

Synoptic Climatology - applications

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Assignment

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Requirements

In the following sections I shall place the scope of the subject and formal requirements to pass the subject Synoptic Climatology - Applications.

1 Theory

1. Introduction to Synoptic Climatology – historical development
2. Contemporary place of Synoptic Climatology in the structure of Climatology
3. What is downscaling? Why do we have to use it?
4. Statistical-empirical downscaling versus dynamical downscaling – methodological differences
5. Synoptic Climatology – examples of applications.
6. Forces governing the air movement in the climate system
 - (a) horizontal pressure gradient force,
 - (b) Coriolis force,
 - (c) centrifugal/centripetal force,
 - (d) friction
7. Air flow characteristics at selected levels of the troposphere
8. Ekman Spiral – wind vertical profile
9. Components of the General Circulation of the Atmosphere
10. Air masses – source regions, characteristics (seasonal variability)
11. SLP features vs. air movement
12. Advection of the air masses – transformation processes, weather characteristics (seasonal variability)
13. Mid-latitude cyclones / high pressure areas development - physical principles
14. Weather characteristics (Lows/Highs)
15. Extreme weather associated with Lows and Highs
16. Why there is a need to classify atmospheric circulation features?
17. Manual classifications
18. Computer assisted classifications
19. Evaluation of above mentioned – pros and cons
20. Circulation indices

21. Statistical-empirical downscaling techniques – regression models, analogues methods, eigenvector based methods, ANNs – Artificial Neural Networks
22. Examples and evaluation of contemporary atmospheric circulation classifications for European Region – COST 733 Action
23. Downscaling tools – empirical statistical downscaling
24. Examples – analysis and evaluation
 - (a) Circulation Indices – regression models
 - (b) Winter temperature variability versus NAO and AO indices
 - (c) Eigenvector based methods
 - (d) Climate change prediction
 - (e) Extreme events – precipitation