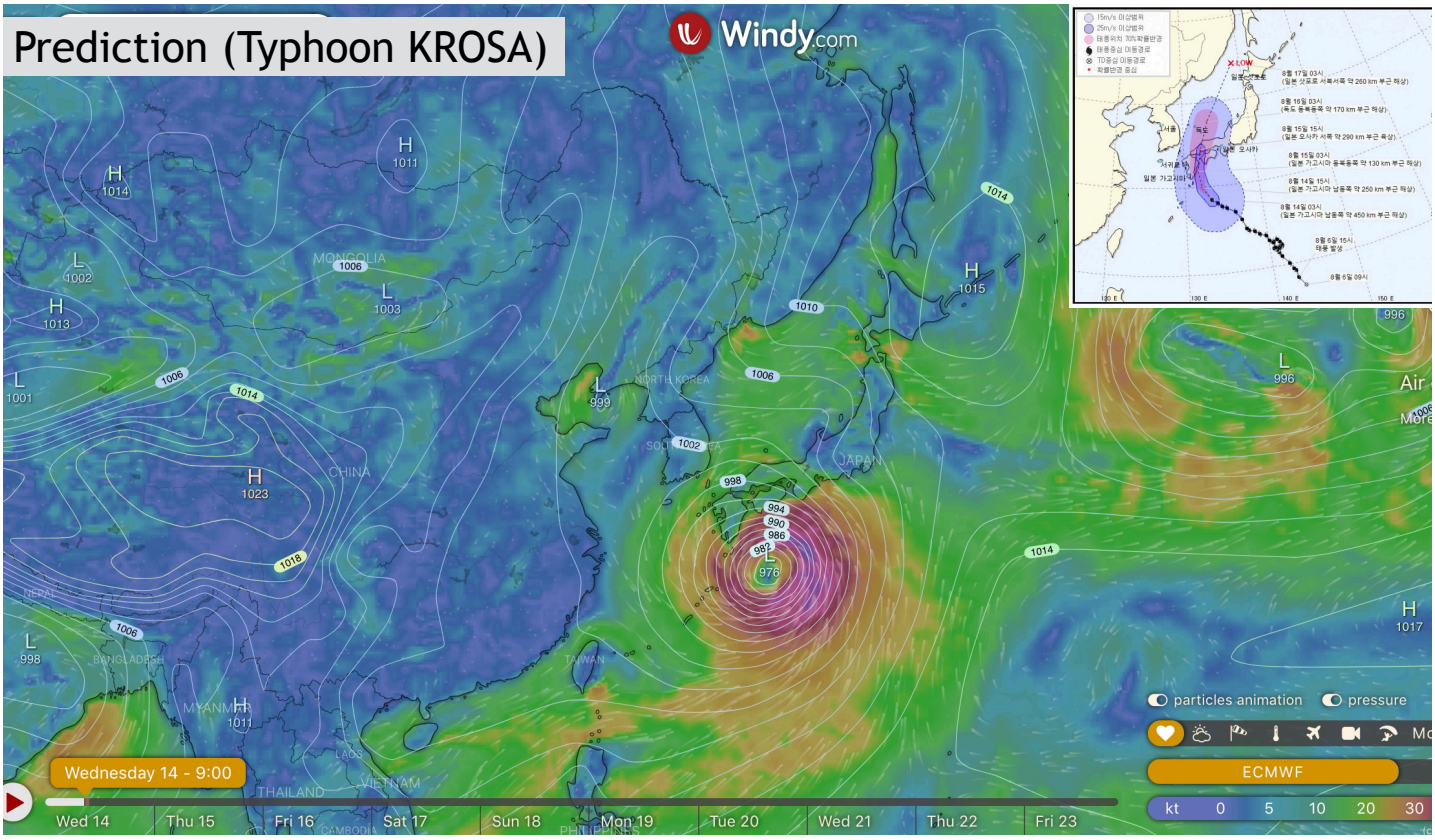


(image: K. Cantner, AGI, university of Wisconsin)



Understanding (Midlatitude cyclones)

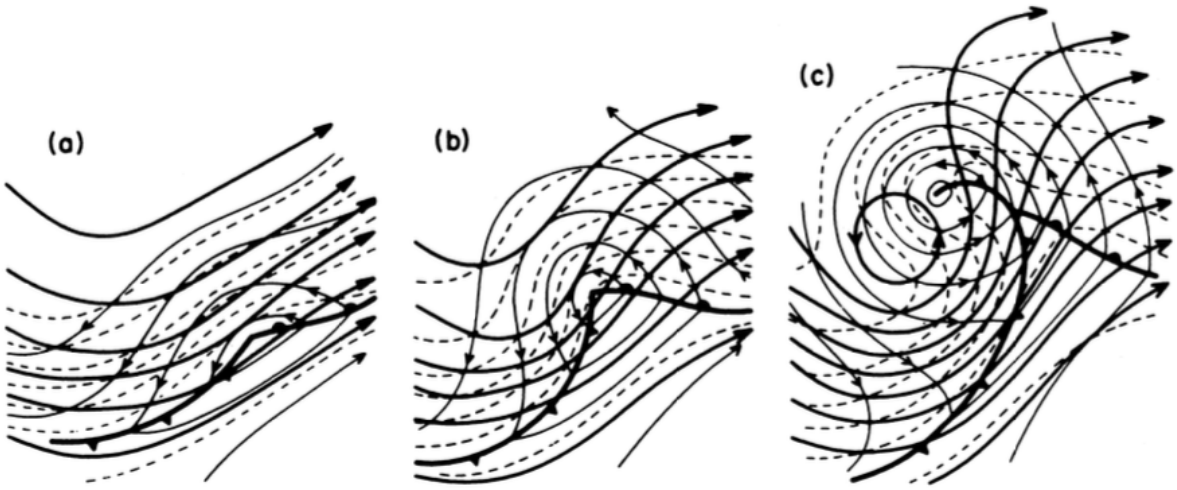
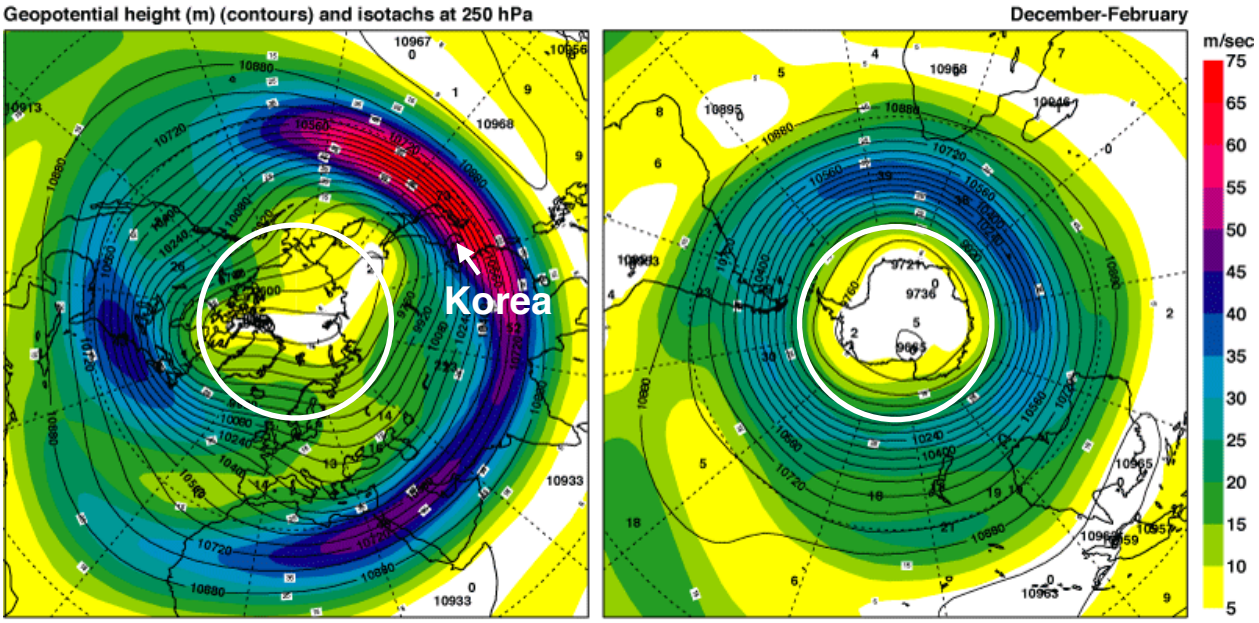


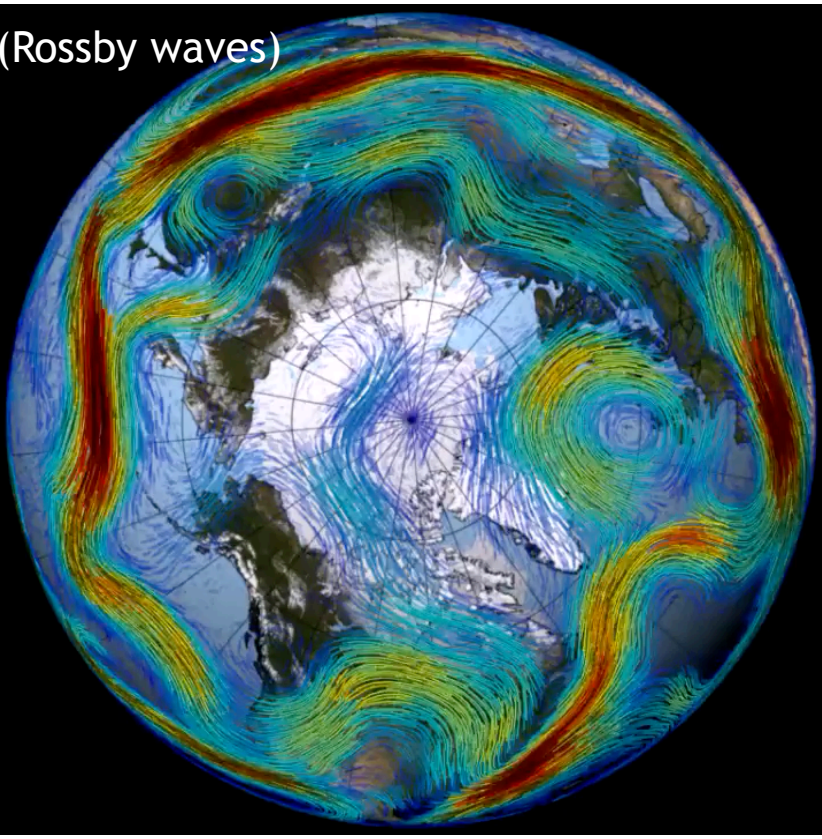
Fig. 6.5 Schematic 500-hPa contours (heavy solid lines), 1000-hPa contours (thin lines), and 1000–500 hPa thickness (dashed) for a developing baroclinic wave at three stages of development. (After Palmén and Newton, 1969.)

Understanding (jet stream)



(from ERA40 Atlas)

Understanding (Rossby waves)



(source: YouTube)

Equations of motion

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$$\frac{DT}{Dt} - \frac{1}{c_p\rho}\frac{Dp}{Dt} = \frac{J}{c_p}$$ **(thermodynamic energy eq. for T)**

$$\frac{D\rho}{Dt} + \rho\nabla\cdot\vec{\mathbf{v}} = 0$$ **(continuity eq. for ρ)**

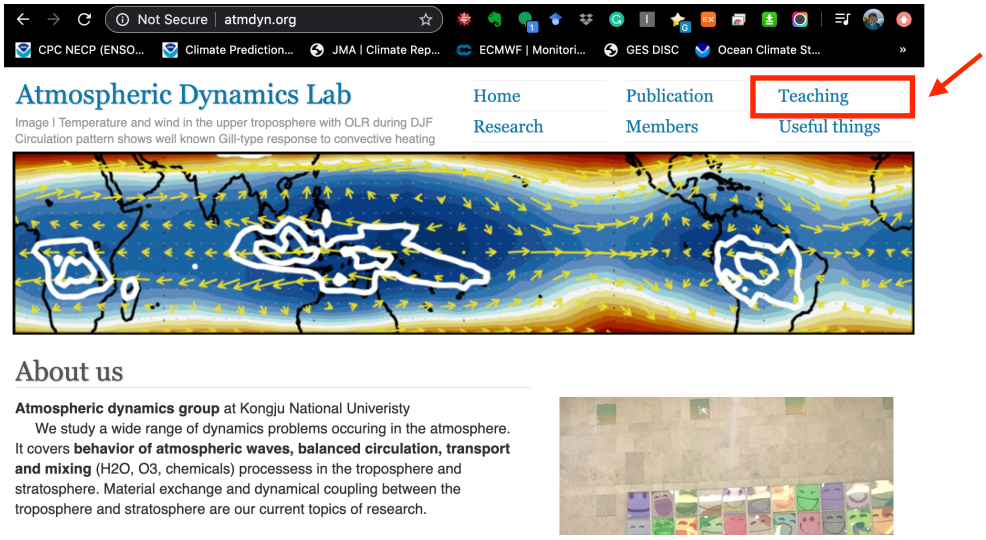
$$p = \rho RT$$ **(equation of state for p)**

수업일정

1. 수업소개 (대기의 기본구조)
2. 대기역학의 기본개념 (대기 연속체, 전미분, 운동량 보존, 질량 보존, 에너지 보존)
3. 대기에 작용하는 힘 1 (중력, 기압경도력, 점성력)
4. 대기에 작용하는 힘 2 (겉보기 힘, 원심력, 코리올리 힘)
5. 운동방정식 (균형류, 경도풍 근사), 이상기체 상태방정식
6. 운동방정식의 규모분석 (대기에서 나타나는 현상들과 그 시공간 규모)
7. 대기의 균형 (지균 평형, 정역학 평형)
8. 중간고사
9. 연속 방정식 (전미분의 재발견 - 율러리안 관점과 라그랑지안 관점)
10. 열역학 에너지 방정식 (온위의 정의, 기온감률, 정적안정도)
11. 등압좌표계 (연직좌표 변환, 로그기압좌표계)
12. 온도풍 (온도풍 방정식의 활용)
13. 원시방정식계 (원시방정식계의 주요가정들)
14. 구면좌표계 (구면좌표계상의 원시방정식계, 원시방정식계의 활용)
15. 기말고사

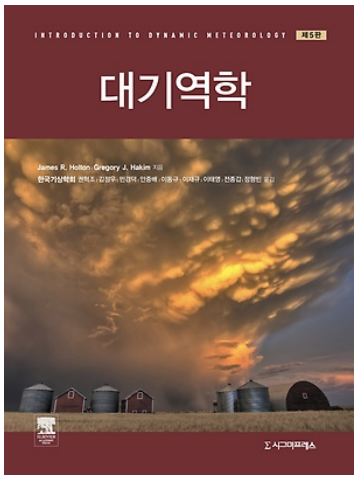
수업 관련 홈페이지

http://atmdyn.org/teaching/intro_dyn1

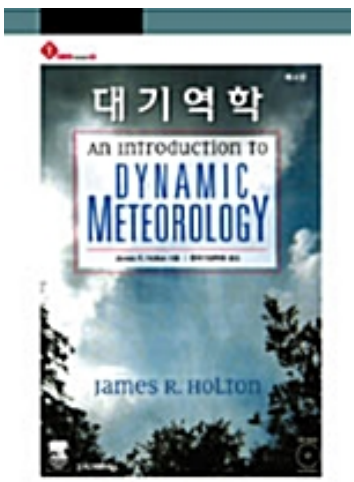


교 재

대기역학 James Holton (시그마프레스)



5판

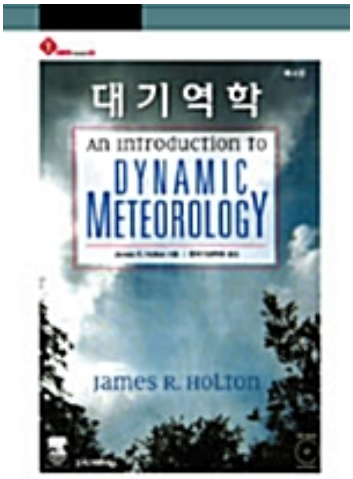


4판

교 재

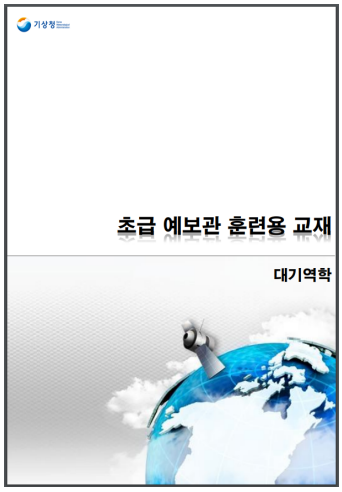
대기역학, James Holton (시그마프레스)

5판



4판

기상청 예보관 훈련서



http://www.kma.go.kr/communication/elearning/fct_trn_1.jsp