Earth Syst. Dynam. Discuss.,
doi:10.5194/esd-2016-37-RC3, 2016

Earth System Dynamics Discussions

Interactive comment on "A network-based detection scheme of the jet stream core" *by* Sonja Molnos et al.

Anonymous Referee #3

Received and published: 10 October 2016

Recommendation: Accepted after major revisions

The authors have developed a new automatic algorithm relying on the Dijkstra's shortest path algorithm, to detect the track and meridional meandering of the PFJ and STJ on a daily basis, around the Northern Hemisphere. It comes as the natural continuation of the previous Rikus' method giving the average jet latitude.

Some aspects call for a more detailed explanation.

Main comments:

1 - The parameters w1, w2, w3 give weights in the edge cost function, respectively of the wind speed, the collinearity between the wind and edge and finally the deviation from a fixed latitude. The STJ and PFJ solutions issued from the Dijkstra's algorithm

Printer-friendly version

Discussion paper

are quite sensitive to the chosen parameter (as seen in Fig. 2 using untuned parameters). The untuned parameter values (Table 1) give the largest value to the jet latitude-guidance term. In order to provide realistic values of the jets, an educated guess of w3 (quite close to 1) is provided, coming from minimization of 6 by simulated annealing. It constrains the solution to be quite linked to the Rikus' solution. The weight w3 is probably linked to the flatness of the function x3 around the phi-clim latitude. By using a sharper function (power 8 instead of 4) weighting latitude deviations will lead to a smaller tuned w3. In fact, the optimal weights depend on the range of x1, x2 and x3 and of the particular choices of the functions x1, x2, x3 giving the weights to the edges. More possibilities exist (ex. the wind projection along the edge unitary vector could be used to substitute weights x1 and x2). Authors shall refer to the different possibilities in the method (section 2).

2- The method is not clear about the optimization of the pressure level of the jet. At which level are computed the winds entering in the method. Is it varying daily or set fixed? There is no explicit vertical guidance of the jets. How do authors deal with this aspect ?

3 – Page 8, line 10. In the discussion of Fig. 7 the algorithm does not resolve properly the PFJ and STJ. In fact, there are other not resolved topologically complex situations like when the jet splits into two branches. Authors should comment that providing hints for solving those issues.

4 - Section 4.2 about the optimization of parameters is too simplistic. A much detailed description is needed. Some points are not clear. The cost function 6 is varying with time. Therefore parameters w1, w2 and phi-clim minimizing it should also depend on time. However, the parameters are set to fixed values for the cold and for the warm season. Therefore, in order to keep consistency, the cost-function 6 should be a seasonal average. Authors should correct and clarify this point.

Technical Corrections

Pg. 1, line 30 kay → key Pg. 2, line 16 linked → are linked Pg. 2, line 21 each → each one Pg. 2, line 22-24 the sentence is rather confusing, rewrite it Pg. 2, line 27 date=2005

Fig. 9 (caption) should refer to STJ, not PFJ.

Table 1 : The start parameters does not sum 1 in agreement with 1. Please correct.

Review of the manuscript “A network-based detection scheme of the jet stream core” by Sonja Molnos, Tarek Mamdouh, Stefan Petri, Thomas Nocke, Tino Weinkauf and Dim Coumou.

Recommendation: Accepted after major revisions

The authors have developed a new automatic algorithm relying on the Dijkstra's shortest path algorithm, to detect the track and meridional meandering of the PFJ and STJ on a daily basis, around the Northern Hemisphere. It comes as the natural continuation of the previous Rikus' method giving the average jet latitude.

Some aspects call for a more detailed explanation.

Main comments:

1 - The parameters w1, w2, w3 give weights in the edge cost function, respectively of the wind speed, the collinearity between the wind and edge and finally the deviation from a fixed latitude. The STJ and PFJ solutions issued from the Dijkstra's algorithm are quite sensitive to the chosen parameter (as seen in Fig. 2 using untuned parameters). The untuned parameter values (Table 1) give the largest value to the jet latitude-guidance term. In order to provide realistic values of the jets, an educated guess of w3 (quite close to 1) is provided, coming from minimization of 6 by simulated annealing. It constrains the solution to be quite linked to the Rikus' solution. The weight w3 is probably linked to the flatness of the function x3 around the phi-clim latitude. By using a sharper function (power 8 instead of 4) weighting latitude deviations will lead to a smaller tuned w3. In fact, the optimal weights depend on the range of x1, x2 and x3

and of the particular choices of the functions x1, x2, x3 giving the weights to the edges. More possibilities exist (ex. the wind projection along the edge unitary vector could be used to substitute weights x1 and x2). Authors shall refer to the different possibilities in the method (section 2).

2- The method is not clear about the optimization of the pressure level of the jet. At which level are computed the winds entering in the method. Is it varying daily or set fixed? There is no explicit vertical guidance of the jets. How do authors deal with this aspect ?

3 – Page 8, line 10. In the discussion of Fig. 7 the algorithm does not resolve properly the PFJ and STJ. In fact, there are other not resolved topologically complex situations like when the jet splits into two branches. Authors should comment that providing hints for solving those issues.

4 - Section 4.2 about the optimization of parameters is too simplistic. A much detailed description is needed. Some points are not clear. The cost function 6 is varying with time. Therefore parameters w1, w2 and phi-clim minimizing it should also depend on time. However, the parameters are set to fixed values for the cold and for the warm season. Therefore, in order to keep consistency, the cost-function 6 should be a seasonal average. Authors should correct and clarify this point.

Technical Corrections

Pg. 1, line 30 kay → key Pg. 2, line 16 linked → are linked Pg. 2, line 21 each → each one Pg. 2, line 22-24 the sentence is rather confusing, rewrite it Pg. 2, line 27 date=2005

Fig. 9 (caption) should refer to STJ, not PFJ.

Table 1 : The start parameters does not sum 1 in agreement with 1. Please correct.

Interactive comment on Earth Syst. Dynam. Discuss., doi:10.5194/esd-2016-37, 2016.